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SUPPLEMENTARY ONLINE MATERIAL FOR

Like phoenix from the ashes: How modern baleen whales arose from a fossil “dark age”

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Supplementary Description

Previously published mysticetes from the Late Oligocene of Australasia include three species of mammalodontid (Fitzgerald 2006, 2010, Fordyce and Marx 2016), several eomysticetids (Boessenecker and Fordyce 2015a, Boessenecker and Fordyce 2015b, Boessenecker and Fordyce 2015c, 2017), and four non-eomysticetid chaeomysticetes (Benham 1937, Tsai and Fordyce 2015, Tsai and Fordyce 2016, Tsai and Fordyce 2018). With one exception (Fordyce and Marx 2016), mammalodontids have so far only been described from Victoria (Australia). Conversely, eomysticetids and other chaeomysticetes have only been reported from New Zealand, although their existence in Australia has previously been hinted at (Piper et al. 2006).

Below, we refer all previously undescribed Late Oligocene mysticetes from Victoria and New Zealand that are known by at least one diagnosable tympanic bulla to one of three taxonomic categories: Mammalodontidae, Eomysticetidae, and ‘other Chaeomysticeti’. These specimens are then combined with already described material into a comprehensive record of Late Oligocene mysticetes from Australasia. Details of all specimens, including their collection numbers, identification, formation and locality, are provided in Table S1.

Institutional Abbreviations. CM, Canterbury Museum, Christchurch, New Zealand; NMNZ, Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand; NMV, Museums Victoria, Melbourne, Australia; OM, Otago Museum, Dunedin, New Zealand; OU, Geology Museum, University of Otago, Dunedin, New Zealand.

Systematic Palaeontology

Cetacea Brisson, 1762

Mysticeti Gray, 1864

Mammalodontidae Mitchell, 1989

Gen. et sp. indet.

Referred material. 30 left and 24 right tympanic bullae; see table S1 and figure S1 for details.

Locality and horizon. OU 22030 comes from the Kokoamu Greensand exposed at Coal Creek, Rangitata River (Central Canterbury, New Zealand). All other specimens come from the southern coast of Victoria, Australia, southwest of Port Phillip Bay. Specific localities include Bells Beach (Point Addis Limestone), Jan Juc (Jan Juc Marl) and Waurm Ponds (Waurm Ponds Limestone); see Table S1 for details. Late Oligocene, Chattian.

Remarks. NMV P7456 is a paralectotype, and P7457 a possible paralectotype of *Cetotolites nelsoni*; (McCoy 1879, Fordyce 1988). NMV P7455 is the holotype of *Cetotolites nelsoni rugosa* (McCoy 1879, Fordyce 1988).

Description. All specimens show ventrally oriented inner and outer posterior prominences, separated by a prominent interprominential notch. In dorsal view, the anterior border of the bulla is squared. In most of the Australian specimens, the medial border of the involucrum is slightly or moderately concave, as seen in *Janjucetus* and *Mammalodon* (Fitzgerald 2006, 2010). The floor of the tympanic cavity is traversed by a well-developed transverse ridge originating from the involucrum.

Chaeomysticeti Mitchell, 1989

Eomysticetidae Sanders and Barnes, 2002

Gen. et sp. indet.

Referred material. 4 left and 6 right tympanic bullae; see Table S1 and figures S1d, S2 for details.

Locality and horizon. NMV P232855 was collected from the Jan Juc Marl exposed at Jan Juc (Victoria, Australia). All other specimens were collected from the Waurm Ponds Limestone exposed at Waurm Ponds (Victoria, Australia). Late Oligocene, Chattian.

Remarks. NMV P7453 and P7452 may represent paralectotypes of *Cetotolites pricei* (McCoy 1879, Fordyce 1988).

Description. All specimens show ventrally oriented inner and outer posterior prominences, separated by a prominent interprominential notch. In posterior view, both prominences are rounded and comparable in size. In dorsal view, the bullae narrow anteriorly, with the anterolateral base of the outer lip being somewhat flattened, rather than squared or obliquely truncated. The medial border of the involucrum is straight or slightly convex medially, but never concave. The floor of the tympanic cavity is traversed by a moderately developed transverse ridge originating from the involucrum.

Chaeomysticeti Mitchell, 1989

Gen. et sp. indet.

Referred Material. 20 left and 11 right tympanic bullae; a further 3 specimens preserved both bullae, and hence were counted only once; see Table S1 and figure S1b,c for details.

Locality and horizon. NMV P232608 and P253705 come from the Jan Juc Marl exposed at Jan Juc (Victoria, Australia). OU 21928 was collected from the Concord Greensand exposed at the Burnside Quarry, near Dunedin, New Zealand. All other specimens were collected from the Kokoamu Greensand or Otekaike Limestone, exposed at various localities throughout North Otago and (mostly South) Canterbury, New Zealand; see Table S1 for details. Late Oligocene, Chattian.

Remarks. OU 22224 has previously been interpreted as an archaic right whale (Fordyce 2002).

Description. All specimens show medially rotated inner and outer posterior prominences, with the outer posterior prominence (= main ridge) and median furrow pointing medially, and the inner posterior prominence forming a dorsal swelling on the involucrum. The medial furrow and interprominential notch are much less defined than in eomysticetids and toothed mysticetes. In dorsal view, the involucral ridge is gently convex medially.

Table S1. The Australian and New Zealand late Oligocene record of mysticetes based on tympanic bullae is available at http://app.pan.pl/SOM/app64-Marx_etal_SOM/SOM_table.xlsx

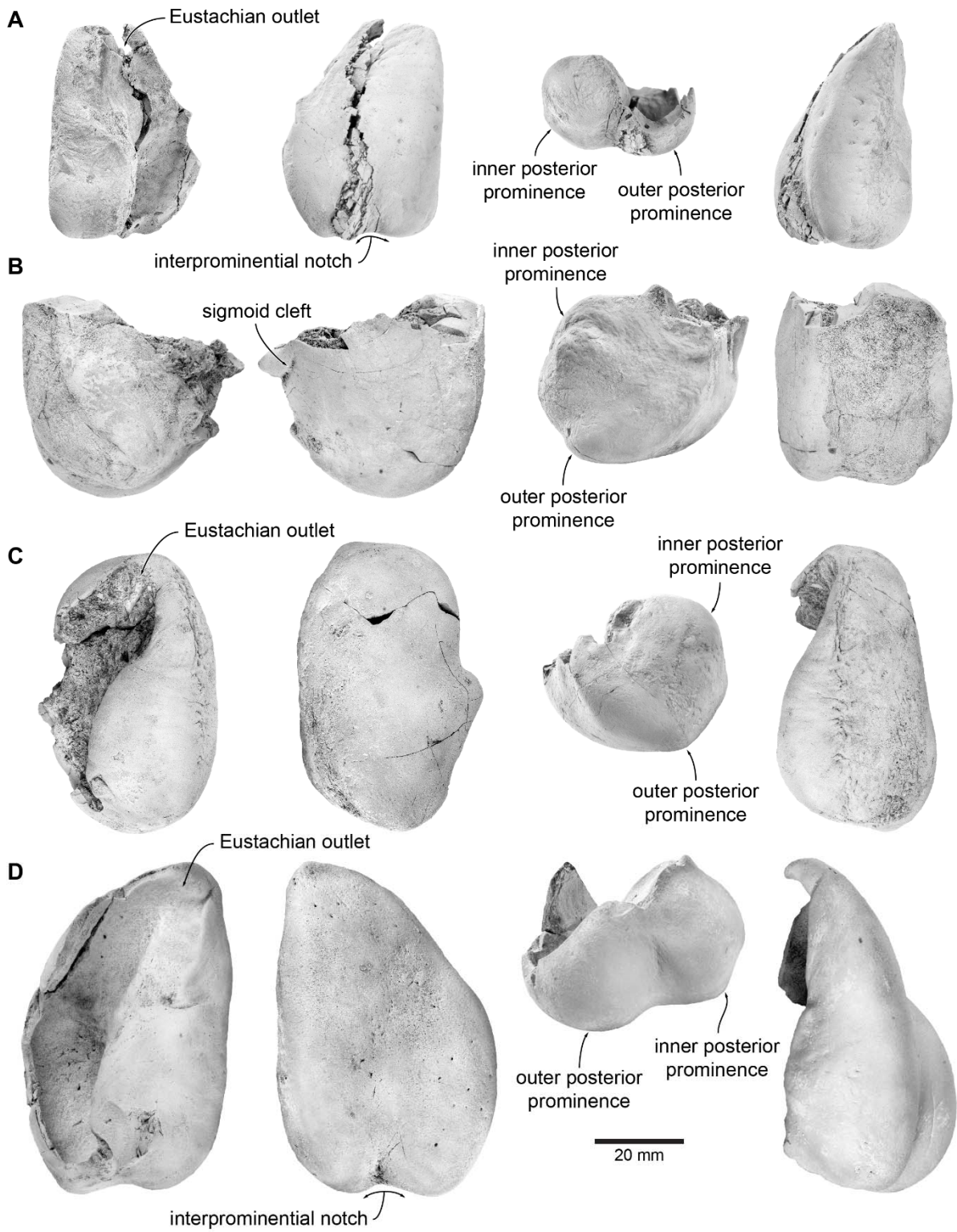


Figure S1. Tympanic bullae in (from left to right) dorsal, ventral, posterior and medial view. **(A)** OU 22030, mammalodontid, right; **(B)** NMV P232608, chaecomysticete, right; **(C)** NMV P253705, chaecomysticete, left; **(D)** NMV P232855, eomysticetid, left.

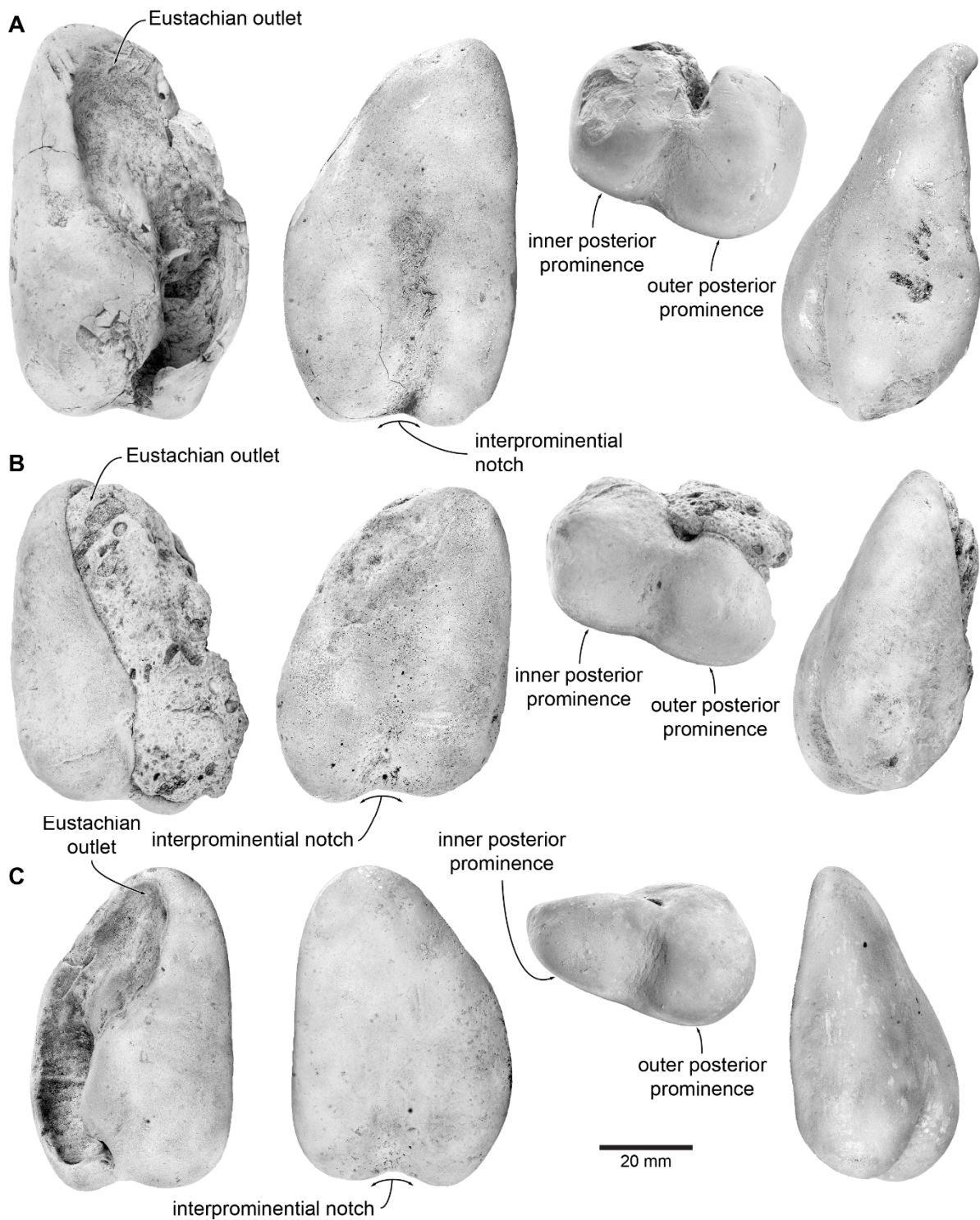


Figure S2. Tympanic bullae in (from left to right) dorsal, ventral, posterior and medial view. **(A)** NMV P48781A, eomysticetid, right; **(B)** NMV P48781E, eomysticetid, right; **(C)** NMV P197862, eomysticetid, left.

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