SECTION B

Aptian *Peratobelus* (*Dimitobelidae*) of Australia

Section B. Aptian *Peratobelus* (*Dimitobelidae*) of Australia

B. 1 Abstract

A review of Australian belemnites referred to the Aptian genus *Peratobelus* (Dimitobelidae) is presented, based on an evaluation of extensive collections from the Great Artesian Basin of eastern Australia, the Carnarvon Basin of Western Australia and the Money Shoals Basin of the Northern Territory. Only two species are recognised, gracile *Peratobelus bauhinianus* which had an Australia-wide distribution and robust *Peratobelus oxys* which is known only from the Great Artesian Basin in Australia but ranged to the Antarctic Peninsula. *Peratobelus oxys* Tenison-Woods was named from guards but is conspecific with *Peratobelus selheimi* Tenison-Woods which was based on a phragmocone. Guards and phragmocones of this species typically separated prior to fossilisation but co-occur in the same horizons and localities. This species possessed an unusually large phragmocone, up to 15 cm in length, among Cretaceous belemnites.

B. 2 Introduction

A distinctive belemnite assemblage characterised by *Hibolithes, Belemnopsis* and *Duvaliidae* spread south from Europe in the Late Jurassic, and characterised the Gondwana margins in the Neocomian (see Stevens, 1965; Challinor, 1991; 1992). It was largely replaced by members of the Family Dimitobelidae in the Aptian, entirely so in east Gondwana where taxa other than members of this group are unknown subsequent to the Neocomian. Dimitobelidae represent an important element of the Austral faunal realm which characterised the Cretaceous marine invertebrate fauna of Gondwana in general, and Australasia in particular, during the Cretaceous Period (see Henderson et al., 2000).

In guard shape and the nature of the phragmocone and the conical anterior cavity within the guard, the alveolus, in which it is housed the Dimitobelidae are unremarkable. However unique grooves are inscribed on their guards, considered to reflect a distinctive soft-part organisation (Stevens, 1965). No clear ancestral stock for the Dimitobelidae has been identified and their origin is uncertain. As noted by Stevens (1973) most authors have favoured an origin from Belemnopseidae or the Hastitidae. However in a more recent review of possible evolutionary connections, Doyle (1988) favoured ancestry from *Hibolithes.*

Early description of Australian belemnites, prior to the nineteenth century, invariably made use of European generic categories. Whitehouse (1924) was the first worker to recognise the distinctive character of Australian faunas and erected the Family Dimitobelidae for "cylindrical and clavate belemnites provided with lateral grooves on the anterior portion of the guard, but devoid of antero-ventral or apical grooves". *Peratobelus* was established by Whitehouse (1924) as the earliest (Aptian) representative of the group, characterised by a robust, cylindrical guard with long, straight ventro-lateral grooves. This genus was replaced throughout Australasia in the early Albian by *Dimitobelus* which persisted for the remainder of the Cretaceous and is readily distinguishable by a characteristically depressed guard with more dorsally positioned, curved ventro-lateral grooves which pass into paired lateral lines. A third genus of the family known only from India and the Antarctic Peninsula, *Tetrabelus*, has surface grooves restricted to the anterior part of the guard (Figure B .2 .1).

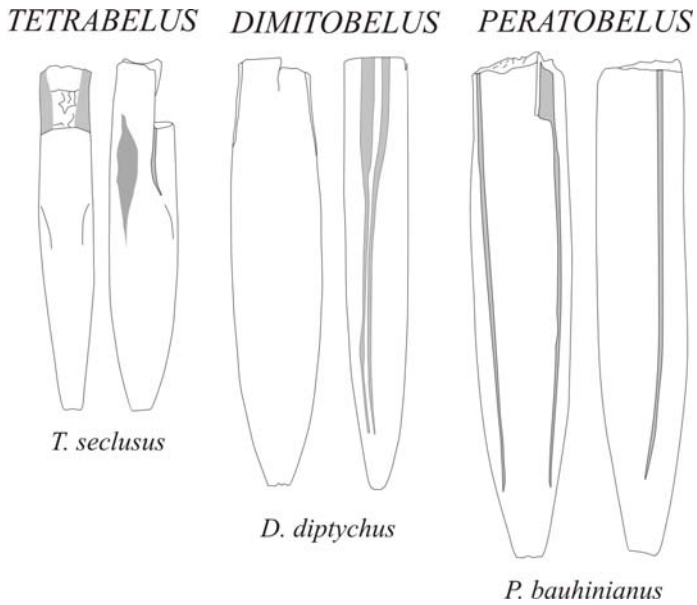


Figure B. 2. 1 Drawings illustrating the differences in surface markings between genera of the Dimitobelidae (modified from Doyle, 1988). The venter is illustrated on the furthest right of each outline view.

Morphological attributes of the groupings within *Peratobelus* are generally well constrained, with the shape, length and nature of the ventro-lateral grooves, and

guard size distinctively categorising individual species. Within *Peratobelus* stocks the majority of specimens are closely alike and hence the specific categories are morphologically distinctive and constrained. However, intraspecific variation does apply and imperfect preservation due to fragmentation and the loss of surface features through abrasion commonly impedes identification. Three species of *Peratobelus* have commonly been recorded from Australia: *P. oxys* (Tenison-Woods), *P. australis* (Phillips), and *P. selheimi* (Tenison-Woods).

Of these, *P. oxys* (= *P. selheimi*) is unusual, commonly being represented by a large and conspicuous phragmocone, rather than the guard as is the case for other species where the phragmocone is smaller and rarely preserved. The combination of guard and phragmocone is a universal attribute of belemnite morphology regarded as having had a buoyancy and trim function for the living animal. This is almost certainly the case for the phragmocone because its morphology is homologous with that of modern *Nautilus* for which a buoyancy function is well known (see Ward, 1987) and for a wide range of extinct ectocochleate cephalopods for which a similar function can be safely inferred. The guard probably acted as a counterbalance to the head and arms, with the buoyant phragmocone acting as a pivot (Stevens, 1965). The size of the phragmocone must be related not only to the weight of the guard but also the mass of soft parts vested in the living animal. It may be inferred that the larger the belemnite, the larger the phragmocone needed to counterbalance the total body and skeletal weight. The large, robust phragmocone of *P. oxys* is likely to reflect a large body size, considerably bigger than that of other *Peratobelus* species.

Most representatives of the genus have been documented from Aptian formations of the Eromanga and Carpentaria basins, deposited within a very extensive epeiric sedimentary system developed in eastern Australia at this time (Figure B. 2. 2; Exon and Senior, 1976; Senior et al., 1978). *Peratobelus* is also known from Aptian strata from the subjacent Maryborough Basin (Whitehouse, 1925, 1926) and there are additional records from Money Shoals Basin of northern Australia (Henderson, 1998a) and the Carnarvon Basin from Western Australia (Hocking et al., 1987).

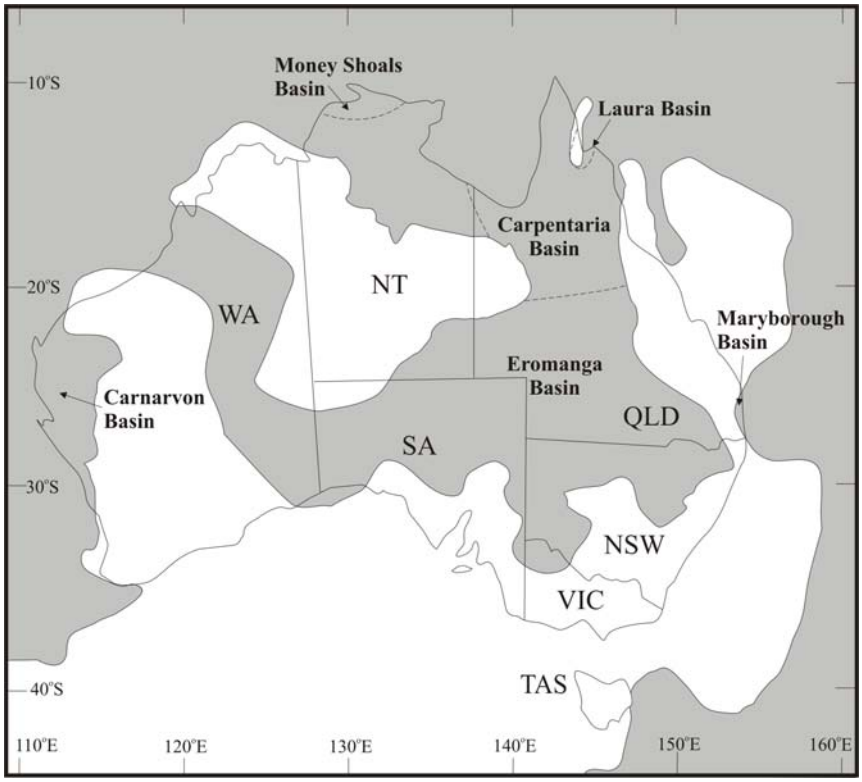


Figure B. 2. 2 Map showing the extent of Aptian flooding (shaded) for Australia (after Frakes et al., 1987) and the location of basins referred to in this paper.

This paper revises the Australian species of *Peratobelus*, drawing on the extensive collections now available. It recognises extensive synonymy amongst the species categories introduced in the older literature where taxa were commonly established on small collections where the specimens available were insufficient to establish the full morphology and/or the range of variation.

B. 3 Collections and localities

For this study, relevant collections held by museums, universities and geological surveys were extensively examined. In addition, it utilizes new collections from the northern Eromanga Basin, and collections newly acquired from stratigraphic drilling by the Geological Survey of Western Australia (GSWA) are of significance.

The specimen suite evaluated here is held by a number of repositories, as follows: AM, Australian Museum, Sydney; SAM, South Australian Museum, Adelaide; GSSA, Geological Survey of South Australia; UA, University of Adelaide; NMV, Museum of Victoria; QGS, Queensland Geological Survey; UQ, University of Queensland; QM, Queensland Museum; JCU, James Cook University; WAM, Western Australian Museum; UWA, University of Western Australia; GSWA, Geological Survey of Western Australia; CPC Commonwealth palaeontological collection, Geoscience Australia. Locality numbers prefixed `L' refer to specific sites registered in these repositories. Modern collections are in general accurately located. However, locality records for older collections are commonly imprecise. Where possible these have been assigned approximate geographic coordinates.

Ages assigned to the various localities are based on their position relative to the lithostratigraphic framework that applies in the regions where they occur. The lithostratigraphic succession of the Eromanga Basin is extensively expressed by surface outcrop as documented by regional mapping and detail of it is augmented by numerous stratigraphic core holes. A useful composite section, through the Aptian and Albian of the northern Eromanga Basin is provided by outcrop along the Flinders River, east of Hughenden.

For the Carpentaria Basin, the Walsh River and its tributaries expose the lower part of the Cretaceous succession and only a few isolated outcrops are known for Cretaceous marine strata of the Laura Basin.

For the Carnarvon Basin, a suite of stratigraphic wells drilled in the last decade by the Geological Survey of Western Australia (GSWA) and collaborators provide a concise record of belemnites from the latest Barremian through to the Cenomanian. These fully cored drill holes, together with collections from representative surface outcrops of the lithostratigraphic succession provide an extensive record of belemnites through the Early Cretaceous Epoch for the Western Australian continental margin.

B. 4 Systematic descriptions

Class CEPHALOPODA Cuvier, 1795

Subclass COLEOIDEA Bather, 1888

Order BELEMNITIDA Zittel, 1895

Suborder BELEMNOPSEINA Jeletzky, 1965

Family Dimitobelidae Whitehouse, 1924

Diagnosis: Cylindrical and clavate guards with two ventro-lateral grooves on the anterior portion of the guard. Antero-ventral grooves absent or rudimentary and apical grooves lacking.

Discussion: The Family Dimitobelidae was established by Whitehouse (1924) for a distinctive group of Cretaceous belemnites from eastern Australia. The position of the siphuncle in the phragmocone shows that grooves inscribed into the guard are ventro-lateral in position whereas the dorso-lateral surface is generally featureless. Successive workers have shown that the representatives of the family also occur in southern India (Whitehouse, 1924), New Zealand (Stevens, 1965), New Guinea (Glaessner, 1945; Glaessner, 1958; Challinor, 1990), Antarctica (Doyle, 1988), and Mozambique (Doyle, 1987b). The Dimitobelidae are now recognised as a distinctive Cretaceous belemnite clade characteristic of Southern Hemisphere mid to high latitudes.

Based largely on eastern Australian material, Whitehouse (1924) recognised four nominal genera within the Family Dimitobelidae: *Peratobelus, Dimitobelus, Tetrabelus* and *Cheriobelus*. Glaessner (1945; 1957) and others (Stevens, 1965; Doyle, 1987a) considered *Cheriobelus* to be a subjective synonym of *Dimitobelus*, thereby reducing the family to three genera. *Peratobelus* and *Dimitobelus* were wide-ranging but *Tetrabelus* is known only from India and the Antarctic Peninsula.

Genus *Peratobelus* Whitehouse, 1924

Peratobelus Whitehouse, 1924, p. 410.

Peratobelus Stevens, 1965, p. 61.

Peratobelus Doyle, 1987*a*, p. 153.

Type Species: *Belemnites oxys* Tenison-Woods 1883a, Aptian of the Great Artesian Basin.

Diagnosis: Slender to robust Dimitobelidae with guard outline subhastate to cylindroconical. Profile is asymmetrical to almost symmetrical, cylindroconical. Transverse sections subcircular, ventral surface generally flattened. Two well-developed, long ventro-lateral grooves are set close to the venter and run approximately parallel to it, extending at least to the stem region. For most or all of their course they are straight but dorsally directed curvature may occur towards their posterior termination. No other surface markings are present.

Range: Widespread in the Aptian of Australia, known also from the Aptian of the Antarctic Peninsula and Mozambique.

Discussion: *Peratobelus* is the oldest representative of the Dimitobelidae, being succeeded by *Dimitobelus* in the Albian. Whitehouse (1924, p. 410) erected the genus, distinguishing it as "cylindrical or clavate (hastate) guards with ventro-lateral grooves only. These grooves extend for about half the length of the guard; alveolus normal." Glaessner (1957) and Stevens (1965) restricted the genus to cylindroconical, non-hastate (non-clavate) species. However, Doyle (Doyle, 1987a, p. 154) observed that the type species *P. oxys* (Tenison-Woods) and related forms such as *P. australis* (Phillips) display some hastation.

The genus *Dimitobelus* Whitehouse (1924) has double lateral lines that are unknown in *Peratobelus* and its guards are generally set apart by being distinctly clavate rather than cylindroconical or weakly hastate. The most distinctive characteristic of *Peratobelus* is its elongate, relatively straight ventro-lateral grooves (Figure B. 2. 1).

Species described from Australian Cretaceous basins include *P. oxys* (Tenison-Woods), *P. australis* (Phillips), and *P. selheimi* (Tenison-Woods). Whitehouse (1924, p.

411) placed a single large guard from the upper Aptian of South Australia (BMNH C. 5309) as "an unnamed species of *Peratobelus*." The specimen was later referred to *Belemnites selheimi* Tenison-Woods by Woods (1961, p. 3), even though that species was originally described from phragmocones only (Tenison-Woods, 1883a, p. 250, pl. 7, fig. 1). *B. selheimi* has been generally regarded as a species of *Peratobelus* (Day, 1967a, 1967b; Hill et al., 1968) but Ludbrook (1966) referred the species to *Dimitobelus*. Doyle (1987a) remarked that *B. selheimi* should be restricted to the Tenison-Woods type, which cannot clearly be assigned to *Peratobelus*. He placed Whitehouse's unnamed species as a variant of *P. oxys*.

Only two Australian species of Aptian age are recognised here. The suite of material now available shows that *Peratobelus oxys* and *P. selheimi* are synonyms. Skwarko (1966) described belemnites that he assigned as *Dimitobelus* from strata he assigned as late Neocomian and Aptian. However, they represent *Peratobelus* as discussed below. The Neocomian age assignment made by Skwarko (1966) is in error as the lithostratigraphic unit from which they were collected also contains the ammonite *Australiceras* which is restricted to the Aptian.

***Peratobelus oxys* Tenison-Woods**

Pl. 1, figs. 6-7; Pl. 2, figs. 1-9

?1862 *Belemnites ? barklyi* Clarke, p. 246, *nomen dubium*.

1870 *Belemnites paxillosus* Schlotheim; Phillips *in* Moore, p.240, pl. 16, figs. 6, 6a, 6b.

1870 *Belemnites australis* Phillips; Phillips *in* Moore p. 258-59, pl. 16, figs. 1, 2, 5 only.

1880 *Belemnites* sp.; Etheridge, p. 20, figs. 1-3.

1883a *Belemnites oxys* Tenison-Woods p. 237, pl. 13, figs. 1-3.

1883b *Belemnites selheimi* Tenison-Woods, p. 150, pl. 7, fig.1.

1889 *Belemnites eremos* Tate, p. 229-30.

1889 *Belemnites selheimi* Tenison-Woods; Tate, p. 230.

1892 *Belemnites australis* Phillips; Etheridge, p. 487, pl. 35, figs. 1-2

1892 *Belemnites oxys* Phillips; Etheridge, p. 487, pl. 35, figs. 1-2.

1892 *Belemnites eremos* Tate; Etheridge, p. 487, pl. 35, figs. 1-2.

1892 *Belemnites selheimi* Tension-Woods; Etheridge, p. 489, pl. 35, figs. 10-11

1902a *Belemnites oxys* Tenison-Woods; Etheridge, p. 48

1902a *Belemnites selheimi* Tenison-Woods; Etheridge, p. 50, pl. 7, figs. 16-17.

1902b *Belemnites oxys* Tenison-Woods; Etheridge, p. 48, pl. 6, figs. 4-6; pl. 7, figs. 5-7; pl. 8, figs. 4-7.

1902 *Belemnites oxys* Tenison-Woods; Etheridge and Dun, p. 81.

1902 *Belemnites selheimi* Tenison-Woods; Etheridge and Dun, p. 81.

1924 *Peratobelus oxys* (Tenison-Woods); Whitehouse, p. 410, figs. 1a-b.

1926 *Peratobelus oxys* (Tenison-Woods); Whitehouse, p. 277.

1961 *Peratobelus* sp. Woods, p. 6.

1961 *Peratobelus selheimi* Tenison-Woods; Woods, p. 3, 6.

1964 *Peratobelus oxys* (Tenison-Woods); Day, p. 18, table 3.

1964 *Peratobelus? selheimi* (Tenison-Woods); Day, p. 18, table 3.

1965 *Peratobelus oxys* (Tenison-Woods); Day, p. 418.

1965 *Peratobelus oxys* (Tension-Woods); Stevens, p. 61.

1966 *Peratobelus oxys* (Tenison-Woods); Ludbrook, p. 192, pl. 27, fig. 23.

1966 *Dimitobelus selheimi* (Tenison-Woods); Ludbrook, p. 192, pl. 27, fig. 22-25.

1968 *Peratobelus selheimi* (Tenison-Woods); Hill et al. p. 6, pl. figs. 12a, b.

1968 *Peratobelus selheimi?* (Tenison-Woods); Hill et al. p. 6, pl. figs. 16a-c.

1969 *Peratobelus oxys* (Tenison-Woods); Day, p. 144, 146.

1969 *Peratobelus*? *selheimi* (Tenison-Woods); Day, p. 144, 146.

1972 *Peratobelus oxys* (Tenison-Woods); Willey, p. 37, figs. 4d and e.

1972 *Dimitobelus* sp. aff. *D. macgregori* (Glassner); Willey, p. 32, figs. 3a, b only.

1987a *Peratobelus* cf. *oxys* (Tenison-Woods), Doyle, p. 154, pl. 21, figs. 1, 2.

Types: Lectotype by monotypy the specimen figured by Tenison-Woods (1883a, pl. 13, figs. 1-3), from a well near Mount Brown, NW NSW. The original was held by the

Macleay Museum, Sydney but presently cannot be located. A plaster cast of this specimen, numbered L1574, is held by the Australian Museum.

Additional Material: Approximately 72 guards and some 30 isolated phragmocones. Eight specimens showing part of both the guard and phragmocone.

Eromanga Basin, Queensland: UQ F12975, 12978, F12980, 12993 and L1160-64, Metowra Creek, near Metboura Woolshed, Tambo, Doncaster Member, 25°02'S, 146°27'E; UQ F35523, F 35781 and F35786, Bungeworgorai Creek, 1/4 mile west of Mount Abundance Homestead, Doncaster Member, 26°36'S, 148°41'E; UQ F35596 Bungeworgorai shell bed, south of Roma, Doncaster Member, 26°35'S, 148°41'E; UQ F35644-5, Bungeworgorai shell bed, 1/2 ml west of Mount Abundance Homestead, Doncaster Member, 26°36'S, 148°41'E; UQ F35816, Bungeworgorai shell bed, 1/4 mile west of Bungeworgorai Creek junction, Doncaster Member, 26°36'S, 148°42'E; UQ F35783-84, Clerk Creek 600 yards west of Bungeworgorai Creek junction, Doncaster Member, 26°37'S, 148°43'E; UQ F61084, 61086-7, 200 yards from the southern side of Warrego Highway, 100 yards west of Bungeworgorai Creek, Doncaster Member, 26°36'S, 148°42.5'E; UQ F64860 Wallumbilla Creek, Wallumbilla, Doncaster Member, 26°39’S, 149°13’E; QM F1308 Yeulba Creek, Doncaster Member, locality uncertain; QM F14320 Glendower Station, Flinders River, Doncaster Member, 20°44’S, 144°29’E; QM F1641, Winton District, Doncaster Member, 22°22'S, 143°02'E; QM F16432 no recorded locality, Queensland, lower Cretaceous; QM F2219 Tambo Station Upper Barcoo, Doncaster Member, 24°04'S, 144°50'E; QM F2568 Curra Station, Mt Abundance area, Doncaster Member, 26°40'S, 148°25'E; QM F27910, Rosevale, South of Muckidilla, Doncaster Member, c.20°42’S, 144°14’E; QM F27745, locality unknown; QM F43847, approximately 12 miles south of Tambo, Doncaster Member, 24°54 S, 146°20'E; QGS F13763 Barcaldine, Doncaster Member, 23°34’S, 145°18’E; QGS F1368 Flinders River near Hughenden, Doncaster Member, 20°51'S, 144°12'E; QGS F1373-4, 9 miles north of Tambo, on Blackall Road, Doncaster Member, 24°44'S, 146°15'E; QGS F1759, near Aramac, Doncaster Member, 22°59'S, 145°13'E; QGS F1763-4, Barcaldine, Doncaster Member, 23°34'S, 145°18'E; QGS F10485-86, Bungeworgorai Creek, near Mount Abundance Homestead, Doncaster Member, 26°36'S, 148°41'E; JCU F6814 Hughenden district, Jones Valley Member, 20°50’S, 144°11’E; JCU F11637, F11650 L912 and

approximately 40 unnumbered specimens, Flinders River, east of Glendower homestead, Jones Valley Member, 20°41'S, 144°34'E; JCU F11638 L916 and approximately 15 unnumbered specimens, near Jones Valley Station, Jones Valley Member, 20°32'S, 143°58'E; JCU F11639 L907 and 3 unnumbered specimens, Glendower Station, Flinders River, Doncaster Member, 20°40'S, 144°36'E; JCU F11636, F11645 L908 and 3 unnumbered specimens, Glendower Station, Flinders River, Doncaster Member, 20°40'S, 144°36'E; JCU F11640, F11651 L909 (approximately 5 unnumbered specimens), Glendower Station, Flinders River, Doncaster Member, 20°41'S, 144°33'E; JCU L911 (approximately 5 unnumbered specimens), Glendower Station, Flinders River, lower Doncaster Member, 20°41'S, 144°32'E; AM L1574 locality unknown; AM F10472-73 South central Queensland, locality unknown; AM F7118-F71120, Ward River Watershed, Doncaster Member, 24°58', 146°09'; AM F7123 watershed of the Barcoo and Ward rivers, Doncaster Member, c. 24°56'S, 146°13'E; AM F10318, F10319, 10474, F10619, F7283, South-central Queensland, locality unknown; AM F10609, Barcoo River, Doncaster Member, c. 24°46', 146°09'; SAM P29169 Wongalee Station, Hughenden, Doncaster Member, 20°36'S, 144°25'E.

Eromanga Basin, South Australia: SAM T1330 Lake Eyre, Bulldog Shale, 28°14'S, 136°35'E; SAM P18960, Marla Bore, NW South Australia, Bulldog Shale, 27°19'S, 133°33'E; SAM P19229, 40 miles north-west Oodnadatta, Bulldog Shale, 27°15'S, 135°58'E; SAM P10664, Stuarts Creek, central Australia, Bulldog Shale, 29°42'S, 137°02'E; SAM P21362, P19612, Cooper Pedy, Bulldog Shale, 28°55'S, 134°54'E; GSSA M2507, Toodina 7 5/570/7, 50kms from Algebuckina, Bulldog Shale, 28°56'S, 135°21'E; NMV P310459, P310460-2, P310464-5, P310463, P310466, P310467, Primrose Springs, Peake Station, Bulldog Shale, 28°05'S, 135°50'E; AM F9082 Mt Margaret, Bulldog Shale, 28°29'S, 136°04'E.

Carpentaria Basin, north Queensland: QM F1603 Hann Northern Expedition, Walsh River, Wallumbilla Formation, c. 16°53'S, 145°14'E; QM L682, Palmer River, Wallumbilla Formation, c. 16°04'S, 142°43'E; QM F33175-78, F33253, Boomers Hole, Wrotham Park Station, Wallumbilla Formation, 16°33'S, 143°47'E; QGS F8324, F8333, F8802 F10502, Elizabeth Creek, west of Wrotham Park Homestead, Wallumbilla Formation, 16°38'S, 143°56'E; QGS F8430, telegraph line crossing of Elizabeth Creek,

Wallumbilla Formation, 16°40′S, 143°59′E; QGS F8773, F8775, F8776, F8781, F10502, Elizabeth Creek, 0.2 mls west of Wrotham Park on Walsh Telegraph Station track crossing, Wallumbilla Formation, 16°39'S, 143°58'E; QGS F8802, near new Dunbar Road 0.4 miles west of telegraph line crossing, Wrotham Park Station, Wallumbilla Formation, 16°32′S, 143°54′E; QGS L 1318, 0.5 miles north of crossing of Emu Creek, Coen 13°47'S, 142°50'E; JCU F5170-2, 5175, Walsh River, Wallumbilla Formation, 16°39', 143°58'; JCU F8107, F8109 Boomers Hole, Walsh River, Wallumbilla Formation, 16°33′S, 143°47′E; JCU F8115, F8116, F8119, Elizabeth Creek, Wallumbilla Formation 16°40′S, 143°59′E; UQ F13146 Wrotham Park NW of Herberton, Wallumbilla Formation, 16°40′S, 143°59′E; AM F175, Walsh River, Wallumbilla Formation, c. 16°39', 143°58'.

Maryborough Basin, Queensland: QGS F7688, UQ 6304, UQ 5934 Woody Island, Maryborough district, Maryborough Formation, 16°23'S, 145°34'E; QM F12211 Jumpinpin, Crusoe Island, dredged sample, c. 27°45′S, 154°26′E; UQ unnumbered, L240, near Bromleys Farm, Nikembah, Maryborough District, Maryborough Formation, Maryborough Basin, 25°19'S, 152°48'E.

Money Shoals Basin, Northern Territory: JCU F1297-13001, 13003-13022,13024-13025,13027-13030, 13036, Imaluk Beach, Cox Peninsula, Darwin Formation, 12°26'S, 130°44'E.

Other: UQ L1304, Stanwell marine band, Stanwell Coal Measures, 23°32'S, 150°18'E; AM F66926-F66928, F37172, White Cliffs, N.S.W, Doncaster Member, 30°50'S, 143°05'E.

Diagnosis: Large, slender to robust *Peratobelus* terminating in a sharply pointed, dorsally offset, apex. Ventro-lateral grooves almost straight, terminating in the stem region. Alveolus extending some one third of the guard length, dorsally offset. Phragmocone large, robust, extending well beyond the anterior termination of the guard.

Dimensions: in millimetres (mm)

Guards only:

	L	**X**	**Dl_{max}**	**Dv_{max}**
SAM P21362	40.4	19.3	9.1	8.7
JCU F8109a	57.8	19.8	11.4	11.0
JCU F8109b	58.1	25.5	8.4	8.3

SAM P19612	61.8	28.8	10.4	8.7
UQ F35816	65.5	29.0	12.5	11.9
UQ F 35784	68.5	30.5	15.3	12.2
UQ F35781	69.2	21.5	15.0	13.2
QGS F1764	70.3	55.4	16.1	13.9
UQ F61086	73.1	32.7	9.9	9.8
AM F66928	73.2	32.4	12.9	10.8
QM F35523	78.2	37.2	15.9	14.5
QM F33252	78.2	47.8	20.1	16.7
GSSA M2470	79.9	39.9	14.1	13.4
UQ F35783	80.1	44.6	16.5	15.1
AM F66926	81.1	37.0	14.0	13.7
NMV P310467 a	82.8	48.0	23.6	21.0
UQ F35644	86.5	69.2	14.8	13.0
QGS F8430	87.6	66.3	23.2	19.1
QM F12211	89.2	61.2	31.9	29.8
GSSA M2507	90.1	43.1	15.8	14.0
QGS F8776 W14	96.9	44.3	20.5	18.8
UQ L1164b	98.2	55.0	12.0	10.9
UQ F61087	104.9	41.4	14.6	12.2
AM F66927	105.5	48.6	16.9	15.0
QGS F 8333	110.1	53.0	24.6	21.2
QM F 16432	112.9	56.6	29.6	26.1
UQ F12980	120.7	62.7	28.1	26.3

Phragmocones only (refer to Figure B. 4. 1 for schematic of measured parameters):

	L	**L_{total}**	**C**	**D_{max}**
QM F33178	32.0	32.0	32.0	10.9
QGS F8324	82.0	117.7	25.0	37.9
QGS F8802 W23	102.5	140.4	27.0	43.5
QM F33176	121.4	140.4	45.0	39.9
QM F5757	101.2	150.1	32.0	32.1
SAM P29169	87.2	150.7	26.0	39.2
QM F1703	121.0	160.2	25.0	44.7

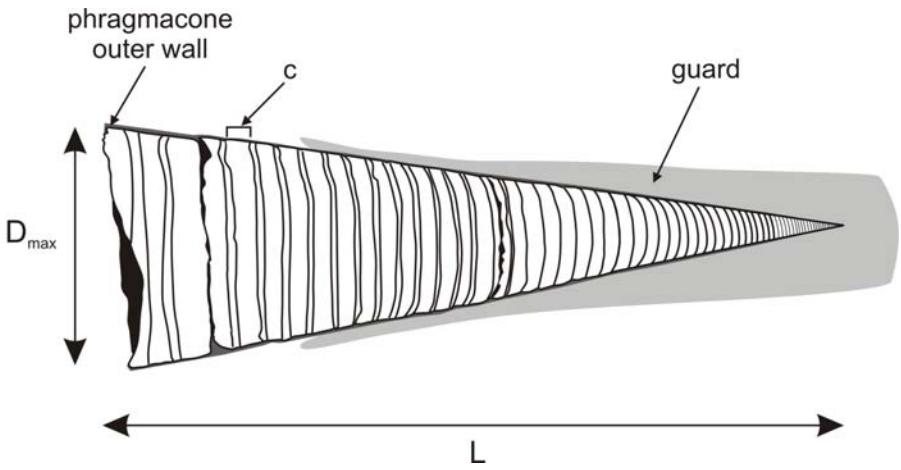


Figure B. 4. 1 Schematic line diagram of position of the phragmocone in relation to the guard, illustrating where measurements where taken. For the dimensions of phragmocones, the near perfect conical form allows a restored length (L_{total}) to be estimated for specimens where the earlier growth stages are missing due to breakage. C is the number of preserved chambers and D_{max} the maximum width of the last growth stage preserved.

Description: *Peratobelus* with large, slender to robust cylindroconical to weakly hastate guards almost symmetrical in profile, subcircular to weakly depressed in cross-section with the venter just slightly flattened at maturity (Figures B. 4. 2 to B. 4. 5). Guard length is 7 to 10 times the maximum width. Alveolar region, when fully preserved, flaring slightly at its anterior margin with alveolar walls tapering very gradually in thickness. Stem and alveolar regions approximately the same length and maintain an almost constant diameter. Apical region typically elongate with its margins in profile almost straight, tapering to a point, but may be blunt with its margins weakly arched in profile; the apex is slightly offset towards the dorsum. Apical angles vary from 15° to 35°. Deeply inscribed ventro-lateral grooves margin the venter. They are straight and extend to the posterior part of the stem region. Alveolus is deeply inset, extending a third of the guard length. Apical line offset towards the venter (Figures B. 4. 2 and B. 4. 5) and arched towards the ventral surface. Phragmocone regularly conical right to its origin, subcircular in cross-section, with the angle of taper varying from 12° to 20°. Up to 50 camerae separated by thin, concave septa are represented. Septa are thin, concave and very regularly spaced with the diameter spanning six to eight camerae in the immediately preceding portion of phragmocone. Siphuncle located at the ventral margin.

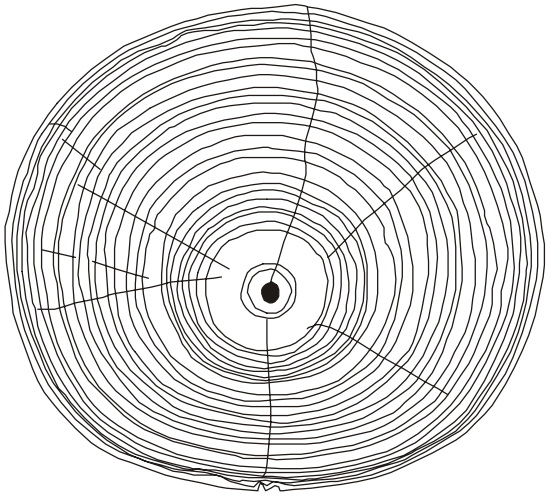


Figure B. 4. 2 *Peratobelus oxys* Tenison-Woods. QM F1641, upper Doncaster Member, northern Eromanga Basin. Transverse section in the stem region at point of maximum inflation, showing multiple growth lines indicating maturity. Impressions of grooves/lines are absent. Outline of guard is elliptical with apical line ventrally displaced, and growth lines more closely spaced in ventral sector. Dl_{max}: 22.8 mm; Dv_{max}: 20.7 mm. Magnification x 3.

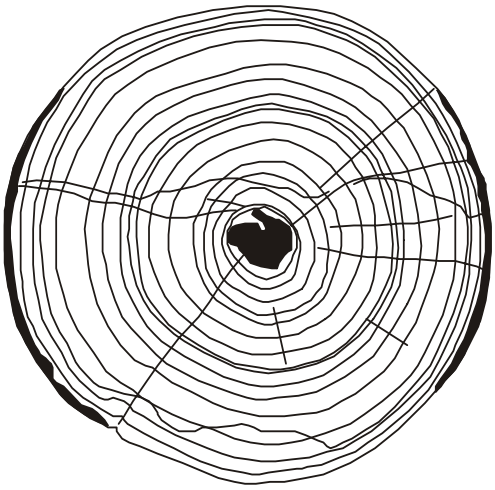


Figure B. 4. 3 *Peratobelus oxys* Tenison-Woods. SAM P19239, Bulldog Shale, southern Eromanga Basin. Transverse section at point of maximum inflation, of immature specimen with apical canal centrally placed. The guard outline is elliptical. No grooves are evident as section is in posterior stem sector were ventro-lateral grooves are lacking. Dl_{max}: 15.1 mm; Dv_{max}: 14.5 mm. Magnification x 4.

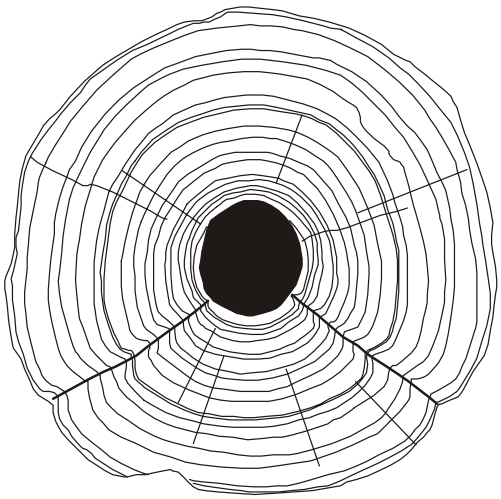


Figure B. 4. 4 *Peratobelus oxys* Tenison-Woods. QGS F8775, Wallumbilla Formation, Carpentaria Basin. Subcircular transverse section in posterior alveolar region, showing incised ventro-lateral grooves. Dl_{max}: 22.1 mm; Dv_{max}: 21.9mm. Magnification x 2.5.

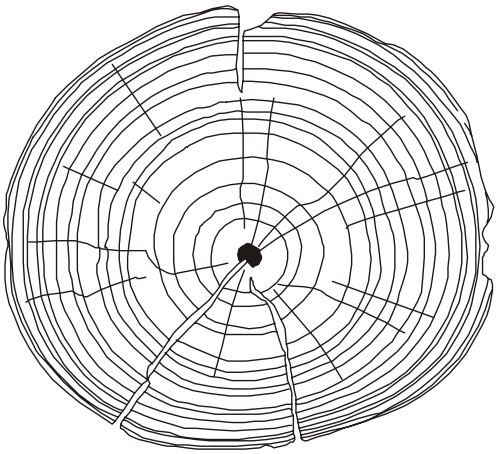


Figure B. 4. 5 *Peratobelus oxys* Tenison-Woods. JCU F11637 L912, Jones Valley Member, Eromanga Basin. Section in posterior of stem region showing slight ventral offset of apical canal. Outline is semi elliptical and slightly depressed. Dl_{max}: 19.3 mm; Dv max: 17.7 mm. Magnification x 2.7.

Discussion: It is now apparent that specimens used by Phillips (1870) in the establishment of *Belemnites australis* are conspecific with *P. oxys.* Phillips had a confused concept of *Belemnites australis*, including in it Albian *Dimitobelus diptychus* (McCoy, 1867a) as illustrated in his plate 16, figures 3, 4. The specimen in this illustration was largely the basis of his description of *B. australis* which notes in particular a hastate shape and the curved character of its ventro-lateral grooves. Also included in *B. australis* was the specimen illustrated in his plate 16, figures 1, 2, a large and robust, cylindroconical guard characterised by straight ventro-lateral grooves which extend only as far as the stem region. The latter has been taken by most subsequent authors as representing *P. australis* and the specimen on which the illustration was based was designated as the lectotype by Day (1967b, p. 6). A small, immature guard with part of a clearly chambered phragmocone attached (his plate 16, figures 6, 6a, 6b) was referred by Phillips to *Belemnites paxillosus* Schlotheim. Subsequently Tate (Tate, 1889, p. 229) considered it to represent a new species which he named *Belemnites eremos.* Both the designated lectotype of *B. australis,* and this specimen, represent *P. oxys,* fitting within the range of variation now established for this taxon. In particular the lectotype shows the shape and diagnostic straight ventro-lateral grooves of *P. oxys*. It shows a blunt apex, somewhat unusual for this species, but within the range of variation known for it. All of Phillips' material is missing, apparently lost in the `Garden Palace fire' which affected Sydney in 1882 as noted by Day (1969).

It might be argued that *P. australis* has priority over *P. oxys*. However, given that the description of *P. australis* was largely based on a specimen of *Dimitobelus diptychus* (McCoy, 1867a), that the type material is missing, and that the name *oxys* has been very widely used in the literature including being designated as the type species of *Peratobelus*, Phillips' name is not employed here. An appropriate action would be an application to the Commission of Zoological Nomenclature to have the name *australis* suppressed.

Previously phragmocones of this species have been referred to *Peratobelus selheimi* whereas guards have been assigned as *P. oxys*. Both commonly occur together, such as in the Doncaster Member of the Wallumbilla Formation exposed along the Walsh and Flinders Rivers in north Queensland, in the vicinity of Bungeworgorai Creek, southern Queensland and at Primrose Springs on Peake Station in South Australia. Very few specimens show both guard and phragmocone and where this is the case, the guard is almost always just a small fragment and/or is obscured by matrix. However, a key specimen, QM F14320, shows a substantially complete guard as characteristic of *P. oxys* and most of a phragmocone as characteristic of *P. selheimi*. It is clear that these two separately named elements belong to a single species.

Publications by Tenison-Woods establishing *Belemnites oxys* and *B. selheimi* both date from 1883. *B. oxys* is taken as the senior subjective synonym because a cast of the lectotype, a guard, is available for it. Given that belemnite species are universally diagnosed on guard characteristics, this specimen is more useful in species definition than the original of *P. selheimi* which is a phragmocone. The original specimens on which the two species were erected have both been lost and there is no replica available of that on which *B. selheimi* was based. An additional consideration in applying priority in this case is that *P. oxys* is the type species of *Peratobelus* and its retention as a species category is in the interests of nomenclatural stability.

The large phragmocone from Wallumbilla described by Philips (1870) undoubtedly must be *B. oxys* (= *selheimi*), "counting above forty septa; with the whole number must have been fifty, without reaching the last chamber… the phragmocone is nearly straight, with an angle of 18°". Clarke (1862) named a specimen from the

same locality as *B. barklyi*, for which McCoy (1866) wrote "a large species…..nearly related to the gigantic species of the Lower Oolite and Lias of Europe, but which cannot be fully characterised from the present specimen, as all the posterior portion of the guard is broken away". Etheridge (1892) suggested that this specimen is very likely to represent *B. selheimi*. However, Clarke's specimen was not figured and cannot be identified in contemporary collections. *B. barklyi* is therefore a *nomen dubium*.

The lectotype cast of *P. oxys*, AM L1574, represents a substantially complete, robust guard as figured by Tenison-Woods (Tenison-Woods, 1883a, pl. 13, figs 1-3), and refigured by Etheridge (Etheridge, 1902a, pl. 6, figs 4-6), apart from the apex which is missing, and shows the characteristic straight ventro-lateral grooves. A number of other guards are similarly robust and show an acute, attenuated apex as figured by that author. However, other specimens are more slender, ranging to AM F37172 and QMF33178 for which the maximum diameter is only one tenth of the full guard length, compared to some seven times the full length of robust morphs. The slender forms have an unusually long, gradually tapered apical region. There is continuous variation in these attributes, similar to that shown by *Dimitobelus stimulus*. This suggests that the animals of some belemnite species showed variation in length for the same body weight to which the buoyancy and trim imparted by the skeleton related. Variation in the shape of the apical region is also evident, with some morphs being less sharply pointed than others as shown by the range of apical angle. Some morphs show the alveolar region as a little more slender than the stem, imparting a weakly hastate outline to the guard, which could possibly be an ontogenetic feature.

The outer wall of the phragmocone is thin and is not fully preserved on specimens free from matrix. These invariably show the internal septa which were very regularly inserted, becoming progressively more widely spaced as growth proceeded. The largest phragmocone, AM F175, had a length of some 14 cm and there are a number of fragmentary specimens of equivalent size. QMF 33175 shows a complete phragmocone some 6 cm in length associated with the alveolar region of the guard which has a diameter of 9 mm. Using these measures to scale, on the basis that

the phragmocone is has a near-perfect conical form, the large phragmocones would have been associated with guards some 2 cm in diameter as is the case for the largest specimens in the collection, including the lectotype replica. Thus guard and phragmocone were of similar lengths and the total skeletal length of guard plus phragmocone combined would have been close to 20 cm when growth was complete.

Fossil occurrence for *P. oxys* shows that post-mortem separation of guard and phragmocone was clearly the norm. This suggests that buoyancy of the phragmocone persisted through destruction of the soft tissues and that it was not firmly attached to the guard. It is surmised that when the skeleton was exposed some time after death, the retained buoyancy of the phragmocone caused its separation from the guard with subsequent transport until the chambers became flooded, settlement occurred and fossilisation commenced.

Willey (1972, fig. 3d) assigned a specimen from south-east Alexander Island, Antarctica, as *P. oxys*. This probably also applies for the partially preserved specimen he referred to *Dimitobelus macgregori* (Glaessner). It is certainly the case for the specimen figured by Willey (1972, figs. 3a, b) as *Dimitobelus* sp. aff. *D. macgregori* (Glaessner) which has a guard shape and straight, undeflected ventro-lateral grooves terminating in the stem region as typical of *Peratobelus oxys*. The Alexander Island specimens assigned by Doyle (1987a) as *P*. cf. *oxys* are considered here as definite representatives of this species.

P. oxys is readily distinguished from *P. bauhinianus* Skwarko which is decidedly smaller at maturity (Figure B. 4. 6), with a generally less robust form, and has the ventro-lateral grooves extending onto the apical region and show a clear deflection towards the dorsum in their distal reach.

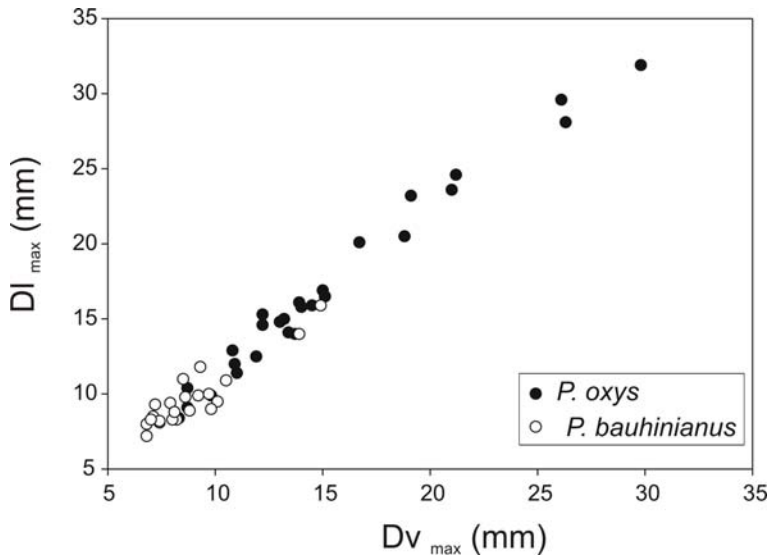


Figure B. 4. 6 Relationship of maximum diameters in *Peratobelus* species. *P. oxys* guards are typically more compressed and can grow to be much longer specimens than *P. bauhinianus*.

Distribution and Age: Within the northern Eromanga and Carpentaria Basins, *P. oxys* is well known from the late Aptian Doncaster and Jones Valley Members of the Wallumbilla Formation. It occurs in the Minmi Member of the Aptian Blythesdale Formation of the Surat Basin and in the Maryborough Formation of the Maryborough Basin of coastal southern Queensland. It is also extensively represented in the Aptian Bulldog Shale, of the south-western Eromanga Basin. Occurrences have also noted near Aramac in the northern Eromanga Basin from at the base of the Coreena Member, a lower division of the Albian Doncaster Formation. However these are considered as due to reworking from underlying Aptian strata as they are associated with Albian *Dimitobelus diptychus* in `belemnite conglomerates' formed on an omission surface (Day, 1969). The species is also known from Aptian strata of the Antarctic Peninsula.

***Peratobelus bauhinianus* Skwarko**

Pl. 1, figs. 1-5

Synonymy:

?1964 *Peratobelus australis* (Phillips); Day, table 3.

1966 *Peratobelus* (?) *bauhinianus* Skwarko, p. 124, pl. 15, figs. 7-11.

?1966 *Dimitobelus* (?) *youngensis* Skwarko, p. 125, pl. 15, figs. 1-6, 12..

1967b *Peratobelus australis* (Phillips); Day, p. 6, pl. 1, figs. 22, 23; text-fig. 1a-d.

?1972 *Peratobelus* aff. *australis* (Phillips); Willey, p. 38, fig. 4f.

?1987 *Peratobelus* (?) sp.; Doyle, p. 155, p. 21, fig. 7.

1998 *Peratobelus forsteri* Doyle; Henderson, p. 119.

Type Specimens: Holotype CPC 4795, west of Borroloola, Northern Territory, Mulliman Beds, 16°06'S, 136°05'E. Paratypes CPC 4797, 4799, west of Borroloola, Northern Territory, Mulliman Beds, 16°06'S, 136°05'E; CPC 4796, 4798, WSW of Borroloola, Northern Territory, Mulliman Beds, 16°08'S, 136°02.5'E.

Material: Approximately 300 specimens.

Northern Eromanga Basin, Queensland: QM F27909-F27915, Rosevale, south of Muckadilla, 26°40'S, 148°25'E; UQ F30495 l1819, western cliff of Bungewogorai Creek, Doncaster Member, 26°36'S 148°42'E; UQ F61084, 61086-7, 200 yards from the southern side of Warrego Highway, 100 yards west of Bungeworgorai Creek, Doncaster Member, 26°36'S, 148°42.5'E; QM F2030 Maranoa River, Mitchell, 26°28'S, 147°58'E; JCU L912 (2 specimens) Flinders River, east of Glendower homestead, Jones Valley Member, 20°41'S, 144°34'E; JCU L909 (5 specimens) Glendower Station, Flinders River, Doncaster Member 20°41'S, 144°33'E.

Southern Eromanga Basin, South Australia: SAM P3023 Lake Eyre, 28°14°S, 136°35'E; SAM P19612 (2 specimens) and P21362, `the shelly patch', Cooper Pedy, 28°56°S, 134°45'E. AM F9214-15, 9926-7, F10004, White Cliffs, western N.S.W, 30°50'S, 143°05'E.

Carpentaria Basin, Queensland: QGS F8431, east Bank of Walsh River, 0.6 mls north of Boomers Hole, Wallumbilla Formation, 16°32'S, 143°47'E; JCU F8109 L169, Boomers Hole, Wrotham Park Station, Wallumbilla Formation, 16°40'S, 144°00'E.

Carnarvon Basin, Western Australia: WAM 62.194 (approximately 50 specimens), Murchison River district, Windalia Radiolarite, 27°36'S, 114°12'E; WAM 65.1159 (approximately 50 specimens), 20 miles west of Binnu via Geralton, Windalia Radiolarite, 28°02'S, 114°40'E; WAM 68.470, surface rock 10 miles East of Kalbarri, Windalia Radiolarite, 27°47'S, 114°21'E; WAM 69.25 (approximately 15 specimens), 11 miles from Kalbarri on road to Ajana, undifferentiated Windalia Radiolarite and Birdrong Sandstone, 27°37'S, 114°10'E; WAM 79.3104 (approximately 20 specimens), West Binnu, near junction of West Binnu Road and Yerina Springs Road, Windalia

Radiolarite, 28°02'S, 114°36'E; WAM 81.1946, Twelve Mill Hill, east of Kalbarri, Windalia Radiolarite 27°41'S, 114°12'E; WAM 83.633/9 (7 specimens),scree at base of west side of Windalia Hill, Windalia Radiolarite 23°16'S, 114°48'E; UWA F92.6 Ajana, track heading south from Yuna, Windalia Radiolarite, 27°57'S, 114°36'E; GSWA Barrabiddy 1, see Appendix A. 1, undifferentiated Windalia Radiolarite, 23°49′57″S, 114°20′E; GSWA Boologooro 1, see Appendix A. 2, Windalia Radiolarite, 24°19′27.3″S, 113°53.3″E; GSWA Edaggee 1, see Appendix A. 3, Windalia Radiolarite, 25°21′27.0″S, 114°14′04.9″E; GSWA Yinni 1, see Appendix A. 4, Windalia Radiolarite, 26°03′22.8″S, 114°48′58.5″E.

Money Shoals Basin, Northern Territory: JCU F1297-13001, 13003-13022,13024-13025,13027-13030, 13036, Imaluk Beach, Cox Peninsula, Darwin Formation, 12°26.5'S, 130°46'E.

Other: UQ F35511, F35606 Minmi Shell Bed Gully, 1/4 mile NE of Minmi crossing, Minmi Member, Surat Basin, N.S.W., 16°29'S, 143°50'E.

Diagnosis: Medium sized, moderately slender, slightly hastate *Peratobelus* with long ventro-lateral grooves that extend onto the apical region and are initially straight but dorsally deflected in the stem region.

Description: Guard of medium size, reaching lengths of about 10 cm, elongate and slender with the length some eight times the maximum width. Outline and profile cylindroconical to weakly hastate, profile symmetrical. Cross-section subcircular to very slightly oval and depressed (Figures B. 4. 7 and B. 4. 8) with the axis of maximum width located at the base of the stem region. Apical region typically attenuated, almost conical and sharply pointed with an apical angle of 12-20°; may be less sharply pointed with curved margins seen in profile with apical angles ranging to 30°; apex central or slightly offset towards the venter. Ventro-lateral grooves long, narrow, deeply incised but becoming less so towards the posterior. They extend from the anterior margin to the anterior part of the apical region. They are straight and subparallel on the alveolar region and anterior part of the stem, where they mark the edge of the venter. On the posterior stem and apical region they weaken and are deflected dorsally. Axial line is subcentral and commonly excavated as a canal.

Alveolus penetrates about one third of the guard length; phragmocone conical, slightly offset towards the dorsum with the siphuncle at its ventral margin.

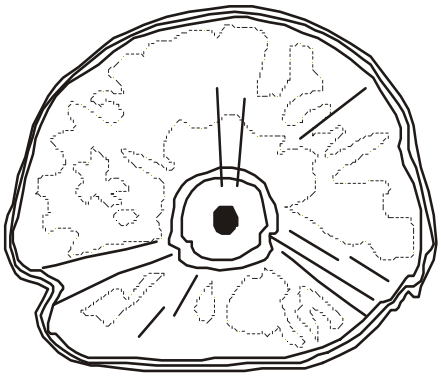


Figure B. 4. 7 *Peratobelus bauhinianus* Skwarko. WAM 65.1159, Windalia Radiolarite, Carnarvon Basin. Transverse view shows ventro-lateral grooves and ventrally offset apical canal. The guard section is elliptical with a slightly flattened ventral surface. Internal microstructure and growth lines lost due to diagenetic overprint. Dl_{max}: 9.6 mm; Dv_{max}: 7.9 mm. Magnification x 5.5.

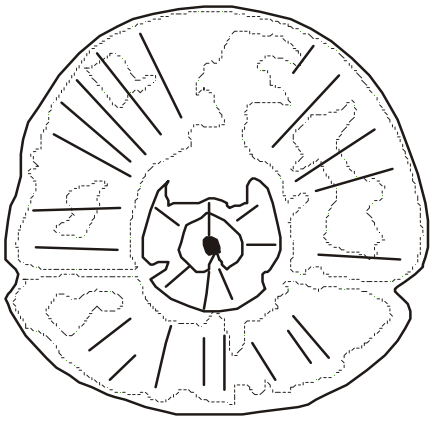


Figure B. 4. 8 *Peratobelus bauhinianus* Skwarko. WAM 62.194, Windalia Radiolarite, Carnarvon Basin. Subcircular transverse section of juvenile specimen showing clear ventro-lateral grooves and of the apical canal slightly offset towards the venter. Internal microstructure and growth lines lost due to diagenetic overprint. Dl_{max}: 9.2 mm; Dv_{max}: 9.0 mm. Magnification x 6.

Dimensions: in millimetres (mm)

	L	X	Dl_{max}	Dv_{max}
JCU F13002	25.5	10.0	-	7.5
WAM 65.1159d	33.7	24.2	8.1	7.4
UQ F35511	36.2	19.7	9.5	10.1
WAM 65.1159c	39.1	18.1	9.8	8.6
WAM 62.194c	39.8	16.1	7.2	6.8
JCU F13025	40.0	15.0	11.5	11.0
WAM 62.194h	40.0	13.4	8.0	6.8
WAM 65.1159b	40.9	17.9	8.5	7.1
WAM 62.194e	43.0	17.9	8.2	7.4
WAM 65.1159a	44.9	26.9	11.8	9.3
WAM 62.194b	44.6	17.9	8.3	8.2
WAM 62.194 g	45.0	18.0	8.3	7.0
WAM 62.194d	45.2	15.9	9.3	7.2
WAM 69.25d	46.0	26.2	9.9	9.2
WAM 62.194f	46.6	19.1	8.3	8.0
WAM 62.194i	47.2	19.0	9.4	7.9
QGS F8431	47.2	27.3	8.9	8.8
WAM 62.194a	48.1	21.2	8.8	8.1

WAM 69.25c	50.6	33.3	11.0	8.5
AM F10004	59.0	26.8	11.1	11.0
UQ F30495	59.4	50.9	15.9	14.9
WAM 83.638	60.8	23.2	10.0	9.7
WAM 69.25b	60.9	40.6	10.9	10.5
SAM P3023	63.2	38.1	20.9	18.7

Discussion: This species of *Peratobelus* has been much confused with *P. oxys* as discussed above. There has been a long history of collection of distinctively slender Aptian belemnites from the Walumbilla Formation and correlative units of the Eromanga Basin but the first available specific name that can be utilised is *P. bauhinianus* which was applied by Skwarko (1966) to a small collection from a single locality near Borroloola in the eastern Northern Territory. Its morphology is clearly represented by a suite of well preserved moulds from the Darwin Formation of the Bathurst Island Group exposed around Darwin Harbour, Northern Territory, where it occurs prolifically in a belemnite bed within a thin Aptian interval as reported by Henderson (1998). The poorly preserved moulds described by Skwarko (1966) as *Peratobelus* (?) *bauhinianus* are from an Aptian horizon within his `coastal suite' of the Mulliman Beds. Strata of this suite are best considered as an inland extension of the Bathurst Island Group (Henderson, 1998). Thus the type series of *Peratobelus* (?) *bauhinianus* is from a stratigraphic horizon that is close to that of the belemnite bed at Darwin Harbour from which much better material is available. The poorly preserved moulds also from the Mulliman Beds assigned as *Dimitobelus* (?) *youngensis* by Skwarko (1966) are likely to be conspecific with *B. bauhinianus*. They have the same slender form, cross-sectional shape and grooves but the apex is unusually blunt. *P. bauhinianus* is extensively represented by collections from the Windalia Radiolarite (Aptian) of the Carnarvon Basin but preservation is generally poor.

The species shows variation in guard inflation, cross-sectional shape (Dl_{max}:Dv_{max} 1.1-1.3), the shape of the apical area, and the degree to which hastation is developed. Even so, it is a distinctive taxon. It is closely related to *P. foersteri*, described from the Aptian of southern Mozambique by Doyle (1987b). The Mozambique species however has a subquadrate cross-section, with a flattened venter, whereas *P. bauhinianus* has a more rounded cross-sectional outline.

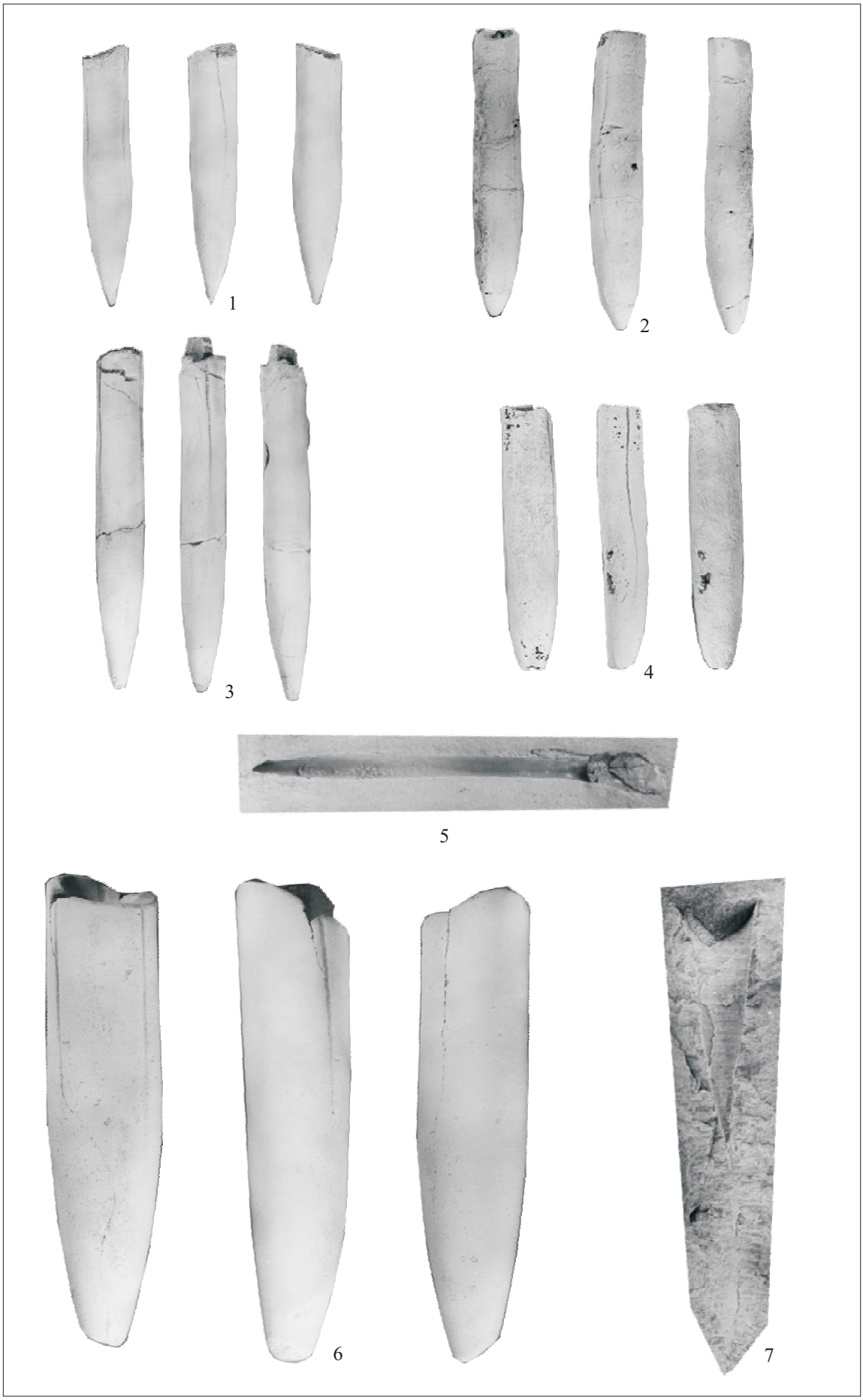
Distribution and Age: This species is widely represented in the late Aptian Wallumbilla Formation of the northern Eromanga and Carpentaria basins. It also occurs in Aptian strata of the south-western Eromanga Basin; only old collections are available but these are likely to have come from the Bulldog Shale. It the characteristic macrofossil of the Windalia Radiolarite which is assigned an Aptian age. A single fragmentary guard from the underlying Munderong Shale (late Barremian) probably represents *B. bauhinianus* but is too incomplete for reliable identification. The species is common in the lower, Aptian, part of the Darwin Formation of the Money Shoals Basin in the Northern Territory and is also known from correlative horizons of the Mulliman Beds.

EXPLANATION OF PLATE 1

Each numbered group illustrates from left to right: ventral outline, profile and dorsal outlines, unless otherwise stated.

Figures 1-5. *Peratobelus bauhinianus* (Skwarko). 1, QGS F8431 x 1, Blackdown Formation, Aptian, Laura Basin. 2, UQ F35606 x 1, Minmi Member, early Aptian, Carpentaria Basin. 3, UQ F61086 x (.75), Doncaster Member, Aptian, north-eastern Eromanga Basin. 4, WAM 62.194 x 1, Windalia Radiolarite, Aptian, Carnarvon Basin. 5, UQ L240 x 1, mould of profile, Maryborough Formation, Aptian, Maryborough Basin.

Figures. 6-7. *Peratobelus oxys* (Tenison-Woods). 6, UQ F12980 x (.75), Doncaster Member, Aptian, north-eastern Eromanga Basin. 7, internal mould, UQ F64860 x (.75), Doncaster Member, north-eastern Eromanga Basin.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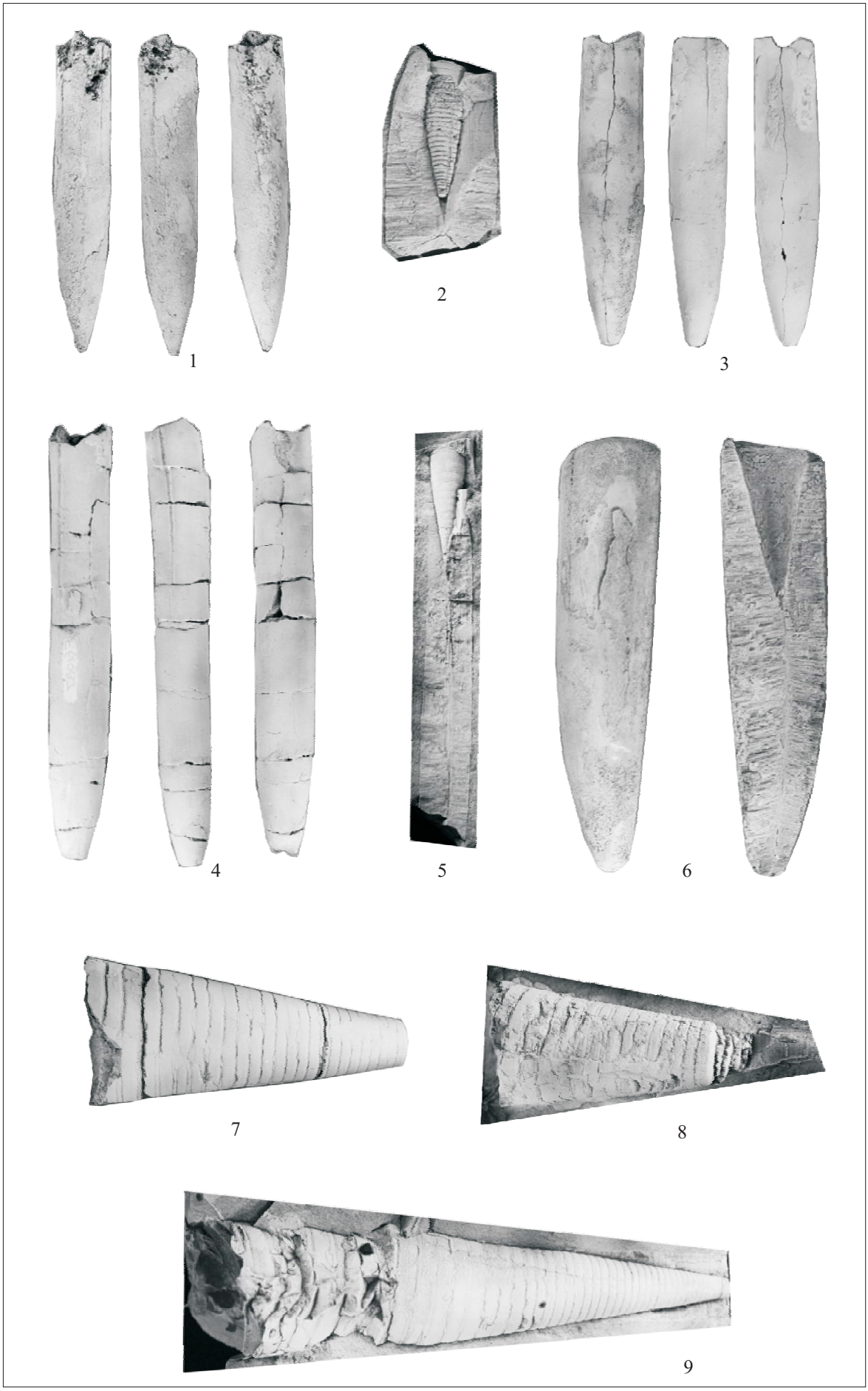
EXPLANATION OF PLATE 2

Each numbered group illustrates from left to right: ventral outline, profile and dorsal outlines, unless otherwise stated.

Figures 1-9. *Peratobelus oxys* (Tenison-Woods). 1, GSSA M2470 x (.75), Bulldog Shale, Aptian, southern Eromanga Basin. 2, longitudinal section, QM F43847 x (.75), Doncaster Member, Aptian, north-eastern Eromanga Basin. 3, Lectotype UQ F35523 x (.75), Doncaster Member, Aptian, north-eastern Eromanga Basin. 4, UQ F61087 x (.75), Doncaster Member, Aptian, north-eastern Eromanga Basin. 5, longitudinal section, QGS F1374 x (.5), Doncaster Member, Aptian, north-eastern Eromanga Basin. 6, lateral and inner profile, QM F16432 x (.5), locality unknown, Aptian, north-eastern Queensland. 7, phragmocone only, QM F5757 x (.5), Doncaster Member, Aptian, north-eastern Eromanga Basin. 8, phragmocone only, QGS F8324 x (.5), Blackdown Formation, Aptian, Laura Basin. 9, QM F33176 x (.5), Blackdown Formation, Aptian, Laura Basin.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