

# Adelieledone, a new genus of octopodid from the Southern Ocean

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**Abstract:** The syntypes of the endemic Southern Ocean octopodid *Pareledone polymorpha* (Robson, 1930) were re-examined and measurements, counts and indices are presented. The two forms described by Robson, namely *oblonga* and *affinis*, are determined to have no taxonomic validity. The species *polymorpha* shows morphological similarities with *Pareledone adeliaeana* (Berry, 1917) but differs in relative arm lengths, sucker counts, external colouration and size at maturity. Both species are transferred to the new genus *Adelieledone*, which is separated from the genus *Pareledone* s.s. by the transverse ridges in the ligula groove of the hectocotylus, the sharp tip of the lower beak, the enlarged posterior salivary glands, the absence of stylets and by skin sculpture, especially by the presence of two longitudinal integumentary ridges on the dorsal mantle. A new species, *Adelieledone piatkowski*, is described from the Antarctic Peninsula. Beak morphology can discriminate the genera in predator studies.

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**Key words:** Antarctica, Cephalopoda, Octopodidae, *Pareledone*, taxonomy

## Introduction

The endemic Southern Ocean octopod genus *Pareledone* is abundant and diverse (Allcock *et al.* 2001) and is of some ecological importance; its species feed on amphipods, polychaetes, fish and ophiuroids (Piatkowski *et al.* in press) and are fed on by top predators such as pinnipeds (Klages 1996) including southern elephant seals, *Mirounga leonina* L., 1758 (Rodhouse *et al.* 1992) and Weddell seals, *Leptonychotes weddellii* (Lesson, 1826) (Lipinski & Woyciechowski 1981).

The wide morphological variability that exists within *Pareledone* s.l. has been noted in many studies and the status of the genus has often been questioned. Voight (1993) suggested there was no conclusive evidence that the congeners shared an evolutionary history. Daly & Rodhouse (1994) illustrated wide morphological differences in the beaks and hectocotyli of *Pareledone polymorpha* (Robson, 1930) and *P. turqueti* (Joubin, 1905), whilst Ogden *et al.* (1998) commented further on the unusual beak of *P. polymorpha*. Lu & Stranks (1994) cited potential morphological reasons, including the W-shaped funnel organ and ribbed ligula groove, for removing *P. adeliaeana* (Berry 1917) and its sister taxon *P. polymorpha* from *Pareledone* s.s. Recent genetic evidence (Carlini *et al.* 2001, Allcock & Pierny 2002) suggests that *Pareledone* is not monophyletic and supports the morphological findings. These studies have led to a better understanding of species within the group and we are now able to define the

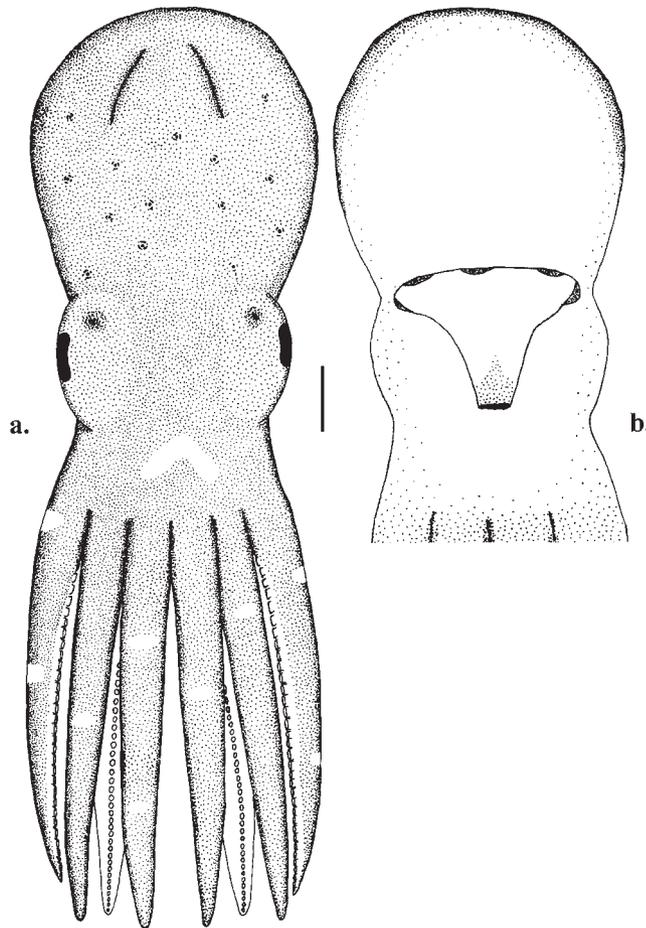
characters that separate *P. polymorpha* and *P. adeliaeana* from *Pareledone* s.s. We have used this information to erect a new genus, *Adelieledone*, to accommodate these two species.

The removal of *adeliaeana* and *polymorpha* considerably simplifies the diagnosis of the genus *Pareledone* and may help remove some of the controversy that has traditionally surrounded this genus. We have included a revised diagnosis.

Robson (1932) suggested that there were two varieties of *polymorpha*: *oblonga* and *affinis*. Deformation associated with preservation is well documented and *polymorpha* is a gelatinous species that might be particularly prone to such deformation. However, while re-examining the type series of *polymorpha*, we realised it included several specimens of *P. turqueti*, removal of which considerably reduced the variability within the series. We include a redescription based on correctly identified material in the type series.

A third new species of *Adelieledone* has been discovered during the course of this work and is described herein.

Abbreviations and indices used throughout this paper follow Roper & Voss (1983). Indices are given as *min-mean-max*. Specimen repositories are abbreviated as: BMNH = Natural History Museum, London; NMSZ = National Museums of Scotland, Edinburgh; MV = Museum Victoria, Melbourne; AM = Australian Museum, Sydney; MNHN = Muséum National d'Histoire Naturelle, Paris.



**Fig. 1.** External anatomy of *Adelleledone polymorpha*, NMSZ 2002037.029, ♀, 57 mm ML. **a.** Dorsal view, **b.** Ventral view. Scale bar 10 mm.

## Systematics

Octopodidae Orbigny, 1840

*Adelleledone* gen. nov.

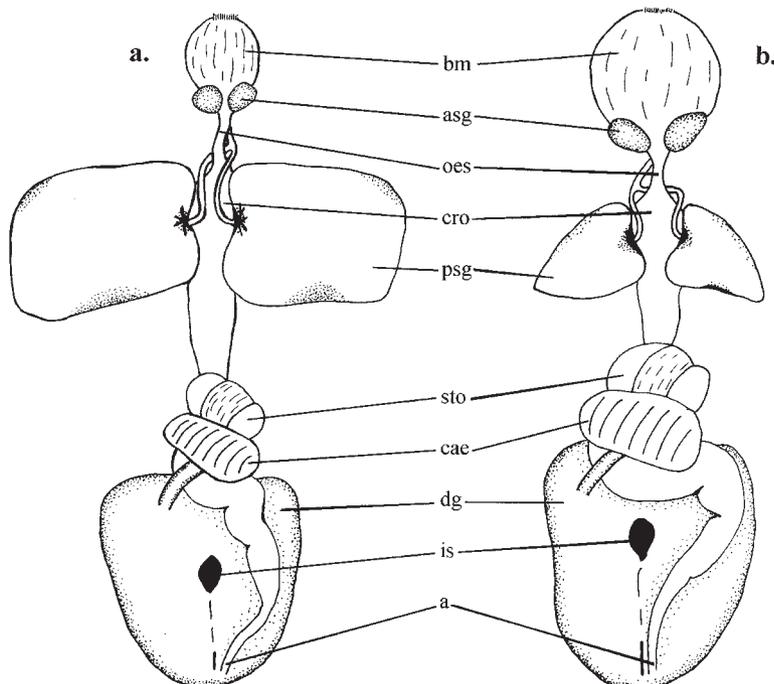
(Figs 1, 2a, 3a–e, 4)

**Diagnosis:** Benthic octopodids, ML to 90 mm; mantle saccular, without fins; eight arms lacking cirri; arms with small (ASI 4–10) uniserial suckers, third right arm of males hectocotylized with end of arm clearly differentiated into ligula and calamus, ligula large (LLI 10–16), ligula groove long, well marked and deep with transverse ridges (Figs 3c & 4c), arm tips not otherwise modified; web depth medium (WDI 20–40); funnel organ W-shaped (Fig. 3b); gills well developed, with 6–8 lamellae; ink sac present or reduced; crop well developed, posterior salivary glands large (length of posterior salivary glands up to twice the length of the buccal mass; Fig. 2a), chromatophores present within the connective tissue covering the dorsal surface of digestive gland; stylets absent; two short, longitudinal integumentary ridges on the mid-dorsal posterior mantle (Figs 1a & 4a); diverticulum of penis not coiled (Fig. 3d), spermatophores medium length (SpLI 60–80) and slender; rostral tip of lower beak sharp (Fig. 3a); radula with nine elements (Fig. 3e), rachidian with large central cusp, rachidian may have other minor cusps.

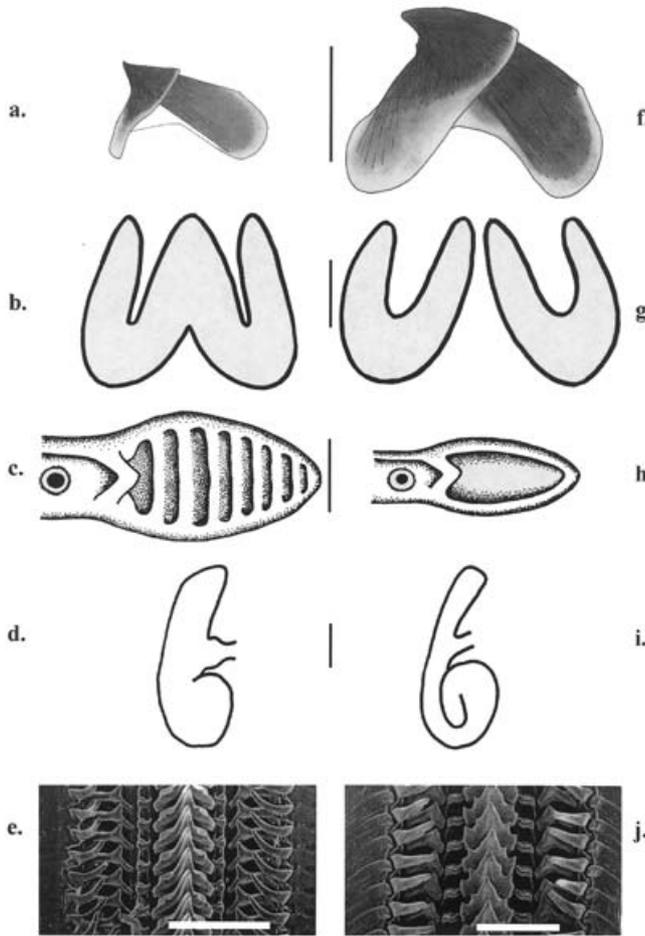
**Type species:** *Moschites adelleana* Berry, 1917. By original designation.

**Included species:** *Moschites adelleana* Berry, 1917, *Graneledone polymorpha* Robson, 1930, *Adelleledone piatkowski* sp. nov.

**Etymology:** From the combination of Adélie (the type



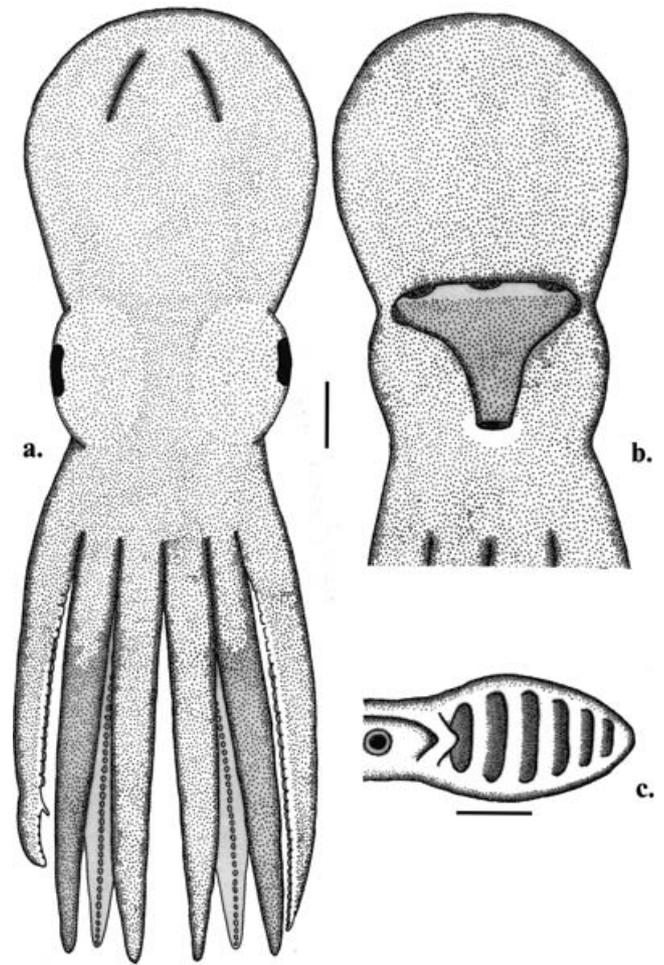
**Fig. 2.** Comparative anatomy of digestive systems. **a.** *Adelleledone polymorpha*, NMSZ 2002037.029, ♂, 75 mm ML, **b.** *Pareledone turqueti*, NMSZ 2002037.046, ♂, 78 mm ML. Scale bar 10 mm. Abbreviations: a = anus, asg = anterior salivary gland, bm = buccal mass, cae = caecum, cro = crop, dg = digestive gland, is = ink sac, oes = oesophagus, psg = posterior salivary gland, sto = stomach.



**Fig. 3.** Comparative anatomy of **a–e.** *Adelieledone polymorpha*, NMSZ 2002037.029, ♂, 75 mm ML and **f–j.** *Pareledone turqueti*, NMSZ 2002037.046, ♂, 78 mm ML (right). **a, f.** Lower beaks, **b, g.** Funnel organ, **c, h.** Hectocotylus, **d, i.** Penis, **e, j.** Radula. Scale bars **a–d,** **f–i** = 5 mm, **e, j** = 0.5 mm.

species is from Adélie Land, Antarctica) and *Eledone*.

Remarks: Members of this genus may be distinguished from *Pareledone s.s.* by the presence of chromatophores within the connective tissue covering the dorsal surface of the digestive gland (absent in *Pareledone*), the sharp rostral tip of the lower beak (Fig. 3a) (rounded in *Pareledone*; Fig. 3f), the presence of transverse ridges in the ligula groove (Fig. 3c) (absent in *Pareledone*; Fig. 3h), the smaller size of the spermatophores (SpLI 60–80 in *Adelieledone*, SpLI 100–200 in *Pareledone*), the uncoiled penis diverticulum (Fig. 3d) (coiled in *Pareledone*; Fig. 3i), the size of the posterior salivary glands (up to twice the length of the buccal mass in *Adelieledone*; Fig. 2a, less than the length of the buccal mass in *Pareledone*; Fig. 2b), the absence of stylets (small cartilaginous stylets are present in *Pareledone*) and the presence of longitudinal integumentary ridges on the dorsal posterior mantle (Figs 1a & 4a) (absent in *Pareledone*).



**Fig. 4.** External anatomy of *Adelieledone piatkowski*, NMSZ 2000081.053, ♂, 58 mm ML: **a.** dorsal view, **b.** ventral view, **c.** hectocotylus. Scale bars **a, b** = 10 mm, **c** = 5 mm.

The clear differences in beak shape between *Pareledone* and *Adelieledone* will be particularly pertinent to researchers involved in predator/prey studies in the Southern Ocean. Because octopod lower beaks show less morphological variability than teuthid beaks, octopod beaks found in predator stomachs are often identified simply as Octopodidae sp. (for examples see Klages 1996). *Pareledone* beaks conform to the octopodid norm (Fig. 3f) and are therefore hard to identify from stomach contents, however the beaks of *Adelieledone* are quite unusual in morphology (Fig. 3a). Because of these differences, *Adelieledone* specific equations will be required when estimating prey biomass. However the sharp rostral point of the lower beak provides a clear and easy character by which researchers can identify beaks of *Adelieledone*.

The unusual beak shape of *Adelieledone* is accompanied by unusually large posterior salivary glands. As suggested by Daly & Rodhouse (1994), it is likely that *Adelieledone* is occupying a different trophic niche from *Pareledone*, but diet studies are needed to confirm this.

**Table I.** *Adelieledone polymorpha* (Robson, 1930). Specimens in the type series.

Catalogue number	Station data	Robson's identification	Current identification	Type status	Sex	Maturity	ML (mm)
1951.4.26.26	Station 42. East Cumberland Bay. Large otter trawl. 1 April 1926. 120–204 m.	polymorpha	polymorpha	holotype	♂	mature	52
1951.4.26.27	Station 45. 2.7 miles S 85°E of Jason Light. Large otter trawl. 6 April 1926. 238–270 m.	oblonga	polymorpha	holotype	♂ <sup>1</sup>	submature	44
1951.4.26.28	Station 39. East Cumberland Bay. Large otter trawl. 25 April 1926. 179–235 m.	oblonga	polymorpha	paratype	♂	mature	47
1951.4.26.29	Station MS 68. East Cumberland Bay. Large rectangular net. 2 March 1925. 220–247 m.	oblonga	polymorpha	paratype	♀	mature	52
1951.4.26.30	Station MS 68. East Cumberland Bay. Large rectangular net. 2 March 1925. 220–247 m.	oblonga	polymorpha	paratype	♂	submature	38
1951.4.26.31	Station 42. Mouth of Cumberland Bay. Large otter trawl. 1 April 1926. 120–204 m.	affinis	polymorpha	holotype	♂	mature	39
1951.4.26.32-37	Station 142. East Cumberland Bay. Large otter trawl. 30 December 1926. 88–273 m. 54°11'30"S 36°35'W.	affinis	turqueti	paratype	♂	submature	38
		affinis	turqueti	paratype	♀	mature	58
		affinis	polymorpha	paratype	♀	mature	60
		affinis	polymorpha	paratype	♀	submature	49
		affinis	polymorpha	paratype	♀	immature	34
1951.4.26.38-39	Station 148 - off Cape Saunders. Large otter trawl. 9 January 1927. 132–148 m. 54°03'S 36°39'W.	affinis	polymorpha	paratype	♀	submature	43
		affinis	turqueti	paratype	♀	immature	28
1951.4.26.40	Station MS 63. East Cumberland Bay. Small beam trawl. 24 February 1925. 23 m.	affinis	turqueti	paratype	♂	mature	45
1951.4.26.41-44	Station MS 62. Wilson Harbour. Small beam trawl. 19 January 1927. 15–45 m.	affinis	polymorpha	paratype	♂	immature	25
		affinis	polymorpha	paratype	♂	immature	13
		affinis	polymorpha	paratype	♂ <sup>1</sup>	immature	18
		affinis	turqueti	paratype	♂ <sup>1</sup>	immature	18
1951.4.26.45-49	Station 42. Mouth of Cumberland Bay. Large otter trawl. 01 April 1926. 120–204 m.	affinis	polymorpha	paratype	♂	immature	40
		affinis	polymorpha	paratype	♀	submature	45
		affinis	polymorpha	paratype	♀	immature	24
		affinis	polymorpha	paratype	♂	immature	19
		affinis	turqueti	paratype	♂	immature	16

<sup>1</sup> originally listed as a female by Robson (1930).

*Adelieledone polymorpha* (Robson, 1930) new combination  
(Figs 1, 2a, 3a–e, Tables I–III)

*Graneledone polymorpha* Robson, 1930: 390, pl 3, fig. 1.

*Pareledone polymorpha* Robson 1932, 276, pl 5, fig. 1;  
Daly & Rodhouse 1994, 165, figs. 3, 7; Piatkowski *et al.*  
1998, 43; Allcock *et al.* 2001, 833; Allcock & Pierny  
2002, 113, fig. 2.

Material examined: BMNH 1951.4.26. Type series of  
*Graneledone polymorpha* Robson, 1930, see Tables I & II.  
[NB. Robson catalogued the material in 1937 as BMNH  
1937.1.21 but could not find the specimens at this time. The  
entire collection, comprising 24 specimens, was  
reregistered by H. Ricketts on 26 April 1951, hence the new  
number series BMNH 1951.4.26.]

South Georgia: RRS *Discovery*: BMNH 20030250, 1♂  
(13 mm ML), off mouth of Stromness Harbour, Stn 144,  
5 January 1927, 155–178 m, 54°04'S, 36°27'W. BMNH

20030251, 1♂ (23 mm ML), Stn MS 71, 9 March 1926,  
60–110 m. RV *John Biscoe*: BMNH 1996099, 1♂ (60 mm  
ML), Cumberland East Bay, 10 January 1987. BMNH  
1996099, 1♀ (58 mm ML), Cumberland East Bay,  
27 January 1987, 207 m.

South Orkneys: RRS *Discovery*: BMNH 20030252, 1♂  
(26 mm ML), off Signy, Stn 167, 20 February 1927,  
244–344 m, 60°50'30"S, 46°15'W.

South Shetlands: RV *Polarstern* ANT XVII/3: NMSZ  
2000081.022, 1♂ (59 mm ML), 1♀ (54 mm ML), Stn  
56/158-1, 26 April 2000, 94–95 m, 63°04.7'S, 57°31.6'W.  
NMSZ 2000081.030, 1♂ (59 mm ML), 2♀ (41, 62 mm  
ML), Stn 56/166-1, 28 April 2000, 666 m, 63°02.3'S,  
59°10.4'W. NMSZ 2000081.035, 1♂ (49 mm ML), 2♀ (34,  
50 mm ML), Stn 56/173-1, 30 April 2000, 352–279 m,  
63°01.2'S, 61°08.7'W. NMSZ 2000081.041, 1 juvenile.  
(12 mm ML), Stn 56/175-1, 30 April 2000, 304–305 m,  
63°01.0'S, 61°08.8'W. NMSZ 2000081.043, 1♂ (55 mm

**Table II.** Counts and measurements for specimens (excluding immature individuals) within the type series of *Adelieledone polymorpha* (Robson, 1930).

Maturity	Holotype											
	1951.4.26.26	1951.4.26.27	1951.4.26.28	1951.4.26.30	1951.4.26.31	1951.4.26.38	1951.4.26.45-49A	1951.4.26.29	1951.4.26.45-49B	1951.4.26.32-37C	1951.4.26.32-37D	
Sex	male	male	male	male	male	female	male	female	female	female	female	
	submature	nearly mature	submature	nearly mature	submature							
Total length	150	120	130	130	120	170	120	170	150	200	150	
Mantle length	52	44	47	38	39	43	40	52	45	60	49	
Mantle width	43	32	33	36	33	40	30	56	43	57	39	
Head width	35	30	29	30	23	31	26	41	30	43	37	
Funnel length	19	13	14	12	17	16	14	18	20	22	18	
Free funnel length	11	4	9	6	10	10	8	10	11	10	8	
Funnel organ length	10	9	10	7	7	11	8	9	9	12	10	
Gill lamellae count	7	7	8	7+1	7	7+	8	7+1	7+1	7+1	7	
Gill length	11	9	10	9	8	12	9	13	13	15	11	
Web depth formula	C=D.B.E.A	B=C=D.A=E	C.B=D.E.A	C.D.B.A.E	C.D.B.A.E	C=D.B.E.A	C.D.E.B.A	D.C.B.A=E	A=B=C.D.E	D.C=E.B.A	D.C.E.B.A	
Deepest web depth	26	26	28	26	25	31	26	37	30	37	38	
Arm length L1	98	65	83	77	~	88	72	108	94	115	95	
Arm length L2	105	76	83	81	~	87	84	121	97	130	101	
Arm length L3	~	~	73	93	100	95	85	136	95	135	98	
Arm length Hc	84	64	70	70	77	-	63	-	-	-	-	
Arm length L4	104	65	82	90	~	95	87	142	97	137	102	
Arm width	7	6	6	8	8	8	7	7	10	10	8	
Sucker diameter	3.0	2.5	2.5	3.0	2.0	3.0	3.0	4.5	3.0	4.0	3.5	
Sucker count L1	61	54	61	57	~	58	48	57	57	~	57	
Sucker count L2	64	56	64	59	~	59	54	61	61	61	59	
Sucker count L3	~	~	61	58	56	61	53	63	60	60	61	
Sucker count Hc	34	30	33	30	33	-	31	-	-	-	-	
Sucker count L4	67	57	60	56	~	60	54	63	60	62	60	
Ligula length	13	8	11	10	10	-	7	-	-	-	-	
Ridges on ligula	7	7	8	8	7	-	8	-	-	-	-	
Calamus length	6	5	7	6	4	-	4	-	-	-	-	
Spermatophore length	41	not mature	32	not mature	40	-	not mature	-	-	-	-	
Egg length	-	-	-	-	-	7.5	-	not mature	not mature	10.0	not mature	
Egg count	-	-	-	-	-	40-50	-	not mature	not mature	c. 50	not mature	

- not applicable; ~ not measured due to damage.

**Table III.** Comparison of counts and indices for *Adelieledone adeliicana* (from the redescription by Lu & Stranks 1994) and *A. polymorpha* (measured from the type series). Indices are given in the format *min-mean-max*. Most noticeable differences highlighted in bold.

	<i>A. adeliicana</i>	<i>A. polymorpha</i>
Mantle length (ML)	<b>to 55 mm</b>	<b>to 60 mm</b>
Total length (TL)	<b>to 160 mm</b>	<b>to 200 mm</b>
Mantle width index (MWI)	62.7-76.1-91.1	70.2-86.4-107.7
Head width index (HWI)	67.8-77.3-91.6	59.0-69.5-78.9
Funnel length index (FuLI)	29.1-34.4-41.3	29.5-36.0-44.4
Mantle arm index (MAI)	45.3-58.4-81.5	55.9-68.0-83.5
Arm length index (ALI) L1	<b>112.9-154.6-205.2</b>	<b>147.7-190.2-208.9</b>
Arm length index (ALI) L2	<b>115.0-161.8-216.5</b>	<b>172.7-204.8-232.7</b>
Arm length index (ALI) L3	<b>117.6-165.0-214.2</b>	<b>155.3-220.8-261.5</b>
Arm length index (ALI) L4	<b>112.4-168.1-221.0</b>	<b>147.7-212.3-273.1</b>
Arm sucker index (ASI)	4.3-6.8-10.1	5.1-6.7-8.7
Opposite arm index (OAI)	81.2-91.5-98.0	74.1-80.6-95.9
Hectocotylied arm index (HcAI)	131.0-156.1-171.0	145.5-165.8-197.4
Ligula length index (LLI)	9.7-12.8-15.0	11.1-13.7-15.7
Calamus length index (CaLI)	45.1-45.4-46.6	40.0-54.9-63.6
Hectocotylied sucker count	<b>22-28</b>	<b>30-34</b>
Opposite arm sucker count	<b>up to 46</b>	<b>up to 63</b>
Web depth index (WDI)	21.2-27.1-32.5	24.8-30.0-37.3
Web formula	B=C=D.A.E	B=C=D.A=E
Gill lamellae count	<b>6-7</b>	<b>7-8</b>
Egg length index (EgLI)	17.3-17.9-18.4	14.4-15.5-16.7
Spermatophore length index (SpLI)	58.7-66.9-78.7	68.1-73.5-78.8
Ligula ridges	approx. 8	7-8

ML), 2♀ (37, 45 mm ML), Stn 56/177-1, 1 May 2000, 200–202 m, 62°49.5'S, 60°49.3'W. NMSZ 2000081.048, 1♀ (70 mm ML), Stn 56/178-2, 2 May 2000, 804–930 m, 61°58.5'S, 60°18.7'W. NMSZ 2000081.055, 3♀ (50, 51, 75 mm ML), Stn 56/183-1, 3 May 2000, 200–204 m, 62°06.7'S, 60°21.7'W. NMSZ 2000081.063, 1♂ (58 mm ML), Stn 56/184-1, 3 May 2000, 338–374 m, 62°00.9'S, 60°20.7'W. RV *Polarstern* ANT XIX/3: NMSZ 2002037.028, 1♂ (58 mm ML), Stn 61/047-1, 30 January 2002, 190 m, 61°04.2'S, 54°36.6'W. NMSZ 2002037.029, 5♂ (75, 75, 74, 64, 55 mm ML), 5♀ (67, 57, 50, 47, 33 mm ML), Stn 61/048-1, 30 January 2002, 343–278 m, 61°09.6'S 54°33.6'W.

Palmer Archipelago: RRS *Discovery*: BMNH 20030253, 1♀ (29 mm ML), 2♂ (17 mm and 14 mm ML), Palmer Archipelago, Neumayr Channel, Stn 187, 18 March 1927, 295 m, 64°48'30"S, 63°31'30"W. BMNH 20030254, 1♀ (16 mm ML), Palmer Archipelago, Anvers Island, Fournier Bay, Stn 186, 16 March 1927, 295 m, 64°25'30"S, 63°2'W.

#### Comparative material examined:

*Moschites adeliicana* Berry, 1917 holotype. AM C40889, Adélie Land, off Mertz Glacier, Mawson Antarctic Expedition, Stn 2, 28 December 1913, 450–549 m, 66°55'S, 145°21'E.

*Moschites aurorae* Berry, 1917 holotype. AM C40891, off Queen Mary Land, Mawson Antarctic Expedition, Stn 8, 27 January 1914, 219 m, 66°08'S, 94°17'E.

*Eledone turqueti* Joubin, 1905 holotype. MNHN 5.7.1089, Île Wandel, Charcot Antarctic Expedition.

*Eledone charcoti* Joubin, 1905 holotype. MNHN 5.7.1095. Île Wandel, Charcot Antarctic Expedition.

*Pareledone framensis* Lu & Stranks, 1994 paratype. NMV F65667, Prydz Bay, RV *Aurora Australis*, Stn AA91-100, 28 February 1991, 145–150 m, 67°27.35'S, 68°50.34'E.

*Pareledone prydzensis* Lu & Stranks, 1994 paratype. NMV F65625, Prydz Bay, RV *Aurora australis*, Stn AA91-89 (2), 24 February 1991, 526–532 m, 66°47'S, 72°36'W.

*Moschites harrissoni* Berry, 1917 holotype. AM C40892, Queen Mary Land, off Shackleton Glacier, Mawson Antarctic Expedition, Stn 10, 29 January 1914, 494–595 m, 65°06'S, 96°13'E.

*Pareledone turqueti* (Joubin, 1905). NMSZ 2002037.046, Antarctic Peninsula, RV *Polarstern* ANT XIX/3, Stn 61/048-1, 30 January 2002, 343–278 m, 61°09.6'S, 54°33.6'W.

Diagnosis: Rostral tip of lower beak sharp (Fig. 3a). Ligula long (LLI 11–16) with well-marked groove crossed by 7–8 transverse ridges (Fig. 3c). Arms short to medium (mean ALI L1 190, L2 205, L3 221, L4 212). Hectocotylied arm with 30–34 suckers. Gills with 7–8 lamellae per demibranch. Widely scattered papillae on dorsal surface (Fig. 1a). Ventral surface smooth and creamy white (Fig. 1b).

Description: (Based on mature and submature animals in Robson's type series, Table II.) Animals small to medium sized (ML to 60 mm; TL to 200 mm). Mantle spherical to ovoid (MWI 70.2-86.4-107.7), head narrower than mantle (HWI 59.0-69.5-78.9). Funnel small (FuLI 29.5-36.0-44.4), gently tapered; funnel organ W-shaped (Fig. 3b). Arms short to medium length (MAI 55.9-68.0-83.5). Arm lengths subequal, arm order usually 3=4.2.1 (ALI L1 147.7-190.2-208.9; L2 172.7-204.8-232.7; L3 155.3-220.8-261.5; L4 147.7-212.3-273.1). Suckers uniserial, small (ASI 5.1-6.7-8.7), without sucker enlargement. Third right arm of males hectocotylied, shorter than opposite number (OAI 74.1-80.6-95.9). Ligula large (LLI 11.1-13.7-15.7); ligula groove long, well marked and deep, with 7–8 transverse ridges (Fig. 3c). Calamus distinct and large (CaLI 40.0-54.9-63.6). Hectocotylied arm with 30–34 suckers, opposite arm with up to 63 suckers. Web of medium depth (WDI 24.8-30.0-37.3), web formula approximately B=C=D.A=E. Ink sac present. Chromatophores present within the connective tissue covering the dorsal surface of digestive gland. Posterior salivary glands large, up to twice the length of the buccal mass (Fig. 2a). Gills with 7–8 lamellae per demibranch. Rostral tip of lower beak sharp (Fig. 3a). Mature ovarian eggs large (> 10 mm). Penis diverticulum uncoiled (Fig. 3d). Spermatophores medium sized (SpLI 68.1-73.5-78.8) and slender. Males mature above 45 mm

**Table IV.** Counts and measurements for specimens of *Adelieledone piatkowski*. Specimens for which no repository is given were not retained.

Repository	NMSZ	BMNH	BMNH	BMNH*	BMNH*	n/a*						
Catalogue number	2000081.053	20030255	20030255	20030255	20030255							
Status	Holotype	Paratype	Paratype	Paratype	Paratype							
Sex	male	male	female	male	female	male	male	male	female	female	female	female
Maturity	mature	mature	mature	mature	mature	mature	mature	mature	mature	mature	mature	mature
Total length	137	118	115	143	156	144	140	143	168	173	181	149
Mantle length	48	43	45	59	64	58	51	52	69	72	73	58
Mantle width	46	36	43	54	53	48	38	47	53	56	53	48
Head width	35	34	33	34	35	30	32	33	35	35	38	34
Funnel length	18	16	16	22	23	17	21	18	20	24	21	20
Free funnel length	12	7	7	11	10	9	11	8	10	13	10	12
Funnel organ length	14	10	10	~	~	~	~	~	~	~	~	~
Gill lamellae count	7	7	7+1	7	7+1	7	7	7	7	7	8	7
Gill length	10	12	10									
Web depth formula	B=C=D.A=E	A=B=C=D.E	A=B=C=D.E									
Deepest web depth	27	20	19	20	22	20	20	21	25	24	28	25
Arm length L1	66	56	61	69	60	84	70		84	85	103	80
Arm length L2	76	65	69	77	69	82	69	91	95	98	105	84
Arm length L3	73	66	69	75	73		76	93	100	99	106	
Arm length Hc	78	58	-	67	-	69	67	84	-	-	-	-
Arm length L4	80	70	73	82	79	84	76	92	99	97	103	80
Arm width	10	7	7	8	9	8	10	9	10	10	10	9
Sucker diameter	4	3	3	4	3	3	3	3	3	4	4	3
Sucker count L1	35	35	38	35	38							
Sucker count L2	37	37	39	37	39							
Sucker count L3	32	39	41	39	41	34	43	41	37	40	41	33
Sucker count Hc	25	26	-	26	-	25	28	27	-	-	-	-
Sucker count L4	38	39	41	39	41							
Ligula length	10	9	-	9	-	10	10	11	-	-	-	-
Ridges on ligula	6	5	-	5	-				-	-	-	-
Calamus length	5	4	-	4	-	4	4	5	-	-	-	-
Spermatophore length	34		-	32	-	34	34	38	-	-	-	-
Egg length	-	-	14	-	16	-	-	-	12	13	15	16

- not applicable; ~ not measurable on fresh tissue; \* measurements made prior to fixation in formalin.

ML, females mature above 60 mm ML.

The skin is often loose and gelatinous prior to fixation. The skin sculpture consists of fine, widely scattered papillae on the dorsal surface. Two short, longitudinal integumentary ridges are present on the mid-dorsal posterior mantle. A ventrolateral integumentary ridge is also present (Fig. 1a). The ventral surface is smooth and creamy white in colouration with a few scattered chromatophores laterally (Fig. 1b). Chromatophores are densely packed on the dorsal surface, which varies (even on a single animal) from brown to green to blue. White markings are usually present on the dorsal brachial crown (often in the form of an inverted V) and smaller areas of leucophores may be present on the dorsal mantle and arms, although these display no obvious regular pattern (Fig. 1a).

Type locality: Southern Ocean, South Georgia, mouth of Cumberland Bay. RRS *Discovery*, 120–204 m depth, 1 April 1926, large otter trawl.

Distribution: Occurs around South Georgia in depths from 116 m to 364 m. Further comment on distribution is made in the remarks section.

Etymology: From the Greek *polu* (much) and *morphe*

(form), because of the variability of mantle shape seen in this species.

Remarks: The identification of seven specimens of *Pareledone turqueti* within the type series of *Adelieledone polymorpha* (Table I), significantly reduces the variability of form seen. Examples of Robson's subspecies *affinis* and *oblonga* still remain within the series, but the series includes neither mature nor submature males of the form *affinis* as these specimens were re-identified as *P. turqueti*. We found no validity for the separation of the species into two forms during our re-examination of the type series, nor during extensive fishing around South Georgia. *Adelieledone polymorpha* has gelatinous skin and is probably prone to distortion effects during preservation. This, combined with the inclusion of incorrectly identified material in the type series, probably led to the unwarranted subdivision of *A. polymorpha* into two morphological forms. We conclude that the forms *affinis* and *oblonga* are not valid.

Specimens from the Antarctic Peninsula do show some morphological variation compared to those from South Georgia. Specimens have been recorded with larger mantle lengths (up to 75 mm). The arms are slightly shorter (mean ALI L1 162, L2 173, L3 180, L4 179) and there is slight

variation in the hectocotylized arm sucker count (26–32). Gill lamellae counts and other counts and measurements appear however to be consistent with those from specimens around South Georgia and we assume that the two forms are conspecific.

*Adelieledone adeliæana* (Berry, 1917) new combination  
(Table III)

*Moschites adeliæana* Berry, 1917, 17, text figs 10–13, pl. 11, fig. 5, pl. 12 figs 6–8.

*Pareledone adeliæana* Robson 1932, 278; Lu & Stranks 1994, 222, figs 1, 9a–d.

*Pareledone umitakæ* Taki 1961, 308, text figs 9–16, pl. 3.

Material examined: AM C40889. Holotype of *Moschites adeliæana* Berry, 1917. 1 female (25 mm ML). Adélie Land, off Mertz Glacier, Mawson Antarctic Expedition, Stn 2, 28 December 1913, 450–549 m, 66°55'S, 145°21'E.

Comparative material examined: NMSZ 2000081.003, 1♂ (51 mm ML), Weddell Sea, RV *Polarstern* ANT XVII/3, Stn 85-1, 2 April 2000, 309–318 m, 71°11.3'S, 12°15.4'W. NMSZ 2000081.010, 1♂ (80 mm ML), 1♀ (30 mm ML), Weddell Sea, RV *Polarstern* ANT XVII/3, Stn 102-1, 3 April 2000, 312–323 m, 71°11.9'S, 12°21.7'W. NMSZ 2000081.018, 1♀ (48 mm ML), Weddell Sea, RV *Polarstern* ANT XVII/3, Stn 136-1, 10 April 2000, 260–271 m, 70°50.2'S, 10°35.4'W.

Diagnosis: Rostral tip of lower beak sharp. Ligula long (LLI 10–15) with well-marked groove crossed by approximately eight transverse ridges. Arms short (mean ALI L1 155, L2 162, L3 165, L4 168). Hectocotylized arm with 22–28 suckers. Gills with 6–7 lamellae per demibranch. Widely scattered papillae on dorsal surface. Ventral surface smooth and creamy white.

Description: See Lu & Stranks 1994.

Type locality: Adélie Land, off Mertz Glacier, eastern Antarctica 66°55'S, 145°21'E in 450–549 m depth.

Distribution: On the continental shelf and slope of Antarctica from approximately 30°E to 90°E in depths from 139–680 m. Further comment on distribution is made in the remarks section.

Etymology: Although not explicitly stated by Berry, the name derives from the type locality, Adélie Land.

Remarks: This species from East Antarctica, previously treated under the name *Pareledone adeliæana* Berry, 1917, is morphologically similar to *Adelieledone polymorpha*. It is herein placed in the genus *Adelieledone*. *Adelieledone adeliæana* differs from *A. polymorpha* in colour (*A. adeliæana* is purple-pink to purple-grey dorsally; Lu & Stranks 1994) and in size at maturity (*A. adeliæana* grows to a total length of 160 mm, males mature at 40 mm ML,

females at 45 mm ML; Lu & Stranks 1994). The original description of *A. adeliæana* was based on one female specimen (TL 110 mm) that was caught together with two juvenile specimens (TL 18 and 16 mm) from 66°55'S, 145°21'E in 288–300 fathoms. The holotype was re-examined as part of this study but the specimen is distorted, several of the arms are damaged and the radula is missing. A fuller description of the species was provided Lu & Stranks (1994) following extensive fishing in the Southern Ocean between 50°E and 75°E. This redescription, based on 10 immature and five mature males, and ten submature, one mature and one spent female, included the standard counts and indices commonly used in octopod taxonomy. Comparison of these measures (Table III) with those derived from the type series of *A. polymorpha* shows that the species are separated by relatively few characters. *A. polymorpha* appears to have relatively longer arms (mean ALI L1 190.2 in *A. polymorpha* versus 154.6 in *A. adeliæana*) which can bear a greater number of suckers (up to 63 in *A. polymorpha* versus up to 46 in *A. adeliæana*), more suckers on the hectocotylized arm (30–34 in *A. polymorpha* versus 22–28 in *A. adeliæana*) and marginally more gill leaflets (7–8 in *A. polymorpha* versus 6–7 in *A. adeliæana*).

It is not clear whether material from the Weddell Sea (see comparative material examined) is conspecific with *A. adeliæana*. Specimens have slightly shorter arms (mean ALI L1 140, L2 153, L3 158, L4 156), the same number of gill lamellae as *A. adeliæana* (6–7) and a slightly higher hectocotylized arm sucker count (25–30). The type localities of *A. polymorpha* and *A. adeliæana* are widely separated and it is likely that these species are valid, especially considering the small differences over which genetic divergence is shown to occur in Antarctic octopuses (Allcock *et al.* 1997). However, there is clearly a continuum of morphological forms around Antarctica and the specific status of these forms can probably only be resolved using molecular techniques.

*Pareledone umitakæ* Taki, 1961 is morphologically similar to *A. adeliæana* and is considered a junior synonym of this species (Lu & Stranks 1994). The type of this species is not available for study. It was presumed extant in a private collection, but it appears that the material has been either mislaid or destroyed (I. Gleadall, personal communication, 2003) so further consideration of this nominal species is not possible.

*Adelieledone piatkowski* sp. nov.  
(Fig. 4, Table IV)

*Pareledone* sp. A. Allcock & Piartney 2001, 131, fig. 2.

*Pareledone* cf *polymorpha* type 1. Piatkowski *et al.* 1998, 43.

Material examined: NMSZ 2000081.053, holotype, 1♂ (58 mm ML), Antarctic Peninsula, ANT XVII/3, RV *Polarstern*, Stn 178-2, Commercial bottom trawl, 2 May

2000, 804–930 m, 61°58.5'S, 60°18.7'W–61°57.3'S, 60°16.7'W. BMNH unreg., paratypes, 1♂ (59 mm ML), 1♀ (64 mm ML), Antarctic Peninsula, ANT XIV/2, RV *Polarstern*, Stn 42/045, 27 November 1996, 807 m, 61°42'S, 59°10'W. BMNH unreg., paratypes, 2♀ (21 mm and 22 mm ML), Antarctic Peninsula, ANT XIV/2, RV *Polarstern*, Stn 42/044, 27 November 1996, 583 m, 61°37'S, 58°46'W.

In addition, the following material was examined fresh, but not retained, during expedition ANT XIV/2 of RV *Polarstern* to the Antarctic Peninsula in 1996, see Table IV: 3♂ (58 mm, 51 mm and 52 mm ML), Stn 42/045, 27 November 1996, 807 m, 61°42'S 59°10'W. 7♂ (64 mm, 68 mm, 60 mm, 60 mm, 63 mm, 57 mm and 57 mm ML), 9♀ (68 mm, 69 mm, 73 mm, 62 mm, 58 mm, 60 mm, 53 mm, 52 mm and 58 mm ML), Stn 42/048, 28 November 1996, 785 m, 61°35'S 58°45'W. 1♀ (72 mm ML), Stn 42/145, 19 December 1996, 1514 m, 62°15'S 56°57'W.

**Diagnosis:** (Based on the type material listed above; additional variation may be inferred from the counts and measurements on unpreserved material given in Table IV.) Beak small; rostral tip of lower beak sharp. Ligula groove long, well-marked and deep with 5–6 transverse ridges (Fig. 4c). Arms short. Hectocotyized arm with 25–26 suckers. Gills with 7–8 lamellae per demibranch. Integument loose and smooth apparently without papillae, although these may become apparent after the animal is fixed. Dorsal and ventral surfaces covered in dense purplish grey chromatophores (Fig. 4a & b).

**Description:** (Based on the type material listed above; additional variation may be inferred from the counts and measurements on unpreserved material given in Table IV.)

Animals small to medium sized (ML to 50 mm; TL to 140 mm). Mantle spherical to ovoid (MWI 83.7–91.7–95.8), head narrower than mantle (HWI 72.9–75.1–79.1). Funnel small (FuLI 35.6–36.8–37.5), gently tapered; funnel organ W-shaped. Arms short to medium length (MAI 60.0–61.0–61.6). Arm lengths subequal, arm order usually 4.3=2.1 (ALI L1 130.2–134.4–137.5; L2 151.2–154.3–158.3; L3 152.1–153.0–153.5; L4 162.2–163.9–166.7). Suckers uniserial, small (ASI 6.7–7.3–8.3), without sucker enlargement. Third right arm of males hectocotyized, on average slightly shorter than opposite number (OAI 87.9–97.4–106.8). Ligula large (LLI 11.1–13.7–15.7); ligula groove long, well marked and deep, with 5–6 transverse ridges. Calamus distinct and large (CaLI 44.4–47.2–50.0). Hectocotyized arm with 25–26 suckers, opposite arm with up to 41 suckers. Web of medium depth (WDI 26.0–29.4–33.8), web formula approximately A=B=C=D.E. Ink sac reduced. Chromatophores within the connective tissue covering the dorsal surface of digestive gland. Posterior salivary glands large (up to twice the length of the buccal mass). Gills with 7–8 lamellae per demibranch. Rostral tip of lower beak sharp. Mature ovarian eggs large (> 14 mm).

Spermatophores medium sized (SpLI approximately 70) and slender. Males and females appear to be mature above a mantle length of 45 mm.

The integument is loose and smooth apparently without papillae, although these may become apparent after the animal is fixed. Two short longitudinal ridges are present on the mid-dorsal posterior mantle (Fig. 4a). A ventrolateral integumentary ridge may be raised but is more apparent in fixed than in fresh specimens. All surfaces are completely covered in purplish grey chromatophores, except for two areas around the funnel that remain white (Fig 4b).

**Type locality:** Antarctica, Antarctic Peninsula, 61°58.5'S 60°18.7'W–61°57.3'S 60°16.7'W. RV *Polarstern*, 804–930 m depth, 2 May 2000, commercial bottom trawl.

**Distribution:** Antarctica: Antarctic Peninsula in depths from 612–1510 m.

**Etymology:** Named after Dr Uwe Piatkowski, Institut für Meereskunde, Germany.

**Remarks:** This species may be distinguished from *Adelieledone polymorpha* and *Adelieledone adelieana* by the presence of densely packed chromatophores on the ventral surface and by the apparent absence of papillae (although see above). The latter is possibly a reflection of the poor condition of these animals when removed from deep trawls (*A. polymorpha* is often taken alive from shallow trawls) as scattered papillae may be discernible in fixed material. The hectocotylus of *A. piatkowski* has fewer transverse ridges (Fig. 4c) than the hectocotylus of *A. polymorpha* (Fig. 3c). In all members of the genus, the ink sac appears to be set deep within the digestive gland (Fig. 2a); in *Adelieledone piatkowski*, however, it appears also to be reduced in size. This is perhaps an adaptation to the increased depths that this species inhabits. The remainder of the anatomy is extremely similar to that of *A. polymorpha* and is therefore not illustrated.

*Pareledone* Robson, 1932  
(Figs 3f–j)

**Diagnosis:** Benthic octopodids, ML to 120 mm; mantle saccular, without fins; eight arms lacking cirri; arms with small (ASI 5–12) uniserial suckers, third right arm of male hectocotyized with end of arm clearly differentiated into ligula and calamus, ligula medium to large (LLI 6–13), ligula groove long, well marked and shallow without transverse ridges (Fig. 3h), arm tips not otherwise modified; web depth medium (WDI 20–50); funnel organ VV-shaped (Fig. 3g); gills well developed, with 6–11 lamellae; ink sac present; crop well developed, posterior salivary glands medium size, length of posterior salivary glands approximately equal to length of buccal mass (Fig. 2b); cartilaginous stylets present but extremely delicate; diverticulum of penis coiled (Fig. 3i), spermatophores long (SpLI 100–200) and slender; rostral tip of lower beak

rounded (Fig. 3f); radula with nine elements (Fig. 3j), rachidian with large central cusp, rachidian may have other cusps.

Type species: *Eledone charcoti* Joubin, 1905. By subsequent designation.

Included species: *Eledone charcoti* Joubin, 1905, *Eledone turqueti* Joubin, 1905, *Moschites harrissoni* Berry, 1917, *Moschites aurorae* Berry, 1917, *Moschites antarcticus* Thiele, 1920, *Pareledone prydzensis* Lu & Stranks, 1994, *Pareledone framensis*, Lu & Stranks, 1994.

Etymology: Although not explicitly stated by Robson, the name derives from the combination of the Greek word *Para* meaning 'beside' with *Eledone*.

Remarks: The diagnosis of *Pareledone* is now simplified. The ligula groove is now restricted to a long shallow groove without transverse ridges. The funnel is restricted to VV-shaped, although caution must be exercised with this character. The funnel organ often does not preserve well and two closely adjacent Vs can resemble a W shape; for this reason we have not included the funnel organ in the diagnostic features for *Adelieledone* and *Pareledone* as it might lead to confusion. The size of the salivary glands is now restricted to a much smaller range, with salivary glands being slightly shorter in length to the length of the buccal mass. The range of length of spermatophores is also restricted. It is likely that the coiled penis diverticulum seen in *Pareledone* is to accommodate the somewhat longer spermatophores. The beak shape is limited to the normal octopodid form where the lower beak has a rounded tip.

The valid species of *Pareledone* still fall into two categories: those with smooth skin (*P. turqueti*, *P. harrissoni* and *P. antarctica*) and those with papillated skin (*P. charcoti*, *P. aurorae*, *P. prydzensis* and *P. framensis*). It is unclear whether these constitute two separate clades and this issue may need to be addressed using molecular markers.

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