NEPTUNEA

vol.16, n°1 April 2022

Kon.B.V.C. Section Coast
is a branch of the
'Koninklijke Belgische Vereniging voor Conchyliologie' (Kon.B.V.C.)
(Royal Belgian Society for Conchology)
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Content:

Covers:
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- **Back cover:** Portraits of Captain Marion du Fresne and French marine biologist Patrick Arnaud, the N.O. '*Marion Dufresne*' and the Crozet Islands

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'***NEPTUNEA***', a publication of B.V.C. Section Coast, is a peer-reviewed magazine. Articles may be refused or sent back to the author(s) for adaptations based upon judgment of the referees.

Responsible editor: Frank Nolf, Pr. Stefanieplein 43 B8, B-8400 Oostende, Belgium
Legal deposit: BD 52.109

Barnea pseudotruncata (Mollusca: Bivalvia: Pholadidae), a new species from Western Sahara (Morocco, W Africa)

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Keywords: new species, *Barnea*, PHOLADIDAE, Bivalvia, Western Sahara.

Abstract: A new *Barnea* species (PHOLADIDAE) is described from Western Sahara (Morocco, W Africa). It was already known but wrongly identified in recent literature, and never described due to a lack of material.

Abbreviations:
CFN: Private collection of Frank Nolf (Oostende, Belgium)
CJV: Private collection of Johan Verstraeten (Oostende, Belgium)
CSH: Private collection of Steve Hubrecht (Koksijde, Belgium)
H.: Height
L.: Length
MNHN: Muséum national d'Histoire naturelle (Paris, France)

Introduction: The family PHOLADIDAE includes 75 species worldwide, at least 11 of them in West Africa. Pholadids from that part of the world are still not studied thoroughly enough. Recently three species were discovered from off West African coasts: *Pholas bissauensis* von Cosel & Haga, 2018; *Barnea ghanaensis* Huber, 2018 and *Pholadidea eborensis* von Cosel & Haga, 2018. Huber (2015) and subsequently Cosel & Gofas (2020) mentioned the presence of another species on the coast of Western Sahara (Morocco). The authors referred to Ardovini & Cossignani (2004) who illustrated a specimen from El Argoub identified as *Barnea truncata* (p.209). This species is described and compared to its relatives in the present paper.

Family PHOLADIDAE Lamarck, 1809

The family Pholadidae in the Americas is quite well known, due to the work of R.D. Turner (1954).

Subfamily Pholadinae Lamarck, 1809
(syn.: Zirfaeinae Gray, 1851)
Genus *Barnea* Risso, 1826

Shells medium-sized, elongate, thin and fragile beaked anteriorly, with a large gape anteriorly with obliquely truncated anterior margin or narrowly gaping with rounded margin, rounded to truncated posteriorly with a moderate to large variable posterior gape, from circular to oval. Umbones well in front of the vertical midline. Umbonal reflection simple without septa and usually closely applied to the surface of the umbo but free anteriorly. Surface with commarginal ridges or lamellae and radial ribs over the whole shell or the anterior and middle part. One dorsal accessory plate.

Subgenus *Anchomasa* Leach, 1852

Shells medium-sized, elongate, beaked anteriorly, with a large oval gape extending back at least as far as the umbo, rounded to truncated posteriorly with a moderate to large and variable posterior gape. Umbonal reflection simple and usually closely applied to the surface of the umbo, free anteriorly.

Barnea pseudotruncata sp. nov.

Pl. I, Figs 1-7; Pl. II, Figs 8-12;
Pl. III, Figs 13-17; Pl. IV, Figs 18-21

Type material
Holotype: MNHN-IM-2000-29926, Rio de Oro, Western Sahara, Morocco.
H. 21.61 mm L. 47.31 mm - leg. CJV

Paratypes: Rio de Oro, Western Sahara, Morocco - in mud – CJV.
Paratype 1: H. 17.53 mm L. 46.10 mm
Paratype 2: H. 17.99 mm L. 36.11 mm
Paratype 3: H. 21.24 mm L. 43.05 mm
Paratype 4: H. 20.88 mm L. 45.22 mm

El Argoub, Western Sahara, Morocco - in mud at low tide, at a depth of 1 m – CJV.
Paratype 5: H. 19.82 mm L. 46.98 mm
Paratype 6: H. 19.15 mm L. 46.79 mm
Paratype 7: H. 19.82 mm L. 37.63 mm
Paratype 8: H. 20.59 mm L. 40.25 mm
Paratype 9: H. 19.84 mm L. 41.31 mm

El Argoub, Dakhla Bay, Western Sahara, Morocco – buried in solid mud at low tide – June 2006 – leg. J. Ahuir – CSH.
Paratype 10: H. 19.37 mm L. 41.26 mm

Rio de Oro, Western Sahara, Morocco – buried in muddy clay - 2000 – CFN
Paratype 11: H. 18.23 mm L. 40.50 mm
Paratype 12: H. 22.05 mm L. 50.52 mm

Type locality: Rio de Oro, Western Sahara, Morocco.

Description: Shell brittle, rather inflated, equivalve, elongate. Inequilateral with the umbones in the anterior half. Approximately elliptical in outline with the front border beaked and curved, exposing a ventral pedal gape. Posterior gape rounded and rather small. Margins smooth, except at the front border, where the projecting spines make it crenulate.
Umbonal reflection raised above the umbo anteriorly, elsewhere adhering closely to the posterior part of the valves. No septa.
Sculpture of 35-40 concentric ridges and an equal number of radiating ribs resulting in tiny spines where they cross, most distinct at the front end of the valves. Anterior adductor scar oval, lying on the umbonal reflection. Posterior scar about halfway along the dorsal line. Pallial line wide, pallial sinus extending to the midline.
Outside pure dull-white in colour, interior glossy white with the external sculpture faintly visible. Periostracum very thin, yellowish to brownish grey ('Isabelline colour').
Protoplax rather small, oval and broad with a shallow central groove. Apophysis thin, fragile, narrow, rather long and slightly bending inwards.

Measurements: from 40 to 50 mm in length.

Type locality: El Argoub, Western Sahara, Morocco, in muddy clay.

Distribution: The new species is only known from the type locality and seems to be restricted to the Western Sahara area.

Discussion: Three other *Barnea* species are known from West African waters: *Barnea candida* (Linnaeus, 1758), *Barnea ghanaensis* Huber, 2018 and *Barnea truncata* (Say, 1822):

- ***Barnea candida* (Linnaeus, 1758)** (Pl. VII, Figs 38-39) lives from northern Norway and the Baltic Sea to the southern coast of France, the Iberian Peninsula, the Eastern Mediterranean, and on the African coast south to Mauritania.
  Shell subelliptical in outline reaching about the same length as *B. pseudotruncata*, thin, rounded anteriorly and tapering posteriorly, gaping slightly at both ends in contrast with *B. pseudotruncata*, which is also more globose. Umbos prominent and located very close to the anterior end.
  A larger number of stronger concentric ridges compared to *B. pseudotruncata*, becoming weaker over the disc on the posterior slope. Imbrications, caused by the intersection of the concentric ridges and radiating ribs, particularly strong but weaker towards the posterior end. Protoplax elongate oval in contrast with the shorter and broader protoplax of *B. pseudotruncata*.

- ***Barnea ghanaensis* Huber, 2018** is only known from Ghana (western part, NE of Secondi-Takoradi) and one valve from northern Angola (Praia São Tiago, Bengo Prov.). *B. pseudotruncata* is much larger compared to *B. ghanaensis* (from 7-20 mm) with more globular valves and less tapering anterior margins. *B. ghanaensis* looks more like the very variable *B. parva* (Pennant, 1777), which has a larger number of concentric and radial ridges over the entire surface of the shell. The apophysis in *B. ghanaensis* are delicate and very thin. This species lives in red sandstone, while *B. pseudotruncata* prefers muddy clay. Unfortunately, in the studied material no juvenile specimens of *B. pseudotruncata* were present to compare with the new species, but small specimens of *Barnea parva* are different from *B. ghanaensis*.

- ***Barnea truncata* (Say, 1822)** (Pl. IV, Figs 22-23; Pl. V, Figs 24-27; Pl. VI, Figs 28-31) is very characteristic with its large, broad parallel, truncate form. The posterior margins are almost vertically truncated, slightly convex to straight. Antero-ventral margin at the gape almost straight, only weakly indented. Ventral margin is more or less long, almost straight or slightly convex.
  Shell reaching about 70-100 mm in length, much larger than *B. pseudotruncata*. Apophysis are stronger and thicker compared to those in *B. pseudotruncata*. Less elongate compared to *B. pseudotruncata*, with umbones prominent and located near the anterior third of the shell, the anterior gape larger and not rounded. It has a coarser sculpture than *B. alfredensis* Bartsch, 1915, with a wider pallial sinus, and the truncated posterior end of the protoplax lacks distinct ears. Protoplax without central groove.

The variability is restricted. The West African specimens are, as stated by Turner (1954), identical to the US forms.
B. truncata is an amphiatlantic species, found in Eastern North America from Nova Scotia, Florida, Maine, through North Carolina, the West Indies to Colombia, Suriname, Brazil and in West Africa from Senegal to Angola and further to South Africa (Table Bay). It lives from 0-55 m, boring into clay, waterlogged wood and soft rocks. It may grow to a size of 100 mm. (Huber, 2015).

Two more similar *Anchomasa* species occur in adjacent European and South African waters:

- ***Barnea parva* (Pennant, 1777)** (Pl. VII, Figs 35-37) is known from Great Britain, the Bay of Biscay, through Gibraltar to Algeria and into the Western Mediterranean. It lives intertidal to a depth of 10 m, boring in clay, soft limestone and waterlogged wood. It has a smaller, stronger and wider shell than *B. pseudotruncata* (generally about 30-40 mm), the maximum size known is 50.5 mm (Beachy Head, The English Channel, CFN 03744).
  The umbones and umbonal reflections are similar to those in *B. pseudotruncata*. The surface sculpture is much finer and consists of twice as many radial ribs and concentric ridges, but the closely set of radial ribs disappears on the posterior slope, in contrast with *B. pseudotruncata* where they remain even strong.
  The shells are gaping at both ends, the posterior end is tapering and not truncated as in *B. pseudotruncata*.
- ***Barnea alfredensis* (Bartsch, 1915)** (Pl. VI, Figs 32-34) is found from False Bay through the type locality Port Alfred to Jeffreys Bay and East London. It lives sublittoral to 55 m, boring in sand- and limestone.
  The maximum size is 46 mm. *B. alfredensis* has a strong commarginal sculpture with only few indistinct radial ribs anteriorly, resulting in a lack of scaly intersections with concentric ribs as in *B. pseudotruncata.* The shell is usually more pointed posteriorly and less truncated.
  In addition, it has never been reported outside South Africa and there are no *B. alfredensis* records from Namibia or from Angola (Huber, 2015).

Derivatio nominis: The name '*pseudotruncata*' refers to the close relationship with *Barnea truncata*, a similar species living in West Africa.

Conclusion: There is no doubt *Barnea pseudotruncata* is different from *B. truncata* by its tapering posterior end, the more closed and rather circular anterior gape. The structure consists of concentric and radiating ribs evenly scattered over the whole surface of the shell. In *B. truncata* the radiating ribs are absent on the anterior part of the shell.

Acknowledgements: Gratitude is due to Steve Hubrecht for supplying additional material and to Jan Libbrecht for carefully reviewing the English text.

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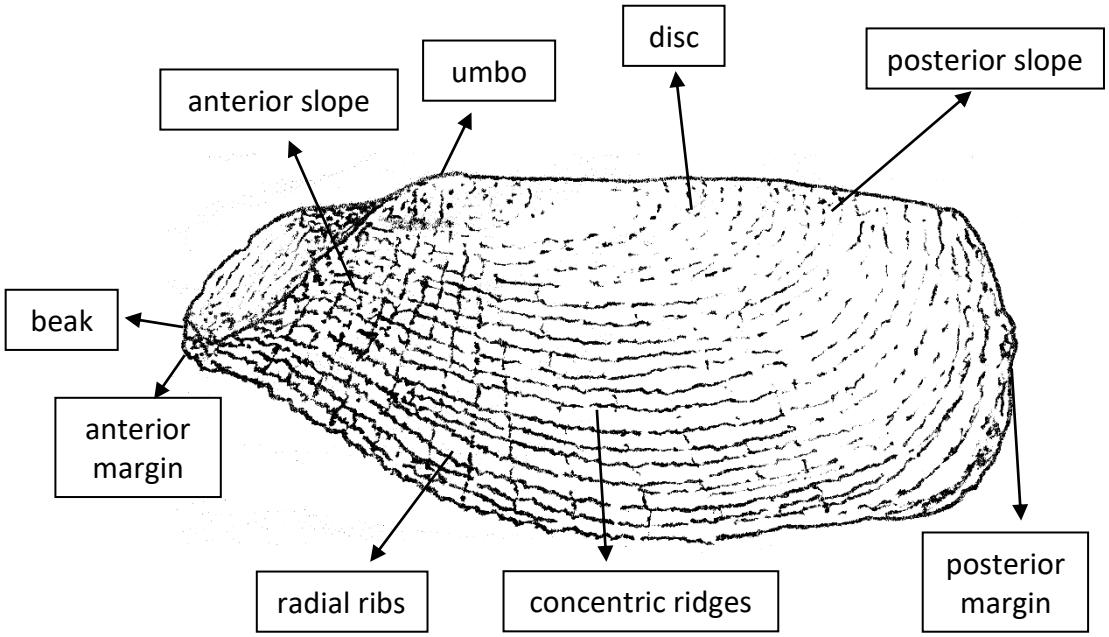


Fig. 1: External view of left valve of *Barnea truncata* with characteristics

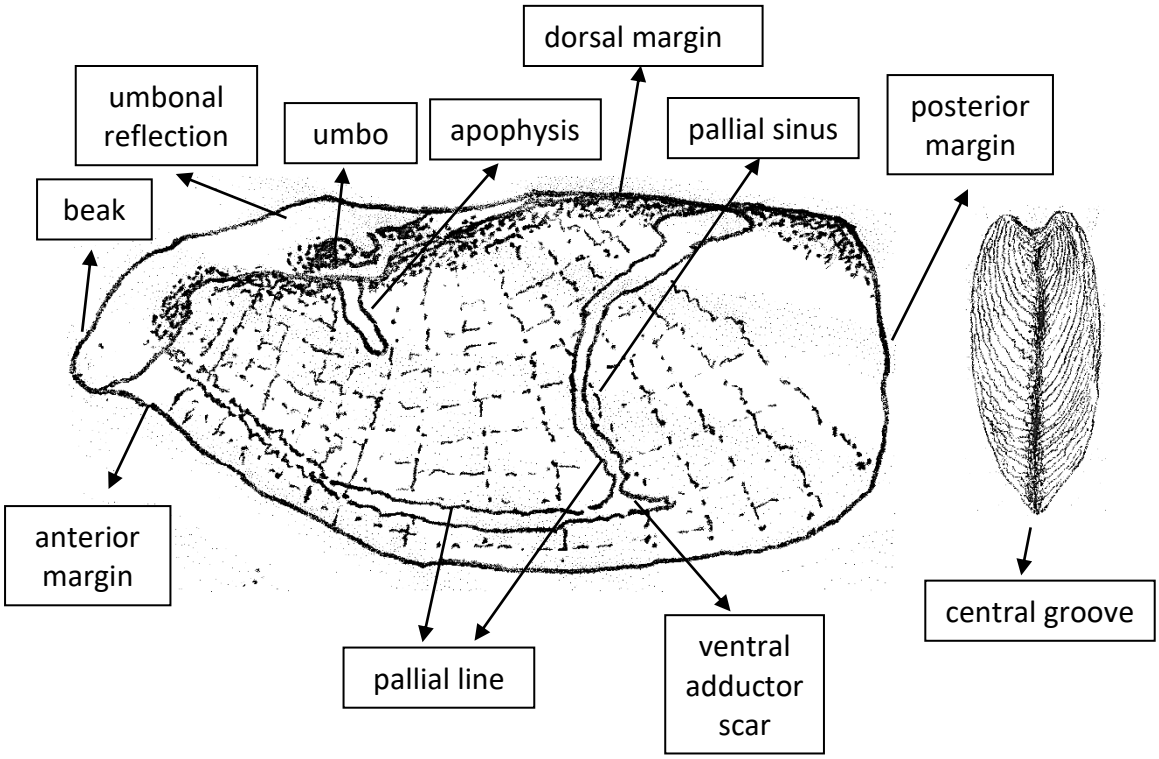
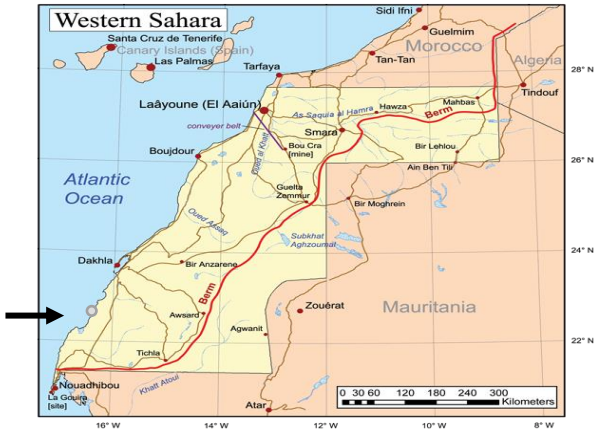


Fig. 2: Internal view of right valve of *Barnea truncata* with characteristics

Fig. 3: Protoplax of *Barnea pseudotruncata*

B. truncata	*B. pseudotruncata*
20-30 radiating restricted to the middle area; same number of concentric ribs	20-30 radiating ribs over the whole surface; concentric ribs more obsolete
truncated at posterior end	**pointed** towards posterior end
thick, broader and slightly curved	thin, fragile, very narrow and slightly curved
free from the umbos, raised anteriorly	completely appressed posteriorly but free anteriorly
large elliptical gape, more beaked	**smaller** gape, less beaked and rather **circular**
large elliptical gape	**small circular** gape
no central groove	**with central groove**

Table: comparison of characteristic differences between *Barnea truncata* and *B. pseudotruncata*



Geographic distribution of *Barnea pseudotruncata* sp. nov.

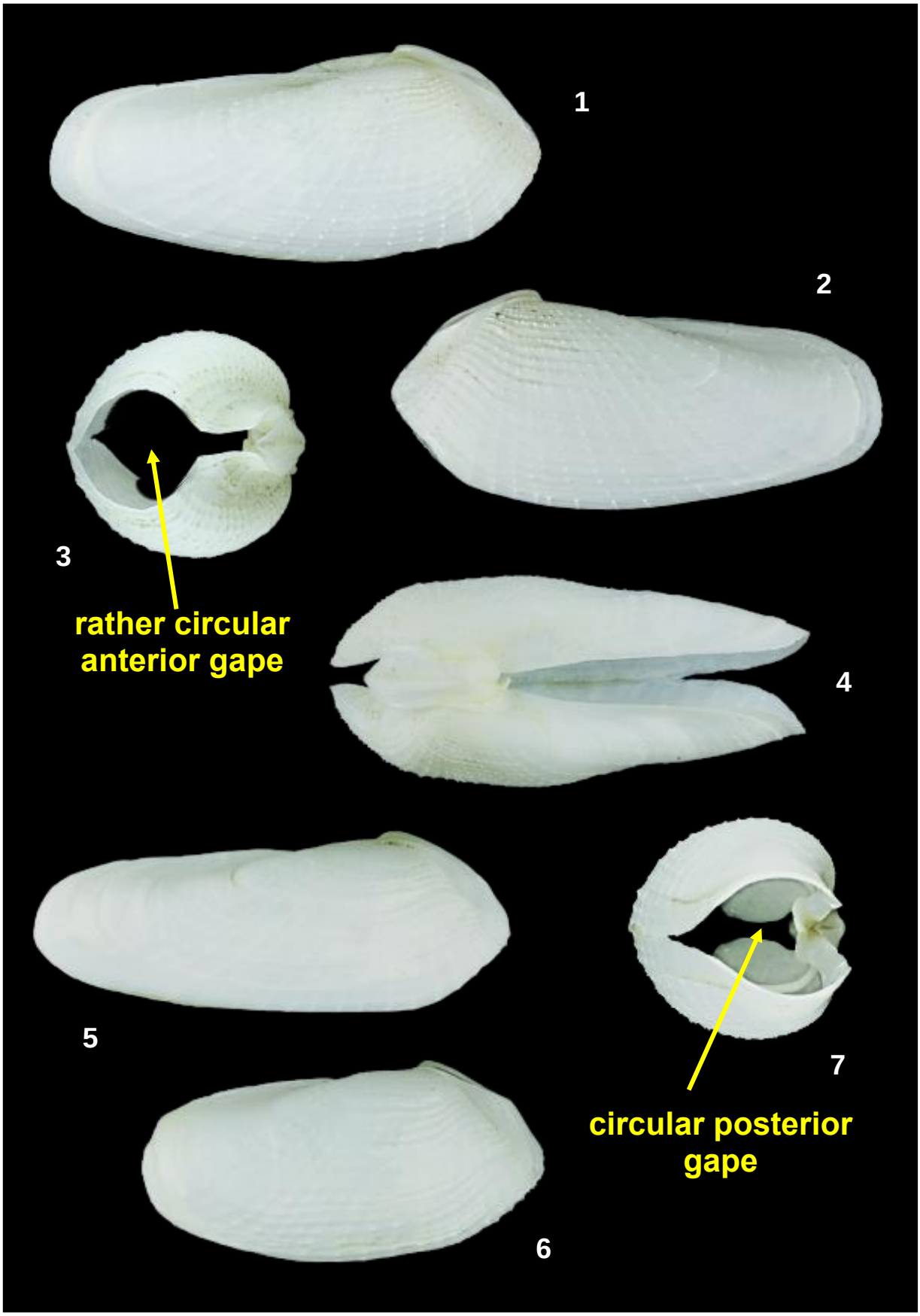


Plate I. Figs 1-7: *Barnea pseudotruncta* sp. nov.; 1-4: Rio de Oro, Western Sahara, Morocco. Buried in mud. Holotype (MNHN); 1-4: H. 21.61 mm L. 47.31 mm; 1: right valve; 2: left valve; 3: anterior gape; 4: dorsal view with protoplax; 5-7: CJV; 5: paratype 1: right valve. H. 17.53 mm L. 46.10 mm; 6-7: paratype 2. H. 17.99 mm L. 36.11 mm. CJV; 6: right valve; 7: posterior gape.

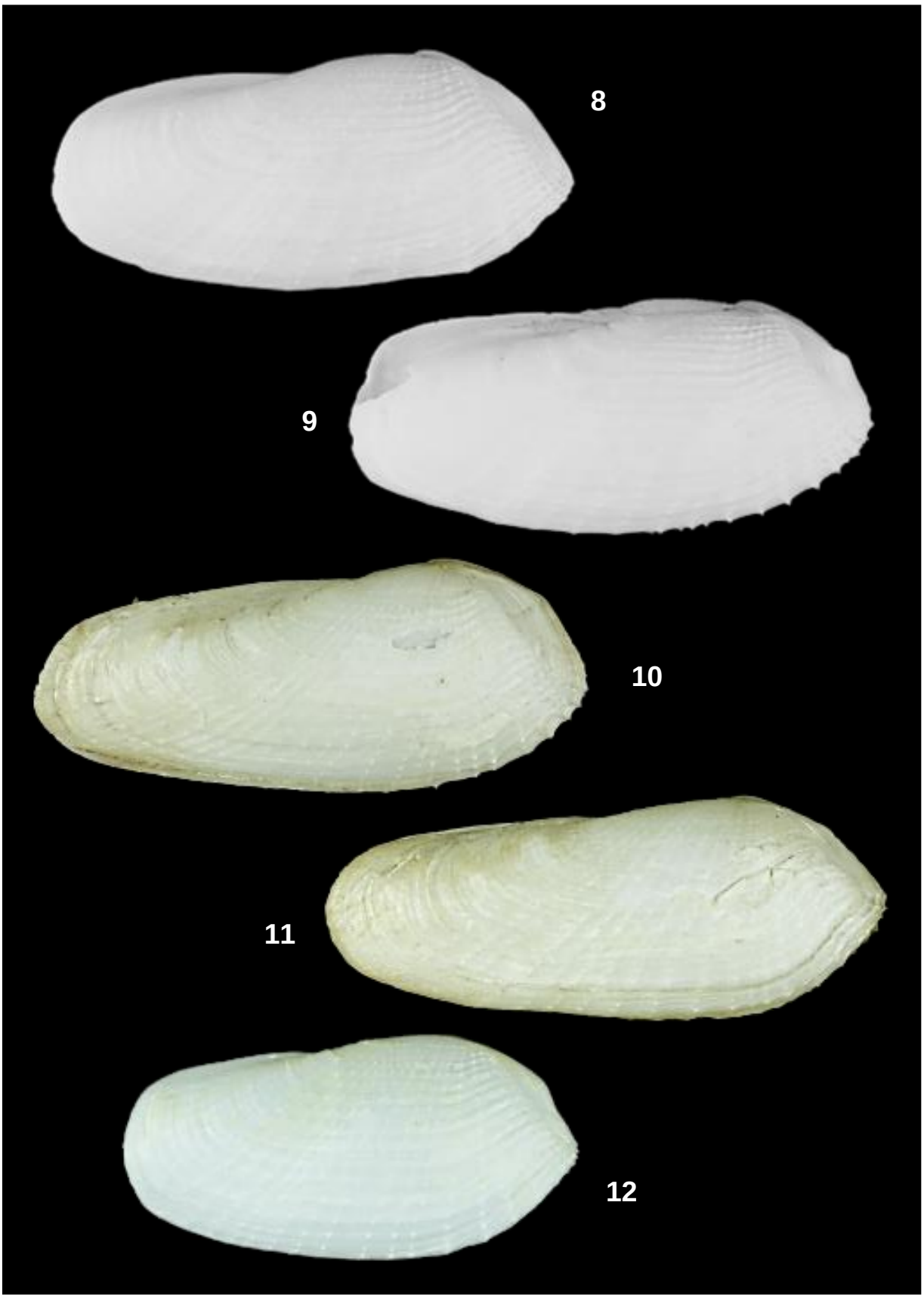


Plate II. Figs 8-12: *Barnea pseudotruncata* sp. nov. Right valves; 8-9: Rio de Oro, Western Sahara, Morocco. Buried in mud. CJV; 8: Paratype 3. H. 21.24 mm L. 43.05 mm; 9: Paratype 4. H. 20.88 mm L. 45.22 mm; 10-12: El Argoub, Western Sahara, Morocco. In mud at low tide at a depth of 1 m. CJV; 10: Paratype 5. H. 19.82 mm L. 46.98 mm; 11: Paratype 6. H. 19.15 mm L. 46.79 mm; 12: Paratype 7. H. 19.82 mm L. 37.63 mm.

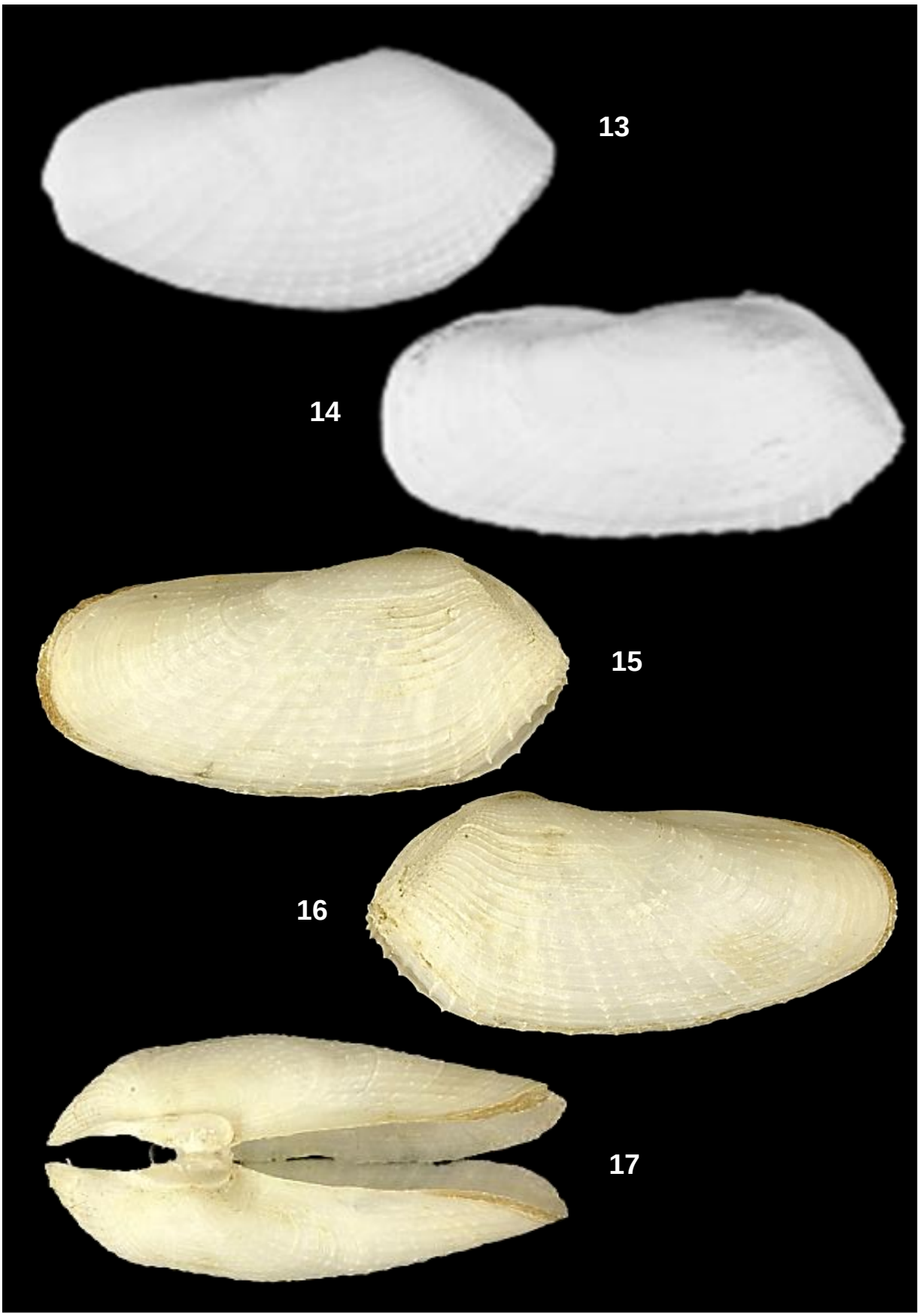


Plate III. Figs 13-17: *Barnea pseudotruncta* sp. nov.; 13-14: El Argoub, Western Sahara, Morocco. In mud at low tide at a depth of 1 m. Right valve. CJV; 13: Paratype 8. H. 20.59 mm L. 40.25 mm; 14: Paratype 9. H. 19.84 mm L. 41.31 mm; 15-17: El Argoub, Dakhla Bay, Western Sahara, Morocco. Buried in solid mud at low tide. June 2006. Paratype 10. H. 24.34 mm L. 41.26 mm. CSH; 15: Right valve; 16: Left valve; 17: Dorsal view.

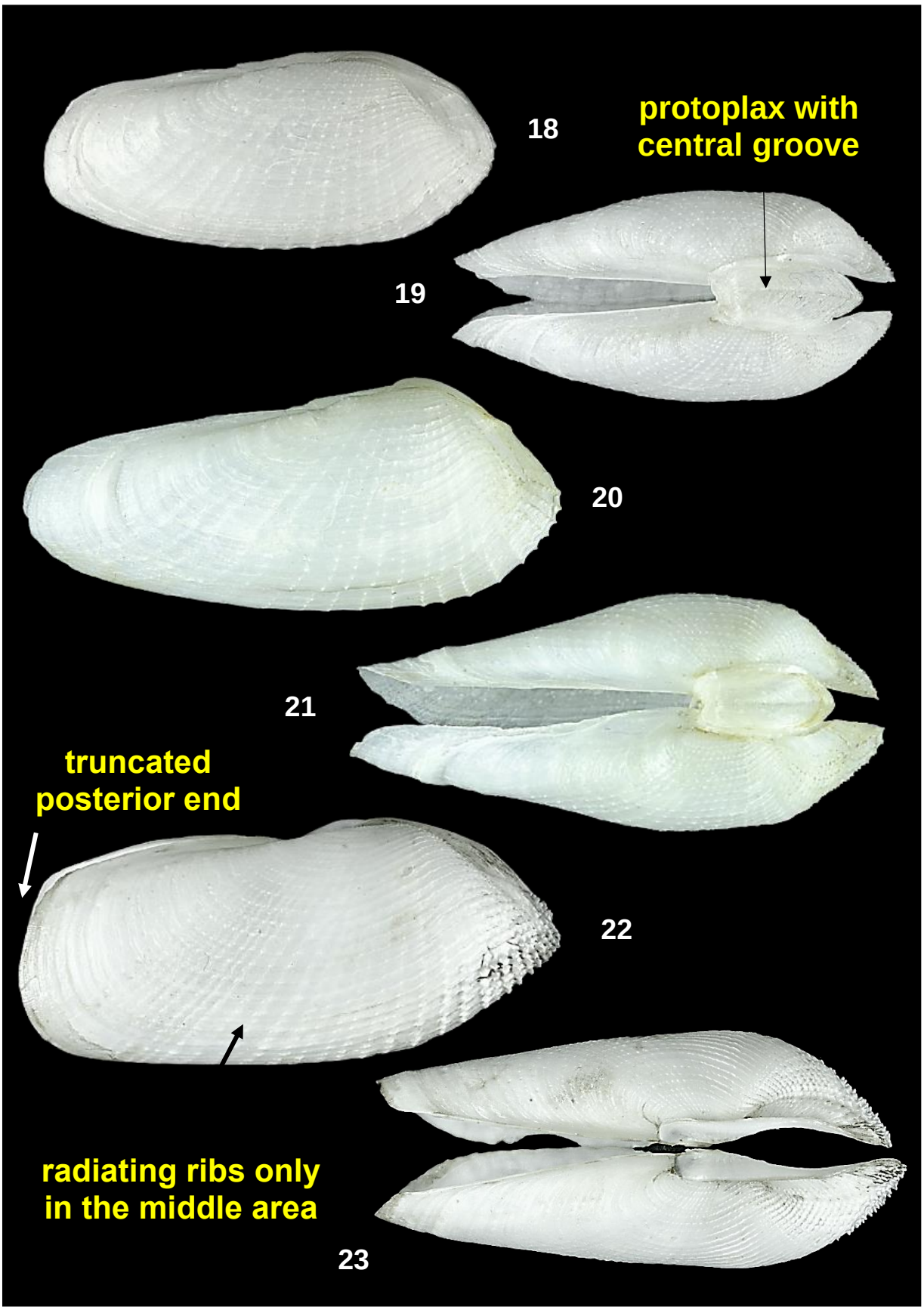


Plate IV. Figs 18-21: ***Barnea pseudotruncta* sp. nov.** Rio de Oro, Western Sahara, Morocco. In muddy clay. 2000. CFN; 18-19: Paratype 11. H. 18.23 mm L. 40.50 mm; 18: Right valve; 19: Dorsal view; 20-21: Paratype 12. H. 22.05 L. 50.52 mm; 20: Right valve; 21: Dorsal view.
Figs 22-23. ***Barnea truncata* (Say, 1822)**. Cap Esterias, N Gabon. 00°47.5 N/ 09°19' E. In littoral rock. 1985. H. 21.58 mm L. 49.77 mm. CFN; 22: Anterior valve; 23: Dorsal view.

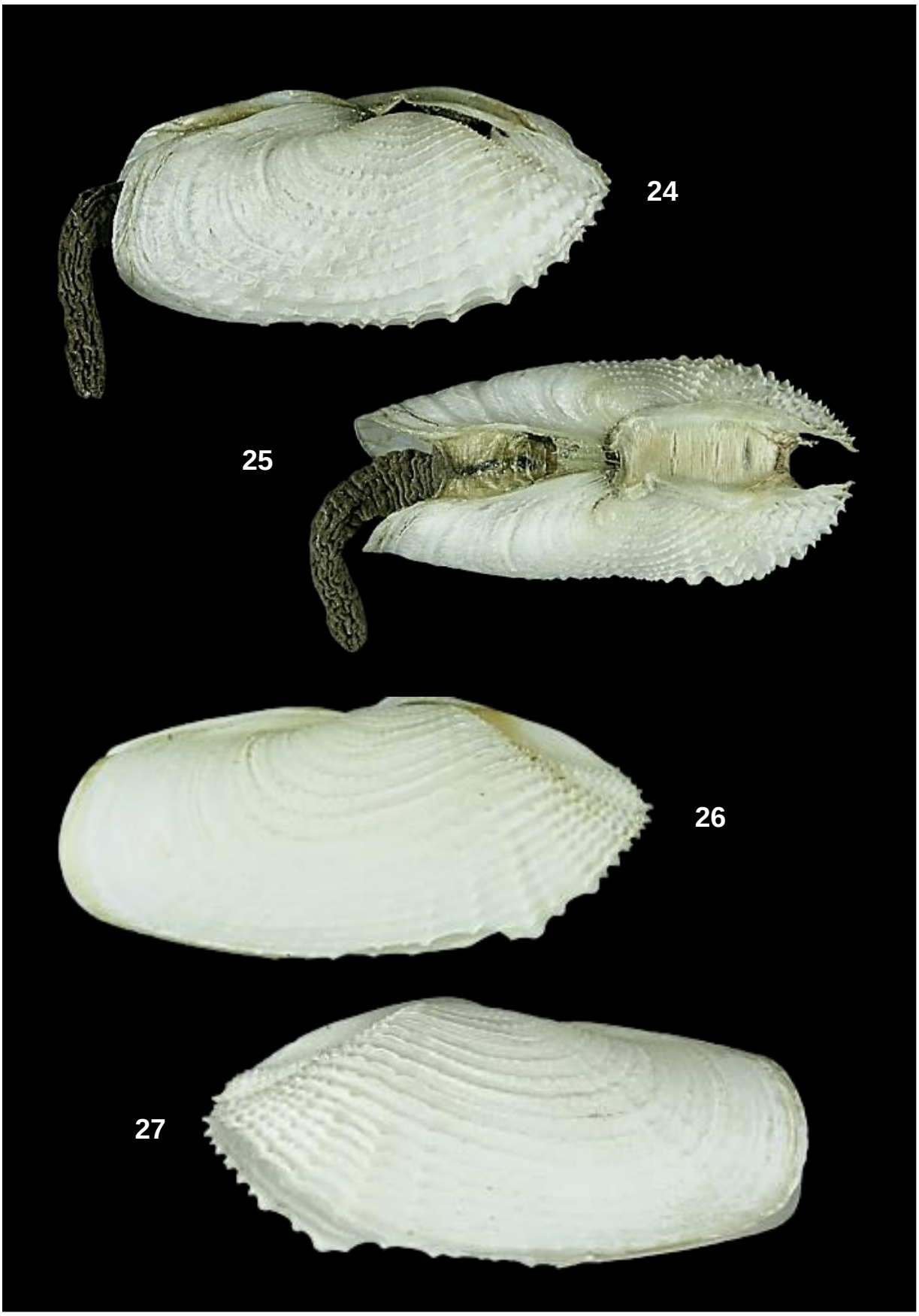
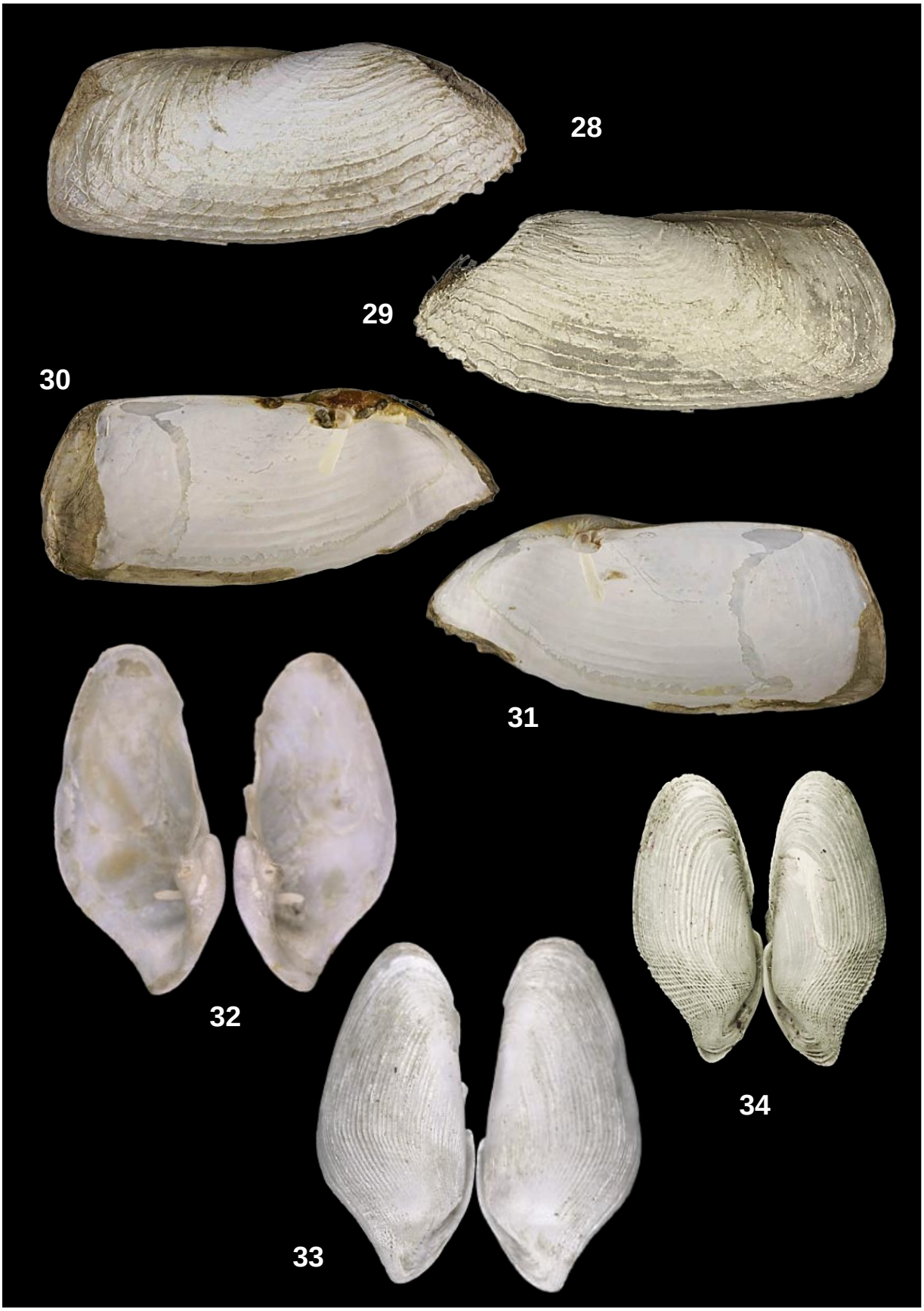


Plate V. Figs 24-27: *Barnea truncata* (Say, 1822). Caswell Beach, Oak Island, North Carolina, USA. Washed ashore in hard piece of peat at incoming tide. 26 May 1998; 24-25: H. 13.5 mm L. 27.89 mm. CFN; 24: Right valve; 25: Dorsal view; 26-27: H. 14.99 mm L. 36.55 mm. CJV; 26: Right valve; 27: Left valve.



Pl. VI. Figs 28-31: ***Barnea truncata* (Say, 1822)**. Parking Field number 10, Jones beach, southern shore of Nassau County State Park, New York, USA. In exposed peat banks. 15 November 2004. H. 16.31 mm L. 37.15 mm. CSH; 28: Right valve; 29: Left valve; 30: Interior of left valve; 31: Interior of right valve.
Figs 32-34: ***Barnea alfredensis* Bartsch, 1915**; 32-33: Jeffreys Bay, Eastern Cape, South Africa. 2010. H. 15.16 mm L. 32.74 mm. CFN; 32: Interior side; 33: Exterior side; 34: Jeffreys Bay, Eastern Cape, RSA. In stone at low tide. May 1989. H. 12.87 mm L. 26.37 mm. CSH.

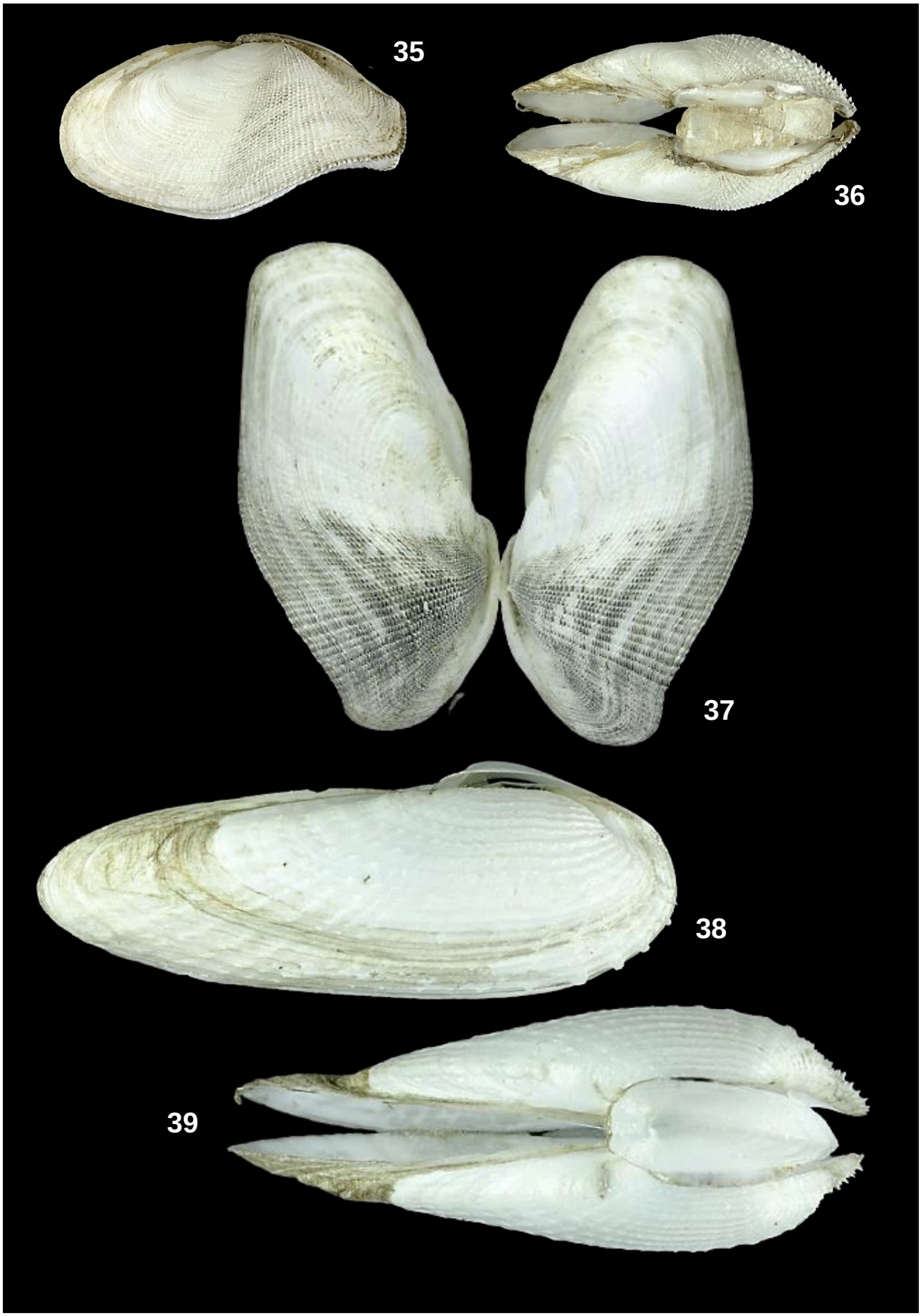


Plate VII. Figs 35-37: ***Barnea parva* (Pennant, 1777)**. Beachy Head, southern England, UK. Trawled by Belgian fishermen at a depth of 45 m. April 2005. CFN; 35-36: H. 20.38 mm L. 38.15 mm; 35: Right valve; 36: Dorsal view; 37: H. 25.83 mm L. 50.19 mm.
Figs 38-39: ***Barnea candida* (Linnaeus, 1758)**. Middelkerke, Belgium. In lump of peat, washed ashore after a storm. October 1966. H. 22.56 mm L. 58.65 mm. CFN; 38: Right valve; 39: Dorsal view.

About the presence of *Pholas dactylus* Linnaeus, 1758 (Mollusca: Bivalvia: Pholadidae) in NW African and South African waters

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Keywords: *Pholas*, PHOLADIDAE, Bivalvia, Western Sahara, South Africa

Abstract: Although *Pholas dactylus* Linnaeus, 1758 is already known to live in Senegal and South Africa (Huber, 2015 – CD Rom: Chapter 5: Systematic listing of 8,500 valid species) few specimens are actually reported from these two areas due to a lack of material. Even von Cosel and Gofas (2020) did not mention this species in their extensive review of West African bivalves.
Moreover, specimens from Western Sahara were mistaken for *Pholas campechiensis* Gmelin, 1791 by shell collectors and dealers. To end this widespread confusion both species are illustrated and commented on their differences.

Abbreviations:

CFN: Private collection of Frank Nolf (Oostende, Belgium)
CJV: Private collection of Johan Verstraeten (Oostende, Belgium)
CSH: Private collection of Steve Hubrecht (Koksijde, Belgium)
H.: Height
L.: Length

Introduction: The family PHOLADIDAE includes 75 species worldwide, at least 11 of them in West Africa. Pholadids from West Africa and South Africa are still not studied thoroughly enough. Recently four species were discovered from off West African coasts: *Pholas bissauensis* von Cosel & Haga, 2018, *Barnea ghanaensis* Huber, 2018, *Pholadidea eborensis* von Cosel & Haga, 2018 and *Barnea pseudotruncata* Nolf & Verstraeten, 2022.
The genus *Pholas* includes only four species worldwide, two of them in the W and E Atlantic Ocean.

Discussion:

Family PHOLADIDAE Lamarck, 1809

The family Pholadidae in the Americas and the Eastern Atlantic is quite well known, due to the work of R.D. Turner (1954).

Subfamily Pholadinae Lamarck, 1809
(syn.: Zirfaeinae Gray, 1851)
Genus *Pholas* Linnaeus, 1758

Shells more or less elliptical in outline, with double, septate umbonal reflections and three accessory dorsal plates. Protoplax oval to quadrangular in outline, thin, calcareous, in one part or divided longitudinally into two parts. Mesoplax transverse and more or less triangular in outline, calcareous and solid in structure. Metaplax transverse and narrow. Shell beaked or rounded anteriorly. Sculpture extending over the entire shell or lacking on the posterior slope.

Subgenus *Pholas* Linnaeus, 1758

Shells medium-sized or large, elongate to very elongate, thin and brittle, **beaked anteriorly**, narrowly gaping with rounded margin or broadly gaping with obliquely truncated margin. Three dorsal accessory plates, protoplax divided longitudinally into two parts with having the nuclei of the divided protoplax located near the **posterior** outer margin. Umbones well anterior to the vertical midline. Surface with strong, commarginal lamellae or ridges bearing spines or scales at the anterior part. Umbonal reflection double, connected by vertical septa between them.
This subgenus is restricted to the East Atlantic.

***Pholas dactylus* Linnaeus, 1758**

Pl. I, Figs 1-6; Pl. II, Figs 7-12;
Pl. III, Figs 13-20

Description: Shell subelliptical in outline, inflated, basically equivalve, reaching about 150 mm in length. Shell thin but strong, beaked anteriorly, rounded posteriorly, with septate umbonal reflections.
Colour dull chalky-white to greyish-white, with the material from the bored substrate often attached and discolouring it. Periostracum pale yellow.
Umbones prominent, located near the anterior fourth of the shell and covered by double septate umbonal reflections. There are 10-14 septa in an average specimen. Umbonal reflections free for a short distance over the

beaks but closely appressed over the umbones and posterior to them.
Umbonal reflections usually worn away at the point of contact between the two valves. Ligament small, pear-shaped, above the line of the apophyses, frequently lost in dead shells.
Sculpture consisting of about 24 or more laminated concentric ridges and an anterior group of about 40 radiating ribs. Laminated ridges well marked for the entire length of the shell in juvenile specimens, but in older specimens, and especially those boring into hard rock, they may be entirely lacking on the posterior slope. Radial ribs prominent on the anterior slope, but becoming weak over the disc and entirely lacking on the posterior slope. Strong imbricated scales project where the concentric ridges and radial ribs cross one another. The shell sculpture is often weak on the posterior slope. Margin smooth, except about the anterior beak where small projecting spines make it crenulate.
Interior of the shell glossy white with the external sculpture faintly visible. Muscle scars and pallial sinus well marked. Anterior adductor scar large, lying on the umbonal reflection, posterior adductor scar small, about halfway along the dorsal line. Pallial sinus broad and deep, expanded into the ventral adductor scar where it curls back into the pallial sinus, which is deep, extending into the anterior half of the shell. Apophyses rather short, solid and strong, flattened and often ridged on the free ends.
Three accessory plates: a divided symmetrical disposed protoplax, a transverse mesoplax, and a long narrow asymmetric metaplax, presenting an inequivalve condition. Protoplax calcareous, fragile, divided through the middle growth lines and with the nuclei near the posterior outer margins. Mesoplax calcareous and solid. Metaplax long and narrow, rather thin and faintly marked with growth lines.

Main distinctive characters: Shell white, beaked anteriorly, rounded posteriorly, with double, septate umbonal reflections and having a divided protoplax, a triangular mesoplax, and a long narrow metaplax. Nuclei of the divided protoplax located near the outer posterior margin.

Geographic distribution: Only in the East Atlantic, from Norway, Scotland (UK) to the Bay of Biscay, the West African coasts from Morocco to South Africa (from False Bay to KwaZulu-Natal), the West Mediterranean Sea, Adriatic Sea, Aegean Sea and Black Sea. Possibly also in the Red Sea and Oman.

Habitat: In muddy sand, peat, clay, waterlogged wood, sandstone and rocks.

Interesting remark: Nearly all the specimens from Mauritania show lilac growth lines, shining through the valves. Perhaps this characteristic was decisive for shell collectors and dealers to label samples as *Pholas campechiensis*, a hitherto rather unknown species from W African coasts, often provided with the striking lilac growth lines, but in fact quite different from *P. dactylus*.

Subgenus *Thovana* Gray, 1847

Shells medium-sized, elongate, **rounded anteriorly**, with septate umbonal reflections and three accessory plates. Protoplax divided into two parts longitudinally with the nuclei of the divided protoplax located near the **anterior** outer margin and more or less centrally located. Metaplax thin, long and narrow. Distribution: Eastern Pacific and both West and East Atlantic.

***Pholas campechiensis* Gmelin, 1791**

Pl. III, Figs 21-26

Description: Shells subelliptical in outline, reaching 80-90 mm in length (American specimens up to 110 mm), very elongate, thin, fragile, rounded gaping slightly anteriorly and more widely gaping posteriorly.
Colour chalky white or dirty white, often with shades of lilac, particularly at the growth lines.
Umbones prominent, located near the anterior fourth of the valve. Umbonal reflections double, the inferior one being free on the anterodorsal margin, but firmly adhering to the umbos and the immediate posterior margin, the upper reflection linked to the lower one by about 10-14 septa.
Sculpture consisting of laminated, concentric ridged and radial ribs over the whole surface. Concentric ridges strong on the anterior slope, becoming somewhat weaker over the disc, and in adult specimens, usually weak and occasionally absent on the posterior half. Radial ribs prominent on the anterior slope, becoming weak on the disc and usually disappearing on the posterior slope. Imbricated scales are formed at the intersection of concentric ridges and radiating ribs. Sculpture below the umbonal reflections consisting of low, smooth, concentric ridges. Interior of shell white and glazed. Radial ribs and concentric ridges usually visible internally, especially on the anterior slope. Umbonal reflections usually worn away where two valves meet each other. Muscle scars and pallial line well marked. Pallial sinus broad, deep and extending inward nearly two thirds the distance to the umbo. Apophyses fragile, small

and broad, and projecting from beneath the umbo at a sharp angle posteriorly. Three accessory plates: a double nearly rectangular protoplax, a transverse mesoplax and an elongate narrow metaplax. Protoplax divided through the middle longitudinally, truncate posteriorly and acuminate anteriorly. The nuclei of the divided protoplax are anterior and nearly centrally located, flattened triangle in outline when seen in position. Metaplax thin, long and narrow.

Main distinctive characters: Shell white, rounded at both ends, with septate umbonal reflections, with the concentric sculpture extending over the entire length of the shell and with three accessory plates consisting of a divided protoplax, a mesoplax and a metaplax. Typical lilac shades in particular at the growth lines.

Geographic distribution: Eastern Atlantic (from Senegal to northern Angola), Western Atlantic from North Carolina to Florida, Gulf of Mexico throughout the Caribbean Sea, southward to Uruguay.

Habitat: Clay, hard mud, peat, waterlogged wood, limestone, soft rocks in subtidal water.

Conclusion: *Pholas dactylus* and *P. campechiensis* are two distinct species, both occurring in West African waters. The present paper is focused on specimens of *P. dactylus* found in Mauritania and South Africa, though other localities on the West African shores may be inhabited. Specimens of *P. campechiensis* have been studied only from Gabon and compared by representatives from Venezuela. It concerns two distinct species, easily recognized from each other. The shells of *P. campechiensis* are rounded at both ends, while *P. dactylus* is beaked anteriorly. Moreover, specimens of *P. dactylus* from Mauritania and Morocco possess lilac growth lines, a typical characteristic in specimens of *P. campechiensis* that some shell collectors or dealers considered sufficient to classify them as *P. campechiensis*. Even Robin (2011) mixed up the two distinct species: fig 3 on Pl. 275 is *Pholas dactylus* instead of *P. campechiensis* and Figs 2 & 4 are *P. campechiensis* from Gabon.

Acknowledgements: Many thanks are due to Steve Hubrecht and Johan Verstraeten for supplying study material and to Jan Libbrecht for revising the English text.

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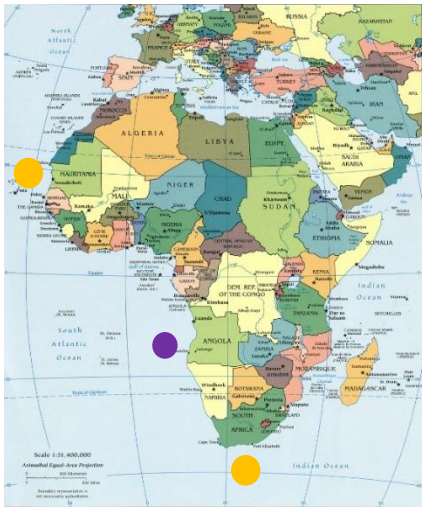

Localisation of studied samples of *Pholas dactylus* (●) and *P. campechiensis* (●)

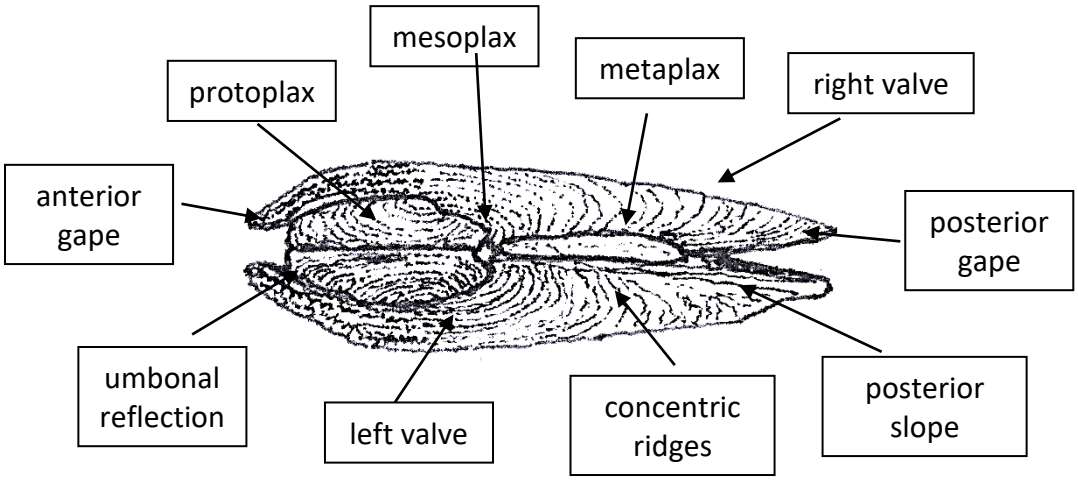

Fig. 1: Dorsal view of *Pholas dactylus* with characteristics

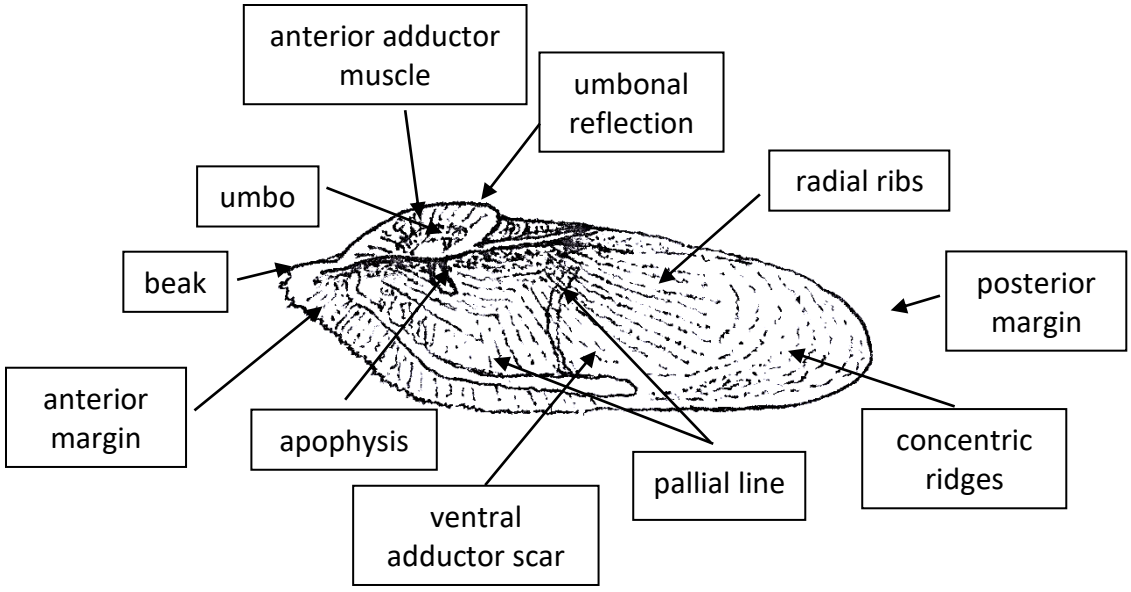

Fig. 2: Internal view of right valve of *Pholas dactylus* with characteristics

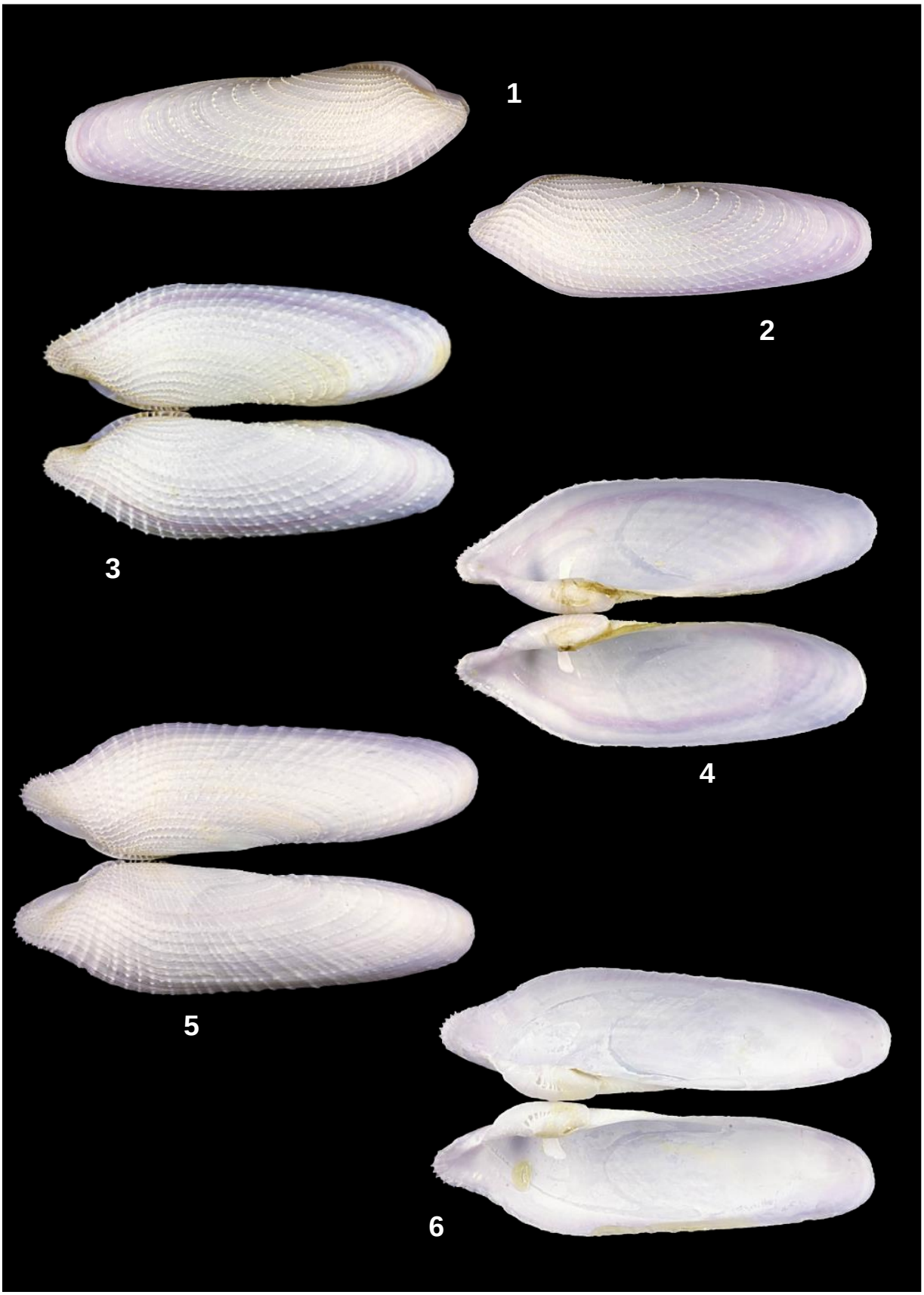

Plate I. Figs 1-6: *Pholas dactylus* Linnaeus, 1758. CSH; 1-4: Râs Timirist, Mauritania. In solid mud at low tide. June 2006; 1-2: 69.61 mm; 3-4: 70.57 mm; 5-6: Cabo Blanco, Mauritania. On sand at low tide at -0.5 m. 73.67 mm.

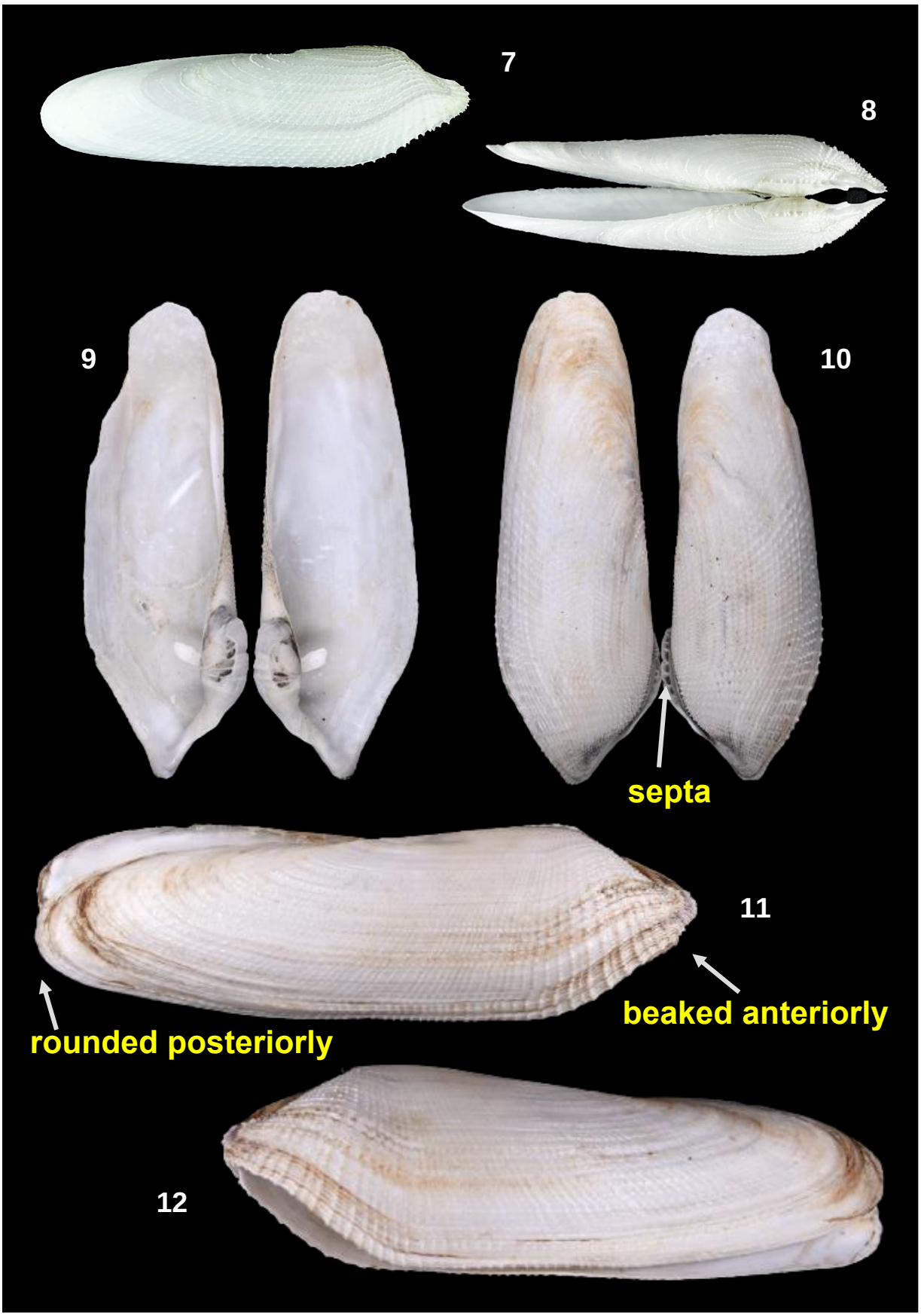

Plate II. Figs 7-12: *Pholas dactylus* Linnaeus, 1758. CFN; 7-8: N Mauritania. In muddy sand. Dived at a depth of 5 m. 1985. H. 21.64 mm L. 78.26 mm; 9-10: Knysna Lagoon, Western Cape, South Africa. Buried in mud on lagoon banks at spring low tide. May 1981. H. 31.32 mm L. 90.40 mm; 11-12: Venice, Italy, Adriatic Sea. On the beach after a storm. 1990. H. 31.76 mm L. 112.28 mm.

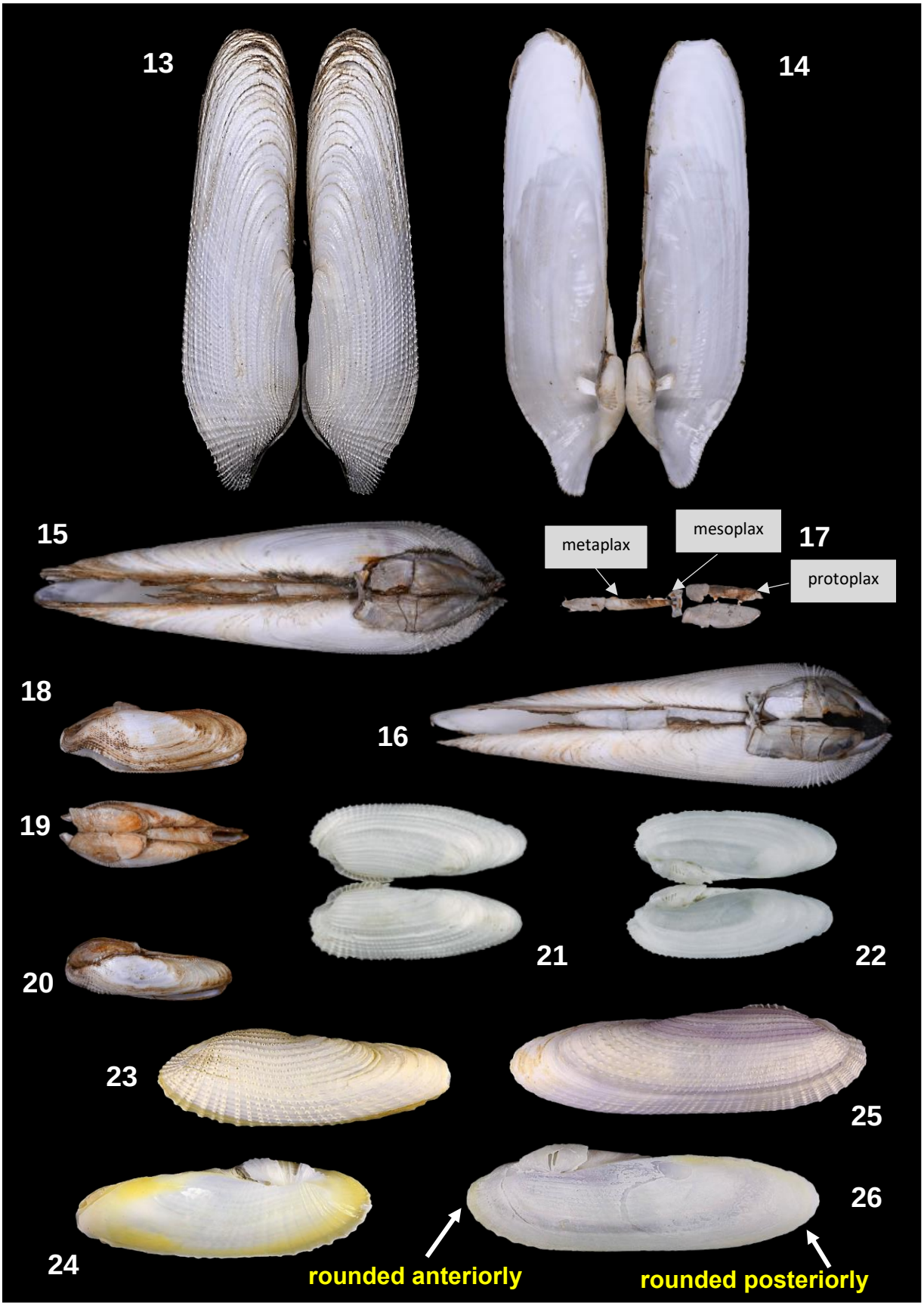

Plate III. Figs 13-17: ***Pholas dactylus* Linnaeus, 1758**. Pointe du Chevet, St. Jacut-de-la Mer, Brittany, France. In muddy clay at very low tide. November 1979. CFN; 13-14: H. 39.16 mm L. 130.49 mm; 15-16: H. 34.29 mm L. 137.58 mm; 17: accessory plates.
Figs 18-20: ***P. dactylus* var. *calllosa* Lamarck, 1818**. CFN; 18-19; Châtelaillon-Plage, Charente Maritime, W France. In muddy clay at very low tide. 26 September 2007. H. 20.84 mm L. 53.62 mm; 20: Beachy Head, S England, UK. In clay. Trawled by Belgian fishermen at a depth of 30 m. March 2010. H. 16.55 mm L. 46.09 mm.
Figs 21-26: ***Pholas campechiensis* Gmelin, 1791**; 21-22: Pointe Noire, Congo-Brazzaville. In rocks north of refinery. September 1996. H. 15.18 mm L. 38.79 mm. CJV; 23-26: La Guardia, Margarita, Venezuela. On the W of town. 19 March 1995. CSH; 23-24: H. 22.79 mm L. 66.89 mm; 25-26: H. 30.61 mm L. 99.44 mm.

Acesta arnaudi (Mollusca: Bivalvia: Limidae), a new species from the southwestern Indian Ocean

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Keywords: Mollusca, Bivalvia, LIMIDAE, *Acesta*, new species, Crozet Islands, SW Indian Ocean.

Abstract: A new species of *Acesta* from the Crozet Islands (SW Indian Ocean) is described and compared with related species. This is the first record of an *Acesta* from the sub-Antarctic area. About 1981 the French biologist Patrick Arnaud already made a description in the manuscript of this species under the name *Acesta subantarctica*, but his paper has never been published for unknown reasons. In honour of his scientific work on the French southern islands, especially on the genus *Acesta*, the new species is dedicated to P. Arnaud.
Furthermore, single valves and fragments of two other species were found off Marion Island and Amsterdam Island. One of them is similar with *Acesta saginata* Marshall, 2002, a species described from New Zealand and probably erroneously reported from New Caledonia.

Abbreviations:
CFN: private collection Frank Nolf (Oostende, Belgium)
CSH: private collection Steve Hubrecht (Koksijde, Belgium)
D.: Diameter
dd: empty shells
fragm.: fragment(s)
H.: Height
L.: Length
lv: live collected specimens
LV: Left valve
MNHN: Muséum national d'Histoire naturelle, Paris
ms: manuscript
RV: Right valve
sv: single valve

Introduction: Specimens studied in the present paper were obtained by the N.O. '*Marion Dufresne*', an oceanographic research vessel chartered by the shipping company of the French Southern and Antarctic Territories. This vessel provided most of the rotations and a regular supply of scientists and all kinds of goods. It disposed of cables that allowed to take samples at a depth of 3,000 m as part of a study of the benthos fauna. During two oceanographic expeditions (April 1976 and September 1980) by the N.O. '*Marion Dufresne*' several live and dead specimens of a new *Acesta* were collected at depths between 730 and 1500 m between the Lena shoals and the Crozet Islands, as well as one valve from Marion Island, Prince Edward Islands. The Crozet Islands are part of a sub-Antarctic Archipelago in the southern Indian Ocean. They form one of the five administrative districts of the French Southern and Antarctic Lands. Broken valves and fragments of *Acesta saginata* Marshall, 2001 were collected off the Kara Dad shoals, and also from Saint-Paul and Amsterdam Island (Pl VI, figs 23-29).
The new species was extensively treated by Patrick Arnaud in a manuscript written about 1981. The manuscript did not consider samples obtained by later expeditions by the N.O. '*Marion Dufresne*' (1982, 1986). Part of Arnaud's collection was transferred by Helmut Zibrowius to the Malacological department of MNHN and Philippe Bouchet asked me to study all material and to describe the involved samples as a new species, originally named by P. Arnaud as *Acesta subantarctica* in his manuscript. H. Zibrowius proposed the name *Acesta arnaudi* in honour of the French biologist. The name *Acesta subantarctica* is indeed less suitable, as there are no records from the other subantarctic oceans.
It must be said that – except for a few live taken specimens – several samples were restricted to single valves and fragments. The holotype was live taken and conserved in alcohol with animal. However, it measured 101 mm (instead of '111 mm'; Arnaud, ms), a size used by the author to make (wrong!) calculations of H/L and to compare this value in other specimens. Further on, Arnaud mentioned '90 mm' as the maximum size [('*la hauteur maxima (sic) observée (90 mm, chez l'holotype)*].

Material and methods: Photographs were made by focus stacking using a Nikon Z6 II camera, provided by a Nikkor MC 50/2.8 macro lens and a Nanlite illumination. Images were edited using Helicon and Adobe Lightroom software.

Family LIMIDAE Rafinesque, 1815

Genus ***Acesta*** H. Adams & A. Adams, 1858

Typetaxon: *Ostrea excavata* Fabricius 177

(by monotypy)

Large, thin-shelled, ovate, equivalve and inequilateral, ventricose, with moderate byssal gape, anterior umbonal ridge ill-defined; anterior auricle reduced or absent; cardinal area mainly posterior to beak, ligament pit broad, curved (Marshall, 2001).

Subgenus: ***Acesta***

Ornament of superficial radiating riblets, commonly strongest laterally and grading into fine striae on median portion of valves.

Chondrophore with the hinge more or less triangular, curved forward in contrast with the subgenus *Callolima*, wherein the ligament and the chondrophore are more or less oval, elongated in the direction of the hinge plate. Anterior auricle present. Radial ribs of equal width not alternating with secondary finer riblets, attenuating towards the middle area of the valves, in contrast with the subgenus *Plicacesta* wherein the ribs become stronger in the middle.

***Acesta arnaudi* sp. nov.**

Pl. I, figs 1-4; Pl. II, figs 5-8; Pl. III, figs 9-12; Pl. IV, figs 13-16; Pl. V, figs 17-20; Pl. VI, figs 21-22

Type material:

Holotype: Crozet Islands, between Pig Island and Possession Island. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976. Preserved in alcohol (lv). H. 101.28 mm L. 82.98 mm D.: 48.67 mm. MNHN-IM-2018-2002. Pl. I, figs1-4.

Paratypes:

- **Paratype 1:** Shoals of Crozet Islands. Collected by the N.O. '*Marion Dufresne*' at a depth of 860 m. Expedition MD24 (BIOMASS). Stn DC48. 52°18' S/ 41°44' E. 1 September 1980. dd. MNHN-IM-2018-2001. H. 90.07 mm L. 69.40 mm D. 40.55 mm. Pl. II, figs 5-8.

Paratype 2-4: Crozet Islands, between Pig Island and Possession Island. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976; lv: with animal.

- **Paratype 2:** MNHN-IM-2012-25446. H. 85.34 mm L. 70.40 mm D. 43.71 mm. Pl. III, figs 9-12.

- **Paratype 3:** MNHN-IM-2012-25445. H. 83.61 mm L. 66.64 mm D. 39.20 mm. Pl. IV, figs 13-14.

- **Paratype 4:** MNHN-IM-2012-25444. H. 74.68 mm L. 58.99 mm D. 38.30 mm. Pl. IV, figs 15-16.

Additional samples:

Crozet Islands. Collected by the N.O. 'Marion Dufresne' at a depth of 1500 m. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976. 1 sv with animal: H. 81.57 mm L. 64.42 mm and 1 sv with animal and hole: H. 93.95 mm L. 74.33 mm; 1 sv from Marion Island. 47°01.78' S/ 37°57' E. South Africa Survey. MAD 57C. Dredged at 680-715 m. H. 100.69 mm L. 77.52 mm; 1 sv from Crozet Islands (Kara Dad shoals). 46°20' S/ 42°28' E. Collected by the N.O. '*Marion Dufresne*'. Expedition MD24 (BIOMASS). Stn DC71. Dredged at a depth of 730 m. H. 87.80 mm L. 68.51 mm and H. 83.73 mm L. 64.44 mm; several fragm. Marion Island. 47°01.78' S/ 37°57' E. South African Survey. MAD 57C. Dredged at 680-715 m; 1 fragm. W of Marion Island. 46°51' S/ 37°34' E. Collected by the N.O. '*Marion Dufresne*'. Expedition MD24 (BIOMASS). Stn DC64. Dredged at a depth of 990-1025 m; several fragm. Amsterdam Island. 37°55' S/ 77°39' E. Collected by the N.O. '*Marion Dufresne*'. Expedition MD50 (JASUS). Stn DC64. Dredged at 1000-1200 m. 15 July 1986; fragm. and animals in alcohol. Shoals of Crozet Islands. 52°18' S/ 41°44' E. Collected by the N.O. '*Marion Dufresne*'. Expedition MD24 (BIOMASS). Collected at a depth of 860 m.

Description: Shell up to 100 mm high, thin and fragile, rather glossy, translucent and strongly inequilateral. Oval in outline, slightly oblique and rather swollen, certainly when compared with similar species of the genus *Acesta*.

Umbones (prodissoconch-2) very anteriorly and beaks (prodissoconch-1) slightly protruding at a distance of about 6 mm from each other. Chondrophore triangular and strongly curved over a distance of 10 mm, a third of the total length of the hinge plate. Anterior end of the cardinal platform shows a very faint nodule, absent in the left valve.

Anterior auricle is extremely reduced and invisible by a lateral view. Posterior auricle larger and rounded, gradually fused with the posterior margin of the valves. Apical angle of the valves between the exterior margin of lunule and the margin of posterior auricles from 115° to 125°.

Lunule is well marked and contains on each valve two longitudinal zones, weakly excavated and separated by a rounded ridge, starting from the anterior auricle, comparable with the lunule of *A. angolensis* (Adam & Knudsen, 1955).

Consequently, the structure of these two areas is different: the central inner part is covered by interlacing growth lines forming real cords near the hinge plate. In the exterior area of the lunule the cords are granulated in the lower part. This ornamentation is crossed by 4-5 ribs, more spaced and distinct than those on the remaining part of the valves.
Valves white, with a shiny appearance, periostracum very thin and yellowish grey ('Isabelline colour'). Fine growth lines in the juvenile growth stage, but very distinct tile-wise in the older stages of larger specimens. Radial structure inconspicuous, more prominent in the anterior and posterior parts. Costulation attenuates from the right and left margins towards the centre part of the valves, where only fine striae are present, sometimes waved or bifurcating and so inducing new striae (about a dozen over a distance of one cm). Costulation shows very small nodules by intersection with the parallel growth lines, but never exceeds the importance of those surrounding the lunule. Outer margins of the valves are not or only faintly crenulated.
Shell is white and thin (0.6-1mm) and so translucent that the living animals can be observed through the valves. Interior of the valves is white, glossy and not influenced by the external costulation. Pallial line is faintly marked at about 15 mm off the ventral margin in the holotype. Anterior adductor scar small and oval (18 x 13 mm in the holotype), nearby the pallial line in the posterior part of the shell.
Animal reddish brown. Foot is remarkably small and provided with a byssus, sparse but with thick fibres.

Dimensions: the holotype measures 101 mm, while paratype and other samples vary between 75 mm and 94 mm.

Habitat: In fine sediment (green mud or calcareous mud), fixed by their byssus on small rocky blocks, or probably on *Scleractinia* or other calcareous organisms of sufficient size like large gorgonia (family ISIDAE). This may be related to the fairly constant association that has been demonstrated between *Acesta excavata* and deep white corals (Bourcier and Zibrowius, 1969). It is also probable that this type of association results from both trophic factors (possible similarities between the requirements of these two zoological groups in terms of food quality and quantity), ecological and mechanical factors (need for support for fixation by byssus; *Scleractinia* are often the only organisms to provide a holdfast in very deep water). This is a remarkably interesting similarity in habitat between *Acesta excavata* and *A. arnaudi*, each living in high and middle latitudes of one of the two hemispheres (Arnaud, ms).

Type locality: between Possession Island and Pig Island, Crozet Islands at a depth of 1500 m - 46°18' S/ 51°19' E.

Derivatio nominis: This species has been dedicated to the late Patrick Arnaud (1939-2016). After obtaining his undergraduate studies at the Faculty of Sciences of the Sorbonne, he started his doctoral studies in biological oceanography in 1960. His fieldwork as marine biologist started in the 1961-1963 wintering at Adélie Island in Antarctica. In 1964 he obtained his Doctor of Science degree. He later took part in other oceanographic missions on the N.O. '*Marion Dufresne'*, a French ship that was built to supply the bases of the sub-Antarctic islands, but also to explore the continental shelves of the Kerguelen, Crozet and other islands from 1973 to 1995. As a specialist in benthic fauna, his research focused on the Mollusca in the sub-Antarctic and Antarctic waters, and he was the author of nearly 200 publications.

Discussion: P. Arnaud calculated the ratio's H/L, D/H and D/L in the holotype and paratypes and after careful verification they were recorded in Table 1. The values have been compared with those obtained from similar *Acesta* species described and mentioned in literature (see Table 2). The average value of D/H measures 0.49, a much higher value as calculated from values mentioned in literature for related *Acesta* species, varying from 0.21 (*A. philippinensis* Bartsch, 1913) and 0.27 (*A. celebensis* Bartsch, 1913) to an equivalent maximum of 0.50 (*A. bullisi* Vokes, 1963). These calculations turned out to be useful to make a difference with all other *Acesta* species, except *A. bullisi* (Vokes, 1963) (W Atlantic), *A. indica* (E.A. Smith, 1899) (India), *A. sphoni* (Hertlein, 1963) (E Pacific) and *A. saginata* Marshall, 2001 with a D/H ratio of 0.46 (but different by the presence of ribs over the whole surface) and to a lesser extent *A. excavata* (Fabricius, 1779) (Arctic area, E Atlantic and Mediterranean Sea). Solely based on this data, we could already decide *A. arnaudi* is indeed a distinct species, considering that the four of these species occur in totally different waters, except the south Pacific *A. saginata*. However, calculations by Patrick Arnaud are mostly based upon a very restricted number of specimens and about half of the number of the samples contained only one specimen.

Calculations with the values of six complete specimens from Crozet Islands show a rather constant average, but holotype and paratype 1 were slightly aberrant. That kind of calculations can only be considered as an auxiliary tool to sustain definitive conclusions about the real identity of a species. Large numbers of specimens are needed to clearly distinguish different species.
More important are the characteristics described above and the comparison with related *Acesta* species:

* ***A. sphoni*** **(Hertlein, 1963)** (California, USA) must be excluded because it belongs to the subgenus *Plicacesta* wherein the radial costulation consists of an alternating and variable number of strong and weaker radiating ribs, which becomes more evident towards the middle of the valves.
* ***A. bullisi*** **(Vokes, 1963)** (Caribbean Sea) is the species closest to the new species, but *A. arnaudi* differs from it, based on the larger number of finer radial ribs (12-18 costulated ribs instead of 8-9 ribs) and also of the deeper hollowed lunule.
* ***A. excavata*** **(Fabricius, 1799**) (N and E Atlantic) is more elongate and oblique, the lunule is relatively flattened and the ornamentation of shell surface consists of a lesser number of radiating ribs (10-12 per cm).
* ***A. indica*** **(E.A. Smith, 1899)** (India) is more oblique than the new species and it has more evident radiating costulations.
* ***A. patagonica*** **(Dall, 1902)** (Pl. VI, figs 30-33) is restricted to East Pacific waters of South America. It has a very narrow hinge plate, it is glossier, and the lunule on right valve of many specimens has a typical indentation as shown in Pl. VII, fig. 32 & Pl. VIII, fig. 36.
* ***A. maui*** **Marshall, 2001** (Pl. X, figs 44-47) (New Zealand, South Australia) has a very glossy surface with similar radiating ribs, varying from nearly invisible in the median area of the shell to strong ribbing in one of the two syntypes of *A. maui*, a very narrow hinge plate and anterior auricles slightly more protruding. The lunule is deeply excavated. Periostracum yellowish brown. *A. maui* has different ratios of H/L, D/H and D/L compared *to A. arnaudi*. It has a more elongate shell, but obliquely in outline and it also possesses a longer hinge plate.
***** ***Acesta saginata*** **Marshall, 2001** (New Zealand) is closer to *A. celebensis* (Bartsch, 1913). (Pl. VI, figs 23-29 & Pl. IX, figs 40-43). It is less bulbous and has a narrower hinge plate with broader and stronger radial riblets across the whole surface of the shell extending beyond the margins. Several broken shells and small fragments of specimens similar to *A. saginata* were collected from Amsterdam Island at 37°55' S/ 77°39' E. Expedition MD50 (JASUS). Stn DC64. N/O 'Marion Dufresne'. Depth: 1000-1200 m (Pl. VI, figs 23-29). Specimens differ from *A. arnaudi* not only by the ribbed surface, but also by the hinge plate with prodissoconch-2 and prodissoconch-1 located at the extreme end of the anterior part of the shells, resulting in a very elongated and narrow resilifer. The possible presence of *A. saginata* off Marion Island, St. Paul and Amsterdam Islands would be a considerable range extension of this species, that until today was only known from New Zealand waters and erroneously reported from New Caledonia (Marshall, 2001).

Conclusion: There is no doubt that *Acesta arnaudi* is a new species. It differs from similar species by its rather glossy surface, the rather bulbous character, the microsculpture of the radiating ribs and the structure of the lunule and the resilifer. Moreover, it is evident that at least one or two more *Acesta* species may occur in subantarctic waters.
A living specimen of *A. arnaudi* was also found in true Antarctic waters at 67-68° S (Piazza et al., 2016), but not described.

Acknowledgements: The material was obtained within the framework of oceanographic expeditions of the N.O. '*Marion Dufresne*', organised by the logistical and financial support of the French Southern and Antarctic Lands (Paris), for which many thanks. The study of P. Arnaud was conducted within the framework of Laboratoire Associé at the 'Comité National section 41' at the CNRS ('Station marine d'Endoume'). I am very grateful to Philippe Bouchet for the loan of the *Acesta* samples from the '*Marion Dufresne*' expeditions and some more similar specimens from the SW Indian Ocean. Virginie Heros sent me photographs of the holotype and paratype 1, and also a copy of the paper by Piazza et al. (2016). Helmut Zibrowius provided me with a lot of additional information and the manuscript of Patrick Arnaud. Steve Hubrecht was an enthusiastic contributor by providing many samples in loan for photography and a lot of literature data. Special thanks are due to Dirk Nolf for teaching me the use of focus stacking, to Johan Verstraeten for carefully proofreading my manuscript and especially to Jan Libbrecht for correcting the English text.

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N.O. 'Marion Dufresne'

	H	L	D	H/L	D/H	D/L
holotype	101.28	82.98	48.67	1.22	0.48	0.59
paratype 1	90.07	69.40	40.55	1.30	0.45	0.58
paratype 2	85.34	70.40	43.70	1.21	0.51	0.62
paratype 3	83.61	66.64	39.20	1.25	0.47	0.59
paratype 4	74.68	58.99	38.30	1.27	0.51	0.65
additional specimen	85.62	68.72	45.41	1.25	0.53	0.66
average value				1.25	0.49	0.62

Table 1: Measurements (mm) of holotype and paratype specimens of *A. arnaudi* sp. nov.

species	H/L	D/H	D/L	number of specimens	origin of data
A. agassizii	1.28	0.38	0.47	1	Dall, 1902
A. angolensis	1.28	0.37	0.47	32	Adam & Knudsen, 1955; Boss, 1965; Nolf & Verstraeten, 2005
A. arnaudi	1.25	0.49	0.62	6	See Table 1
A. borneensis	1.19	0.41	0.40	1	Bartsch, 1913
A. bullisi	1.20	0.50	0.60	1	Vokes, 1963
A. celebensis	1.34	0.27	0.36	4	Prashad, 1932
A. diomedeae	1.09	0.40	0.43	1	Dall, 1908
A. excavata	1.34	0.43	0.58	61	Verkrüzen, 1872; Dall, 1902; Bartsch, 1913; Bourcier & Zibrowius, 1969; Nolf & Verstraeten, 2005
A. goliath	1.35	0.35	0.48	4	Dall, 1902; Bartsch, 1913; Hirase, 1951; CSH
A. indica	1.23	0.45	0.56	1	E.A. Smith, 1899
A. maui	1.38	0.37	0.51	3	CSH
A. niasensis	1.36	0.34	0.46	1	Thiele, 1918
A. patagonica	1.39	0.43	0.59	23	Dall, 1902; coll. Arnaud
A. philippinensis	1.59	0.21	0.33	1	Bartsch, 1913
A. rathbuni	1.36	0.30	0.40	3	Bartsch, 1913; Prashad, 1932
A. saginata	1.29	0.46	0.59	3	CSH; MNHN
A. smithi	1.31	0.43	0.54	8	G.B. Sowerby III, 1888; CSH
A. sphoni	1.25	0.49	0.62	1	Hertlein, 1963
A. verdensis	1.19	0.45	0.53	1	Bartsch, 1913
A. virgo	1.20	0.30	0.40	1	Habe & Okutani, 1968

Table 2: Dimensional ratios of most *Acesta* species, of which data are available in literature and the manuscript of P. Arnaud

The French Southern Antarctic Lands

Pig Island

Possesion Island

The Crozet Islands

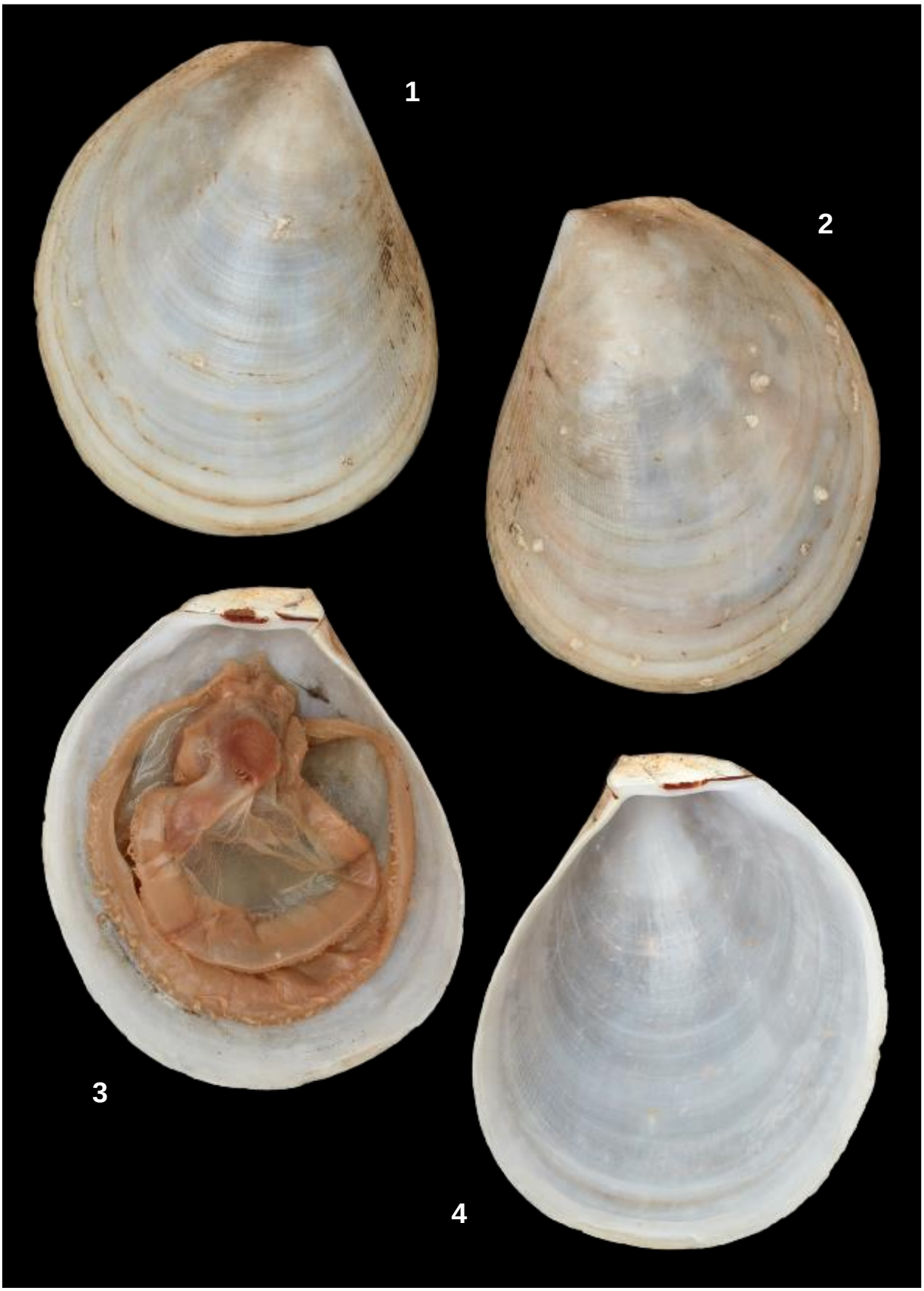


Plate I. Figs 1-4. *A. arnaudi* sp. nov. Crozet Islands, between Possession Island and Pig Island. 46°18-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*'. Expedition MD08 (BENTHOS). Stn 44 CP199. Depth: 1500 m. 15 April 1976. Holotype. MNHN-IM-2018-2002. H. 101.28 mm L. 82.98 mm D. 48.67 mm; 1: exterior of RV; 2: exterior of LV; 3: interior of LV; 4: interior of RV.

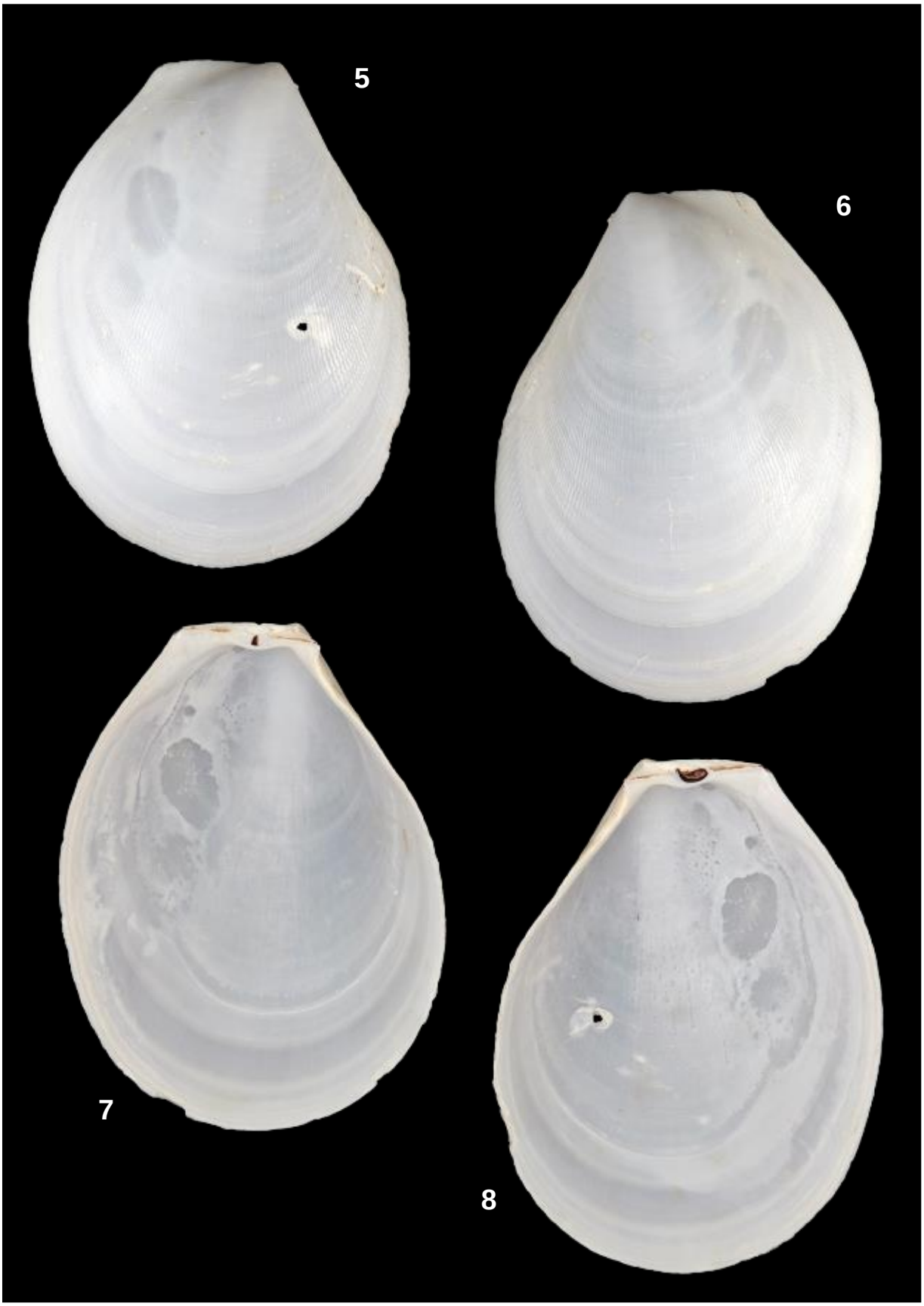


Plate II. Figs 5-8. *A. arnaudi* sp. nov. Shoals of Crozet Islands. Collected by the N.O. '*Marion Dufresne*' at a depth of 860 m. Expedition MD24 (BIOMASS). Stn DC48. 52°18' S/ 41°44' E. 1 September 1980. Paratype 1. MNHN-IM-2018-2001. dd. H. 90.07 mm L. 69.40 mm D. 40.55 mm; 5: exterior of RV; 6: exterior of LV; 7: interior of LV; 8: interior of RV.

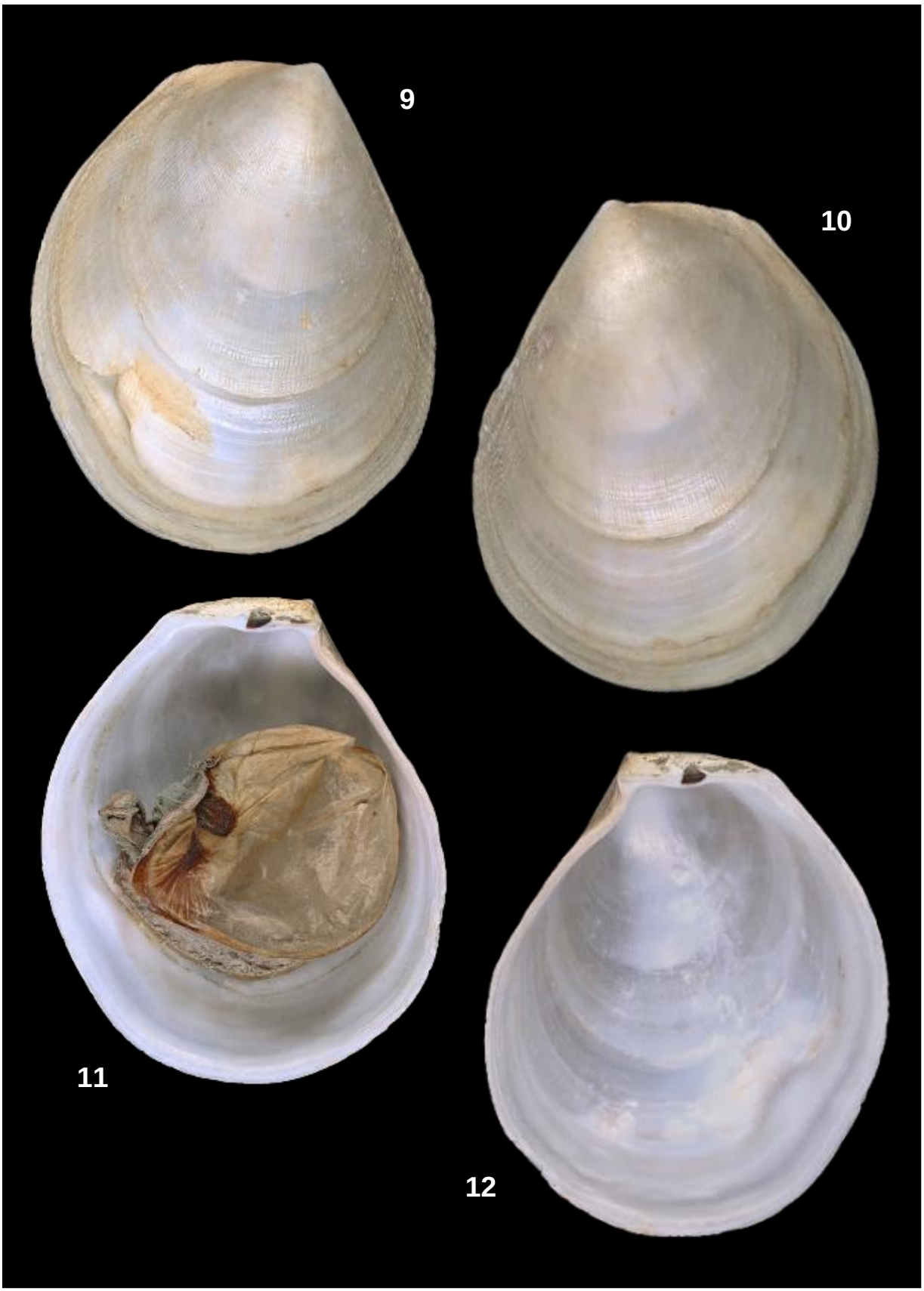
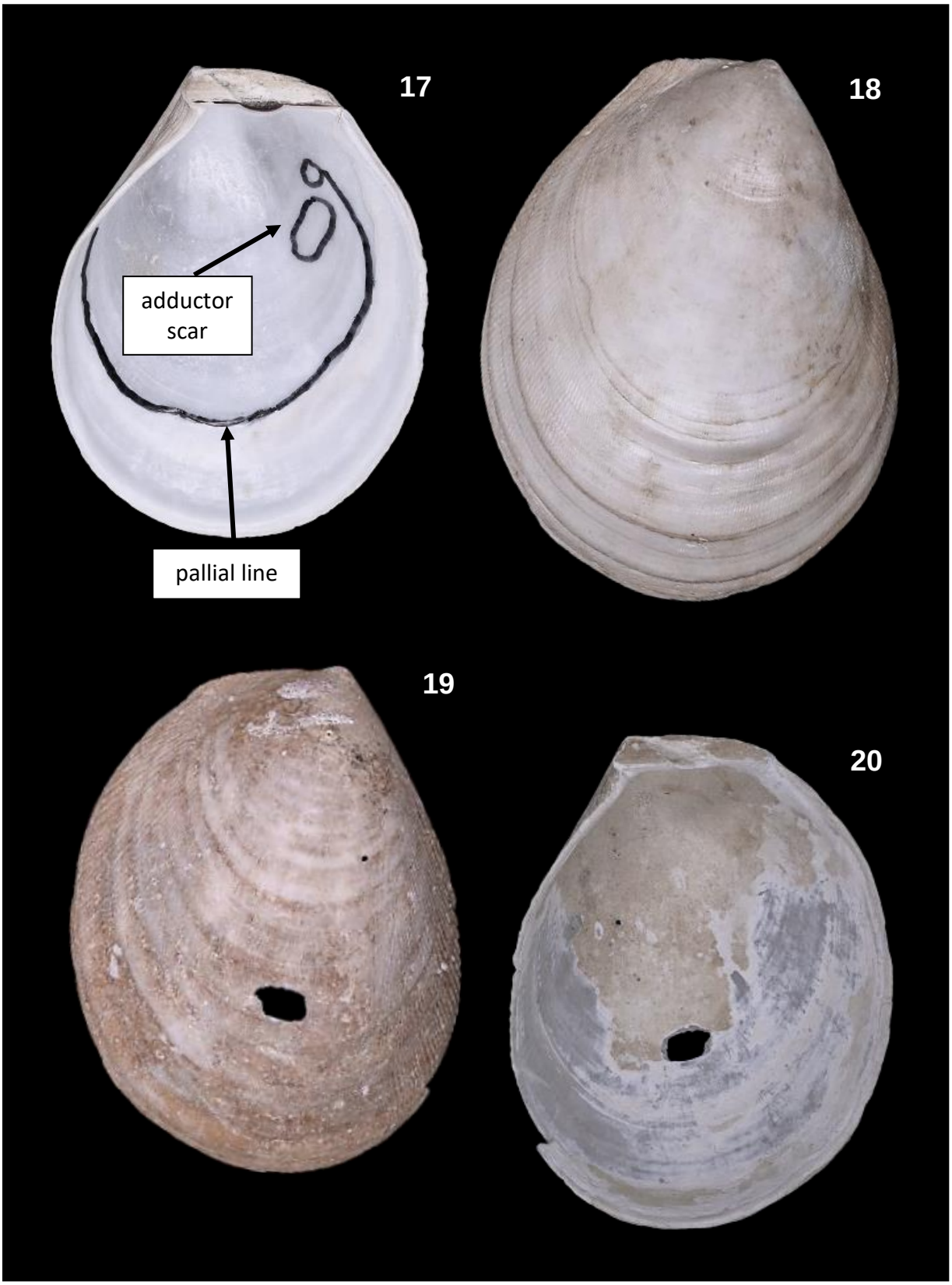
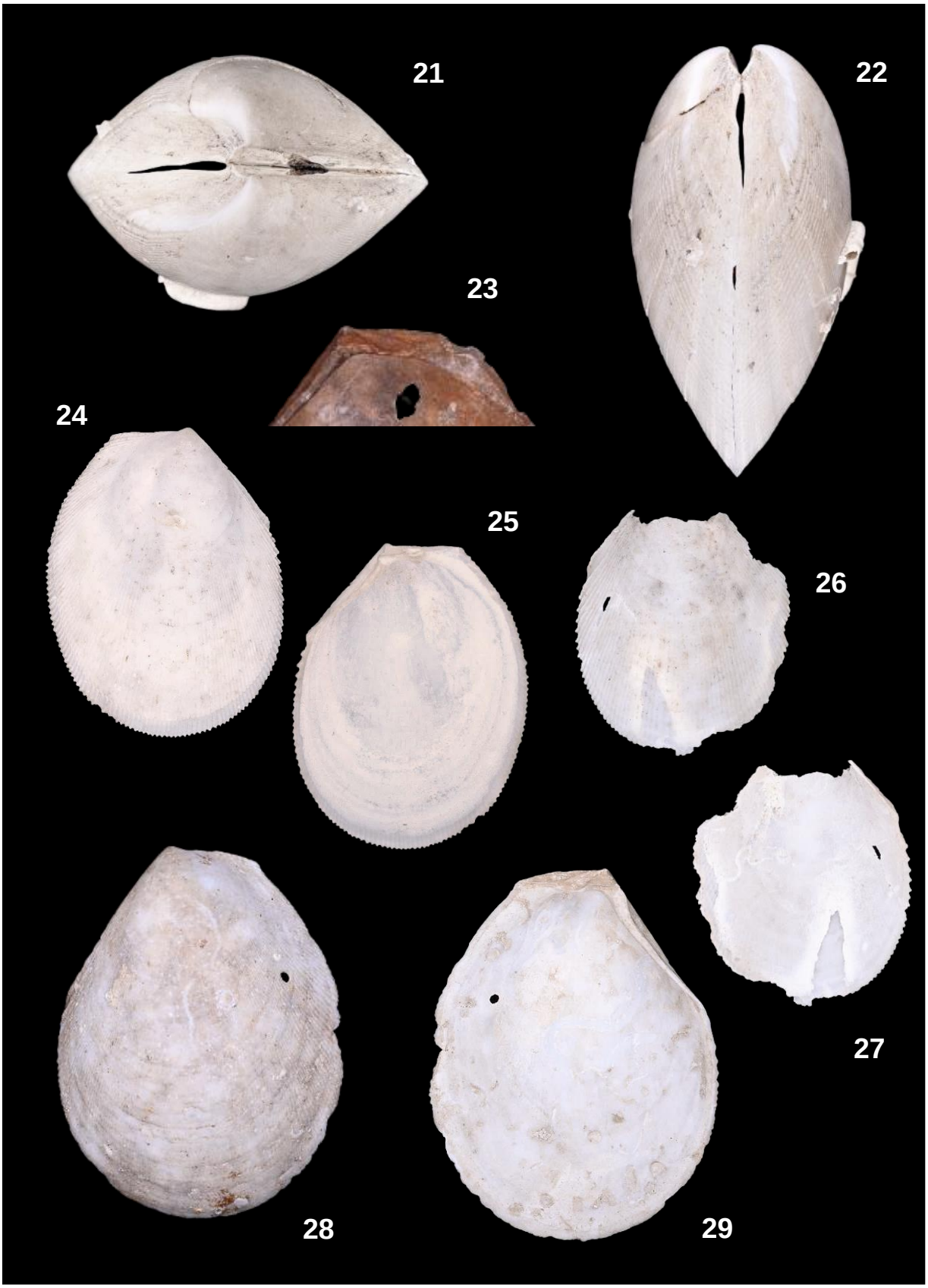


Plate III. Figs 9-12. *A. arnaudi* sp. nov. Crozet Islands, between Pig Island and Possession Island. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976. Paratype 2. MNHN-IM-2012-25446. lv, with animal. H. 85.34 mm L. 70.40 mm D. 43.71 mm; 9: exterior of RV; 10: exterior LV; 11: interior of LV; 12: interior of LV.

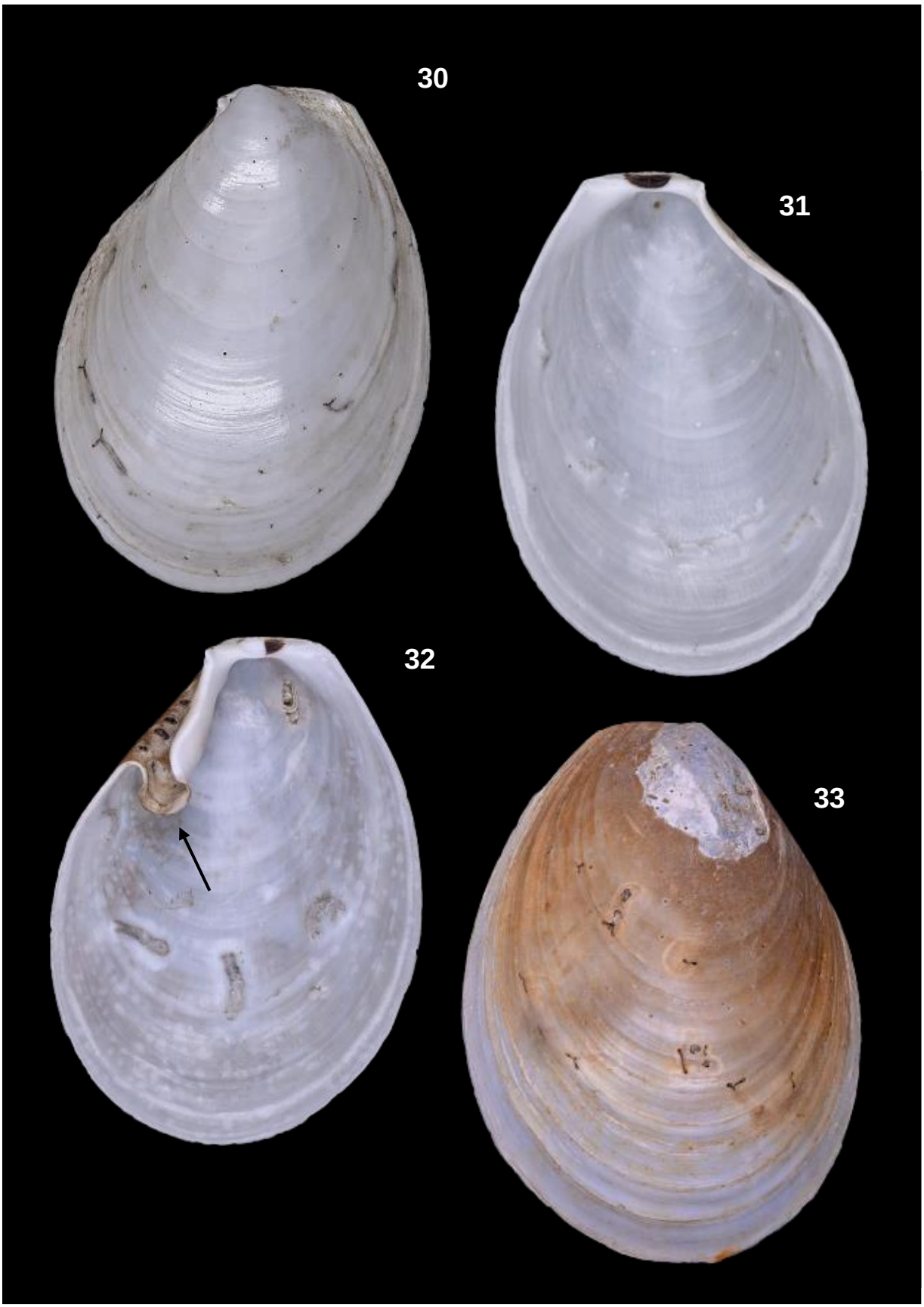
Plate IV. Figs 13-16. *A. arnaudi* sp. nov. Crozet Islands, between Pig Island and Possession Island. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976. lv with animal; 13-14: Paratype 3. MNHN-IM-2012-25445. H. 83.61 mm L. 66.64 mm. D. 39.20 mm; 13: exterior of RV; 14: exterior of LV; 15-16: Paratype 4 MNHN-IM-2012-25444. H. 74.68 mm L. 58.99 mm D. 38.30 mm; 15: exterior of RV; 16: exterior of LV.



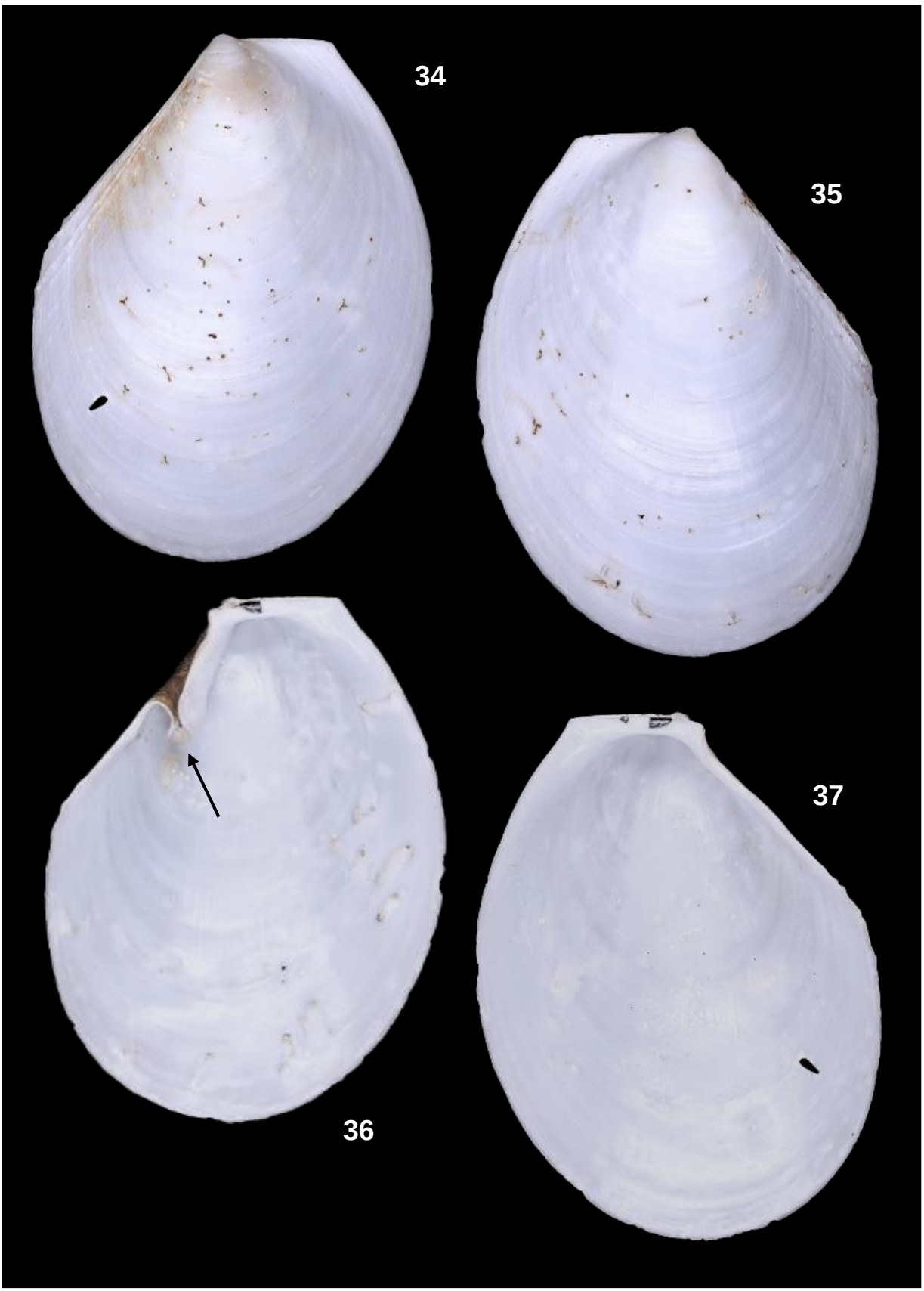
Pl. V. Figs 17-20: *Acesta arnaudi* sp. nov.; 17: Crozet Islands, between Pig Island and Possession Island. 46°18'-16' S/ 51°14-13' E. Collected by the N.O. '*Marion Dufresne*' at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976; 18: Marion Island. 47°01.78' S/ 37°57' E. South African survey. Marion Island Dredge. Depth: 680-715 m. 28/04/1989. H. 100.69 mm L. 77.52 mm; 19-20: Crozet Islands. Kara Dad shoals. 46°20' S/ 42°28' E. N.O. '*Marion Dufresne*'. Expedition MD24 (BIOMASS). Stn DC71. Depth: 730 m. 08/09/1980. H. 87.80 mm L. 68.51 mm.



Pl. VI. Figs 21-22: ***Acesta arnaudi* sp. nov.** Paratype 4. MNHN-IM-2012-25444. Crozet Islands, between Pig Island and Possession Island. 46°18' S/ 52°14-13' E. Dredged at a depth of 1500 m. Expedition MD08 (BENTHOS) Stn 44 – CP199. 15 April 1976.
Figs 23-29: *Acesta* sp.; 23-27: Amsterdam Island. 37°55' S/ 77°39' E. Stn DC64. 15 July 1986; 24-25: H. 48.48 mm L. 36.89 mm; 28-29: Off Crozet Islands. Kara Dad shoals. Dredged by N.O. '*Marion Dufresne*'. 46°20' S/ 42°28' E. H. 83.73 mm L. 64.44 mm.

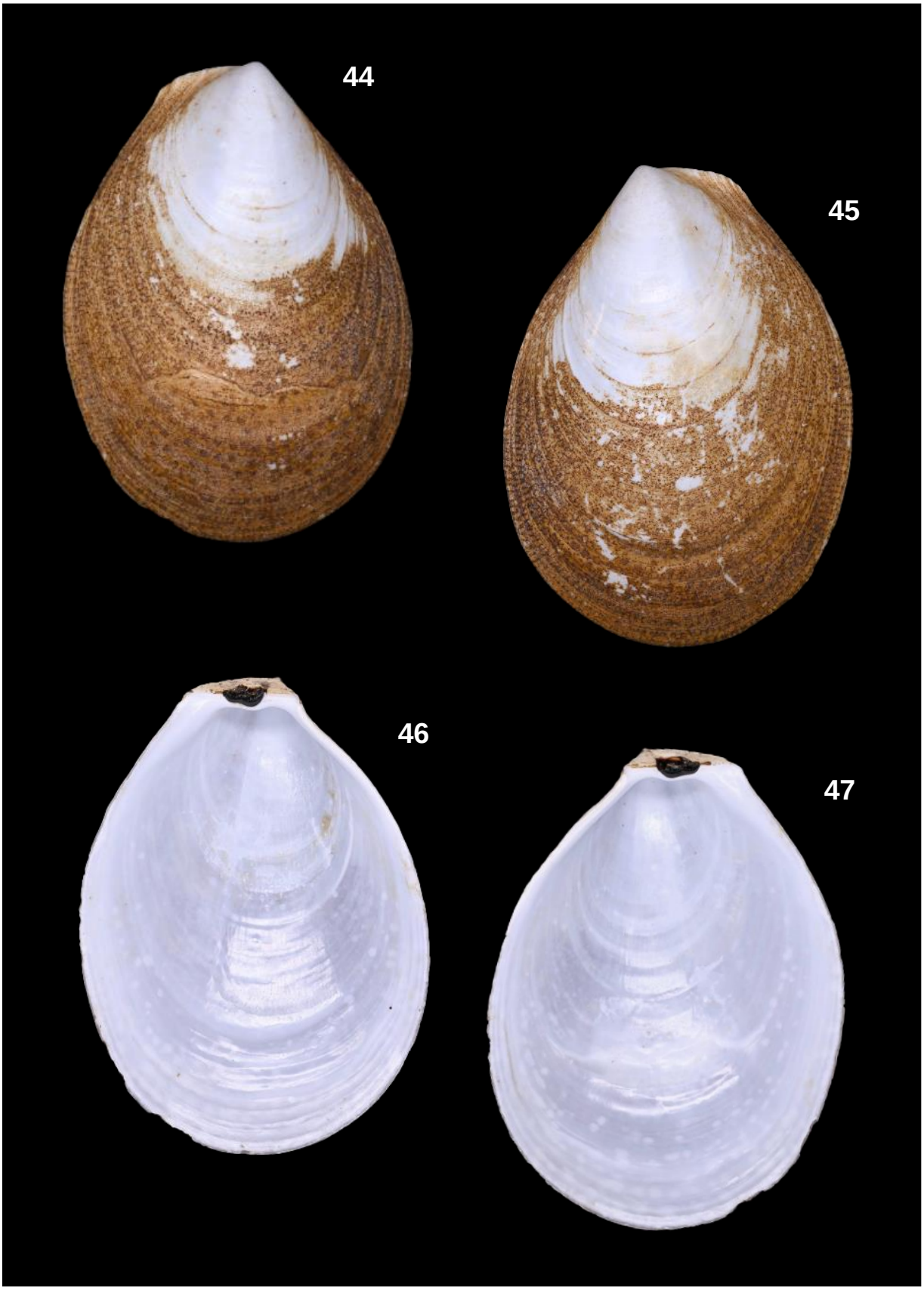


Pl. VII. Figs 30-33: *Acesta patagonica* (Dall, 1902); 30-32: off Los Vilos, Chile. In mud. Trawled at a depth of 400 m. October 1986. H. 86.52 mm L. 63.31 mm D. 36.24 mm. CFN; 30: exterior of LV; 31: interior of LV; 32: interior of RV; 33: off Zapallar, Chile. Trawled at a depth of 350 m. 27 September 1977. H. 91.62 mm L. 68.22 mm D. 40.25 mm. Exterior of RV. MNHN.



Pl. VIII. Figs 34-37: *Acesta patagonica* (Dall, 1902). Off Quintero, Chile. Dredged at a depth of 350-400 m. H. 90.5 mm L. 68.0 mm. CSH; 34: exterior of LV; 35: exterior of RV; 36: interior of RV; 37: interior of LV.

Pl. IX. Figs 38-39: ***Acesta patagonica* (Dall, 1902).** Bahia Parry, Strait of Magellan, Chile. Trawled at a depth of 80 m. H. 83.7 mm L. 66.3 mm. CSH; 38: exterior of LV; 39: interior of RV.
Figs 40-43: *Acesta saginata* Marshall, 2001. Chatham Rise, New Zealand. Dredged at a depth of 1000 m. H. 65.7 mm L. 50.8 mm. CSH; 40: exterior of LV; 41: exterior of RV; 42: interior of LV; 43: interior of RV.



Pl. X. Figs 44-47: *Acesta maui* Marshall, 2001. Chatham Rise, New Zealand. Dredged at a depth of 450 m. December 2002. H. 165.8 mm L. 119.1 mm. CSH; 44: exterior of RV; 45: exterior of LV; 46: interior of LV; interior of RV.

Pl. XI. Figs 48-52: *Acesta maui* Marshall, 2001. CSH; 48-50: Chatham Rise, New Zealand. Dredged at a depth of 500 m. H. 100.8 mm L. 69.6 mm; 48: exterior of LV; 49: exterior of RV; 50: interior of LV; 51-52: Dredged of Beachport, South Australia at a depth of 120 m. In sand. H. 121.7 mm L. 86.7 mm, 51: exterior of LV: interior of LV.

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