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# TWO NEW TROPHONINAE (GASTROPODA: MURICIDAE) FROM ANTARCTIC WATERS

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## ABSTRACT

Two new species of *Trophon* from Antarctic waters are described. *Trophon emilyae*, n. sp., from the northwestern Amundsen Sea, is characterized by a small, slender, almost smooth shell and a thin profile. Axial sculpture consists of regular, thin varices, and four weak cords on the first whorls are the only spiral ornamentation. It is similar to *T. declinans* Watson, 1882, but the radula and shell ornamentation are clearly different. *Trophon arnaudi*, n. sp., was collected off South Sandwich Island. It is a small species similar to *T. scolopax* Watson, 1882, from the Kerguelen Islands. The shell is chalky white, with 10–11 axial lamellae crossed by five spiral cords on the last whorl. Adult specimens of the new species are illustrated, described and compared with other living species of the same genus and of similar geographic distribution. Lectotypes of *T. septus* Watson, 1882, and *T. declinans* Watson, 1882, are here designated.

Key words: Antarctica, *Trophon arnaudi* n. sp., *Trophon emilyae* n. sp., Muricidae, Trophoninae, systematics, biogeography.

## INTRODUCTION

The subfamily Trophoninae is by far the largest group of marine living gastropods in Antarctica. A detailed survey shows more than 100 names published for this group in southern South America and Antarctica. From this total, approximately 30 belong to Patagonian species of the genus *Trophon s. l.*, 34 to *Xymenopsis*, and the rest to Antarctic species. Recently, *Xymenopsis* was show to have only four valid species by Pastorino & Harasewych (2000).

In the last comprehensive revision of southern species of *Trophon*, Powell (1951) described *T. cuspidarioides* and included Watson's species *T. scolopax*, *T. septus*, and *T. acanthodes* in the same group, because of their long anterior canals. However, he considered this feature not of sufficient taxonomic importance to warrant separation of this group of species. This is true, because *T. acanthodes* Watson, 1882, despite the similarities in the long anterior canal, has a very different radula and protoconch (Pastorino, in prep.).

In this paper, two new living species of the subfamily Trophoninae are described from Antarctic waters. Adult specimens, operculum, radula, protoconch, and shell ultrastructure are described for each. Due to the extraordinary morphological variation within this genus, comparison with all similar species from the same geographic area is mandatory.

## MATERIAL AND METHODS

Specimens studied in this work are housed in the collections of: the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires (MACN); The Natural History Museum, London, (NHM); and Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZIN). Material housed at USNM, collected by the ship R/V Eltanin belongs to the United States Antarctic Program (USAP) and material housed at ZIN was collected by the R/V Evrica. In addition, type specimens from the Strebel collection housed in part at the Zoologisches Institut und Zoologisches Museum der Universität Hamburg was also studied.

Dissections were performed on ethanol-preserved specimens to study radulae and male reproductive system. Radulae were prepared according to the method described by Solem (1972) and observed using a LEO 440 scanning electron microscope (SEM) at the USNM. Radular terminology follows Kool (1993: fig. 6B). Shell ultrastructure data were procured from freshly fractured colabral sections taken from the central portion of the lip on the last whorl of two individuals per taxon, whenever sufficient material was available.

Photographs were taken using a digital scanning camera. Several images were scanned from black and white 35 mm negatives using a slide scanner. All images were digitally processed.

## SYSTEMATICS

Class Gastropoda Cuvier, 1797
Order Neogastropoda Wenz, 1938
Family Muricidae Rafinesque, 1815
Subfamily Trophoninae Cossmann, 1903
Genus *Trophon* Montfort, 1810
Type species: *Murex magellanicus* Gmelin, 1791, = *Trophon geversianus* (Pallas, 1774), by original designation.

### ***Trophon emilyae*** Pastorino, new species (Figs. 1–14)

#### Diagnosis

Shell small, slender, almost smooth; siphonal canal very long, twisted, narrow. Axial sculpture of regular, thin, gentle varices; spiral sculpture of four very weak cords in the first whorls, then obsolete.

#### Description

Shell small in size (up to 16 mm), slender, fusiform, very thin, translucid; protoconch of one and a half whorls; teleoconch of five moderately convex whorls; spire 1/4 of total shell length; subsutural shelf faint. Spire angle about 40°, suture abutting; aperture small, its interior glossy white; anterior siphonal canal very long, twisted, narrow; umbilicus closed; outer lip rounded; columellar lip almost indistinct. Axial ornamentation of regular, thin varices, about 8–11 on last whorl, slightly developed, running along whorl surface from adapical suture to siphonal fasciole, weakly projecting outwards along keel. Spiral ornamentation of low, rounded spiral cords, four in the first whorls then obsolete, the entire shell surface covered by regular threads. Regular growth lines covering whorls and lamellae.

Innermost shell layer very thin, comprising about 5% of shell, composed of aragonite (?), with the crystal planes oriented perpendicular to growing edge of shell; second layer aragonitic crossed-lamellar, representing 95% of shell thickness.

Operculum suboval, completely covering aperture, brownish in color, thin, with terminal nucleus; growth lines covering external surface curved at upper ends; attachment area with two or three horseshoe-shape scars.

Rachiglossan radula with teeth very closely packed; rachidian two times wider than height; central cusp very thin; lateral cusps shorter but of similar thickness to central cusp, denticle between central and lateral cusp very large. Base of rachidian teeth curved, large; marginal area inclined, smooth. Lateral teeth large size, with a thick attached portion.

#### Etymology

This species is dedicated to Dr. Emily Vokes, of Tulane University, New Orleans, Louisiana (now retired), who helped me with my first steps on *Trophon*.

#### Type Material & Locality

Holotype: USNM 896438; R/V Eltanin Station 1343, 567–604 m, collected with rock dredge, 7 November 1964, 54°50'S/29°50'W.

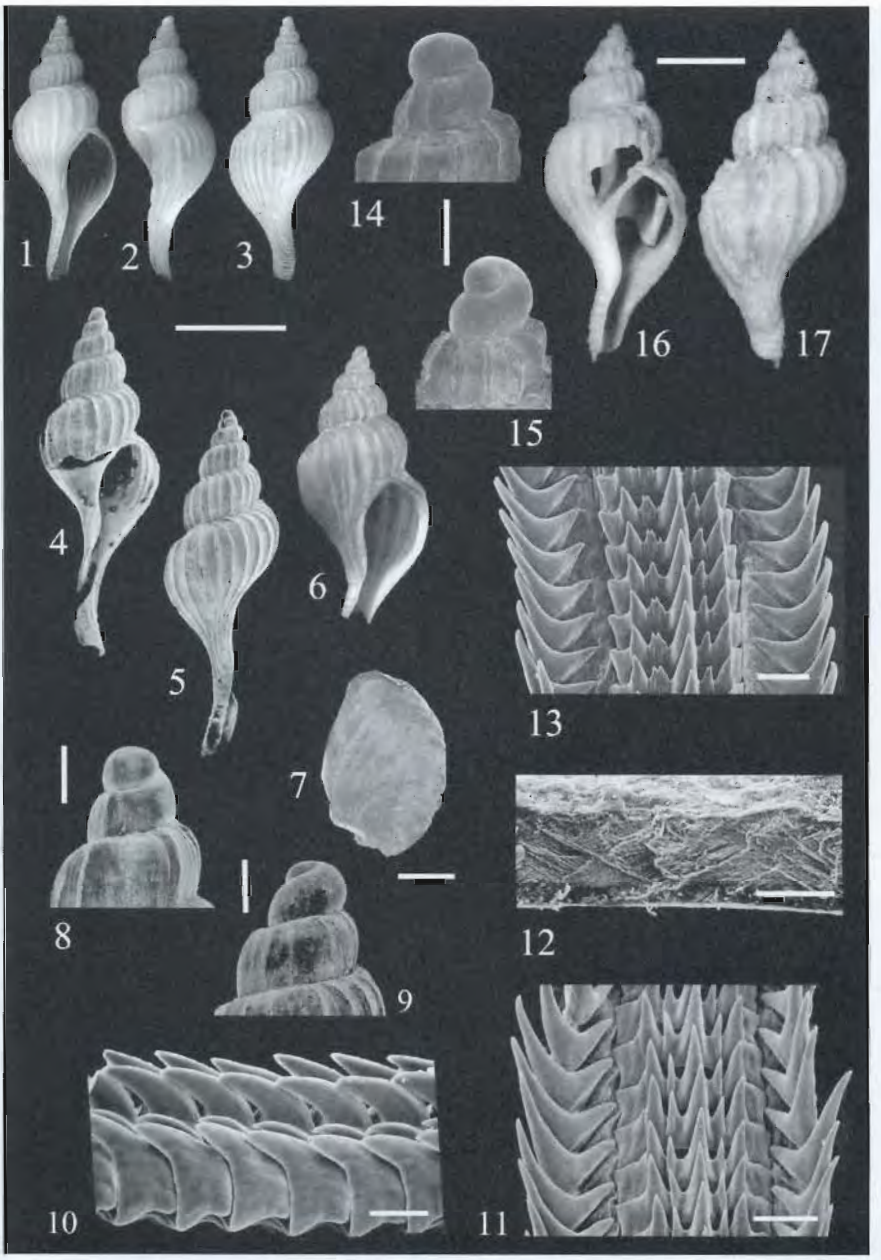
Paratypes: USNM 1003475, from type locality, 3 specimen (one with animal); USNM 896441, R/V Eltanin Station 1346, 549 m, 54°49'S-129°48'W, 4 specimens; USNM 898917, R/V Eltanin Station 1345, 915–1153 m, 7 November 1964, 54°50'S/129°48'W, 4 shells, collected with Menzies trawl.

#### Distribution

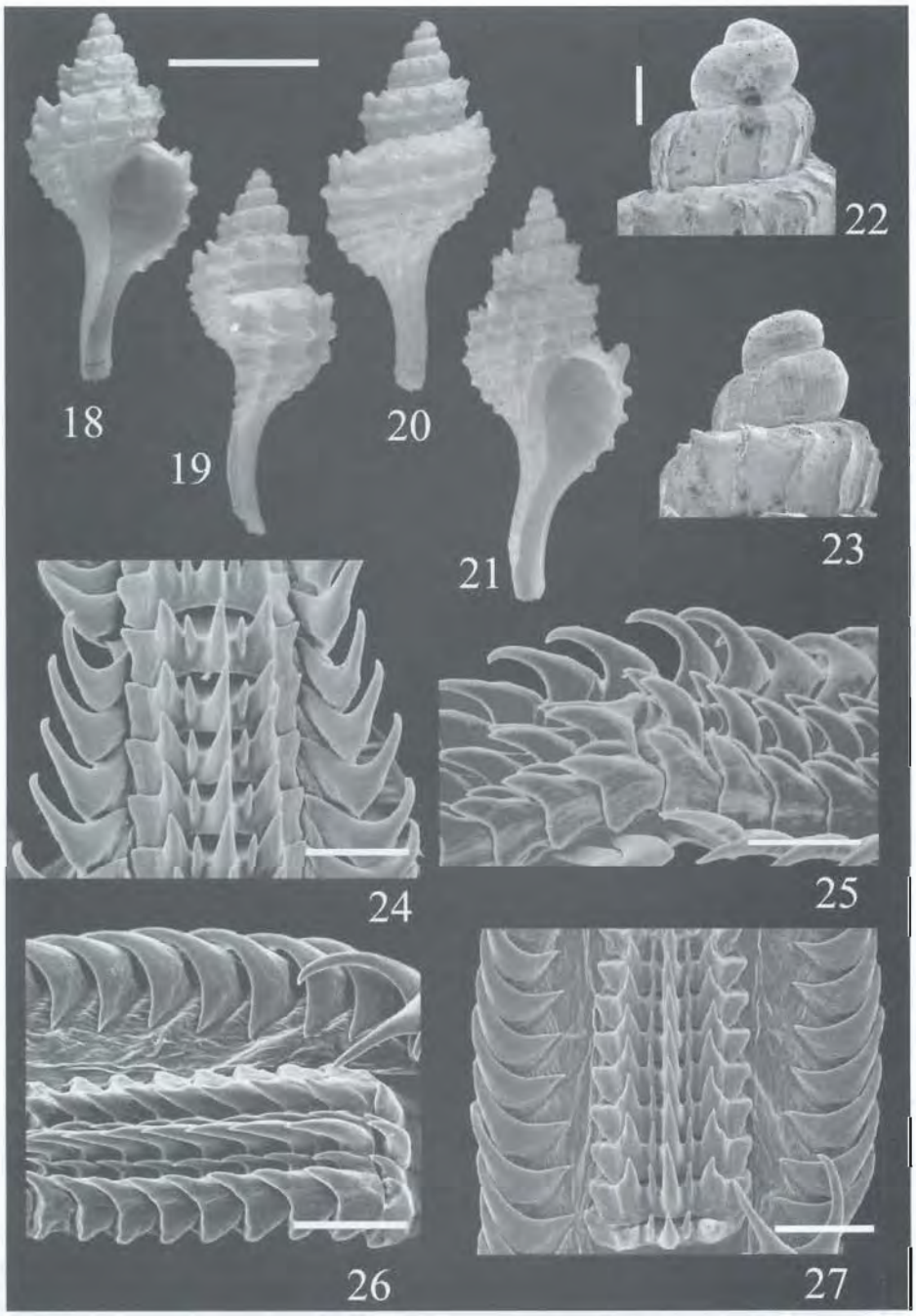
Known only from the vicinity of the type locality.

#### Remarks

The shell morphology of *T. emilyae* is comparable to some specimens of *T. declinans* Watson (Figs. 16, 17) despite the distance between their distributions on the opposite sides of Antarctica (Fig. 44). The shell of *T. emilyae*




FIGS. 1–3. *Trophon emilyae*, new species, three views of holotype, USNM 896438; scale bar = 0.5 cm. FIGS. 4, 5. Two views of a paratype, USNM 896441, uncoated SEM; same scale as in Figs. 1–3. FIG. 6. Apertural view of a paratype, USNM 896441; same scale as in Figs. 1–3. FIG. 7. External view of operculum of paratype in Figs. 4, 5; scale bar = 1 cm. FIGS. 8, 9. Two views of protoconch of paratype in Figs. 4–5; scales = 500 µm. FIG. 10. Radula side view; scale bar = 10 µm. FIG. 11. Radula front view; scale bar = 20 µm. FIG. 12. Shell ultrastructure, uncoated SEM; scale bar = 30 µm. FIG. 13. *Trophon declinans* Watson, 1882, MACN 34956, collected by P. Arnaud, February 3, 1975, from NW of Kerguelen Islands in 70 m, radula front view; scale bar = 30 µm. FIGS. 14, 15. Two views of protoconch of same specimen; scale = 500 µm. FIGS. 16, 17. *Trophon declinans* Watson, 1882, two views of lectotype, NHM 1887.2.9.573; scale bar = 0.5 cm.




FIGS. 18–20. *Trophon arnaudi*, new species, three views of holotype, USNM 1003473; scale bar = 0.5 cm. FIG. 21. Apertural view of paratype ZIN 59775; same scale as in Figs. 18–20. FIGS. 22, 23. Holotype, two views of protoconch, uncoated SEM; scale bar = 400 µm. FIG. 24. Radula frontal view; scale bar = 30 µm. FIG. 25. Radula side view; scale bar = 30 µm. FIGS. 26, 27. *T. scolopax* Watson, 1882. FIG. 26. Radula side view, MACN 34955; scale bar = 40 µm. FIG. 27 radula frontal view, same specimen as in Fig. 26, scale bar = 80 µm.

is more slender, with a longer anterior canal. The axial lamellae in *T. declinans* are somewhat protruding from the whorl side, whereas in *T. emilyae* they are never detached from the shell wall. The radulae are also different; the base of the rachidian in *T. emilyae* is somewhat curved, with a long, thin intermediate denticle between the central and lateral cusps. The lateral cusps are thinner and longer in the new species (Figs. 10, 11). To fix the identity of the taxon (ICZN, 1999: Art. 74.7), the specimen of *T. declinans* illustrated here in Figures 16 and 17 (NHM 1887.2.9.573) is **here designated lectotype**. The other three lots with one specimen each therefore become paralectotypes (NHM 1887.2.9.574, 1887.2.9.575, and 1985041).

Cernohorsky (1977) mentioned the Magellanic *T. ohlini* Strebel, 1904, as being very similar to *T. declinans*. The type material of *T. ohlini*, housed in the Zoologisches Institut und Zoologisches Museum der Universität Hamburg, was studied as part of the complete revision of the genus in progress. Based on the morphology of its protoconch, it is apparently not related to any Antarctic species.

***Trophon arnaudi*** Pastorino, new species
(Figs. 18–20)

Diagnosis

Shell small, thin, fusiform; axial ornamentation of regular low lamellae, projecting outwards along periphery; 2–3 spiral rounded cords on the first whorls become 4–5 on the last whorl.

Description

Shell small in size (~ 13 mm), thin, fusiform, chalky; protoconch of 1¾ whorls; teleoconch of four and a half, right-angled whorls; spire 1/5 of total shell length; subsutural shelf short but clearly defined. Spire angle about 45–50°, suture abutting; aperture small, rounded, its interior glossy white; anterior siphonal canal long, curved backwards; umbilicus closed; outer lip rounded, with lirations from spiral ornament; columellar lip narrow. Axial ornamentation of regular, thin lamellae, about 8–11 on last whorl; lamellae moderately developed, running along whorl surface from adapical suture to base of last whorl, projecting outwards along periphery. Spiral ornamentation of rounded cords, slightly developed on the first whorls to 4–5 on the last. Regular growth lines covering whorls, cords and lamellae.

Operculum and shell ultrastructure unknown.

Radula rachiglossate, rachidian with central cusp very thin; lateral cusps slightly shorter but of similar thickness to central cusp, denticle between central and lateral cusp large, rising from the base. Base of the rachidian teeth curved; large, smooth marginal area. Lateral teeth large, with a thick attached portion.

Etymology

This species is dedicated to Dr. Patrick Arnaud from Endoume, Marseille, for his many contributions to Antarctic malacological studies.

Type Material & Locality

Holotype: USNM 1003473; R/V Islas Orcadas, Cruise 575, Station 53, 26 May 1975, off South Sandwich Island, 57°41.4'S/ 26°22.3'W, 355–468 m; one paratype: ZIN 59775 collected alive by R/V Evrica on 22 January 1987, drag 2, in 370 m, 57°38'S/26°18'W, volcanic sand bottom.

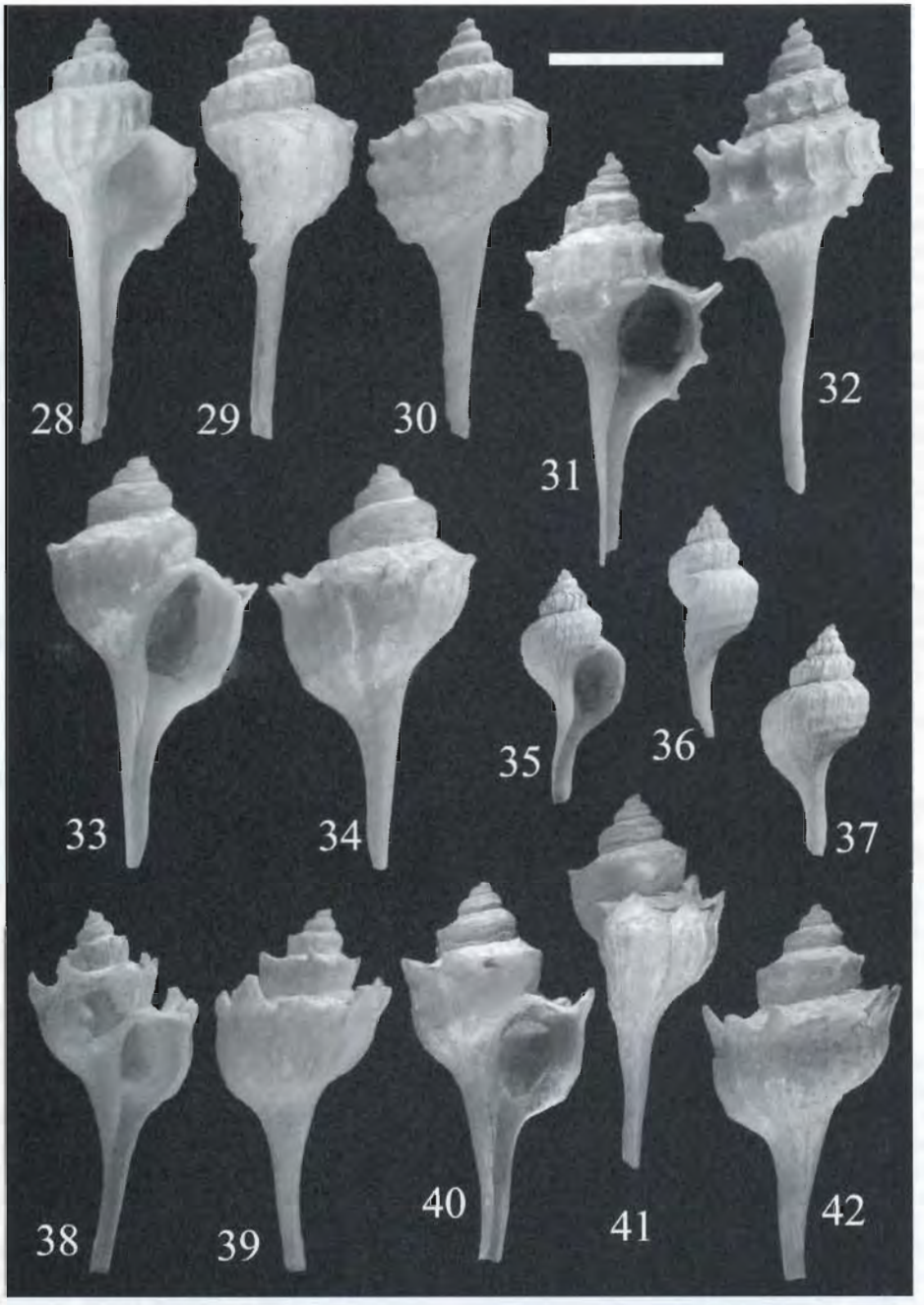
Distribution

Known only from the vicinity of the type locality.

Remarks

Despite the 100° of longitude separating their distributions, *T. scolopax* Watson, 1882, described from off the Kerguelen Islands and Crozet Island, is comparable, but it has different lamellae. In *T. scolopax*, after a large sutural shelf, the lamellae end in vaulted spines in number of two or three plus the keel. In addition, the 2–3 rounded spiral threads in *T. scolopax* are 4–5 real cords in *T. arnaudi*. The anterior siphonal canal is shorter and curved in *T. arnaudi* and always measures less than half shell height. *Trophon scolopax* has a straight siphonal canal that is more than half the shell length.

*Trophon scolopax* was described by Watson from material belonging from the Challenger Expedition. The holotype (Figs. 28–30) is housed in the NHM under the number 1887.2.9.580. There were very few literature citations after the original description. Cantera & Arnaud (1985) cited living specimens of *T. scolopax* between 60 to 620 m off the Kerguelen Islands.




FIGS. 28–30. *Trophon scolopax* Watson, 1882; three views of holotype, NHM 1887.2.9.580; FIGS. 31, 32. *T. scolopax* apertural and adapertural views, MACN 34955, collected by P. Arnaud on April 7, 1974, in 560–525 m, NE of Heard Island; FIGS. 33, 34. MACN 34955 apertural and adapertural view of a smooth specimen from same lot of specimens in Figs. 31, 32. Figs. 35–37. *T. cuspidarioides* Powell, 1951, three views of holotype, NHM 1961547. FIGS. 38, 39. *T. septus* Watson, 1882, paralectotype, NHM 1887.2.9.579. FIGS. 40–42, lectotype, NHM 1887.2.9.578; scale bar = 1 cm for all figs.

*Trophon cuspidarioides* Powell, 1951, known only from the original material from off mouth of Cumberland Bay, South Georgia Island, resembles a somewhat smooth specimen of *T. arnaudi*. However, *T. cuspidarioides* (Holotype: NHM 1961547) (Figs. 35–37) never develops the spines, lamellae and the spiral cords that characterize *T. arnaudi*.

Finally, *T. septus* Watson, 1882, the last comparable Antarctic species, known from off the Kerguelen Islands, differs in having triangular upturned spines and smooth whorls. Three syntypes are in the NHM 1887.2.9.578, 1887.2.9.579 and 1887.2.9.579a, the first two lots dry are illustrated here in Figures 38–42. The specimen illustrated in the Figures 40–42 is **here selected as lectotype** (ICZN. 1999: Art. 74.7). The remaining syntypes are therefore paralectotypes.

Cernohorsky (1977) mentioned some resemblance of large specimens of *T. septus* with *T. coronatus* H. Adams & A. Adams, 1864, a boreal species not related to the Antarctic groups and which belongs in *Nodulotrophon*. Previously, Powell (1951) pointed out theories of bipolarity of some species of gastropods. In fact, Egorov (1993) in a revision of Russian Trophoninae illustrated all living Russian trophonine species, and several of them show

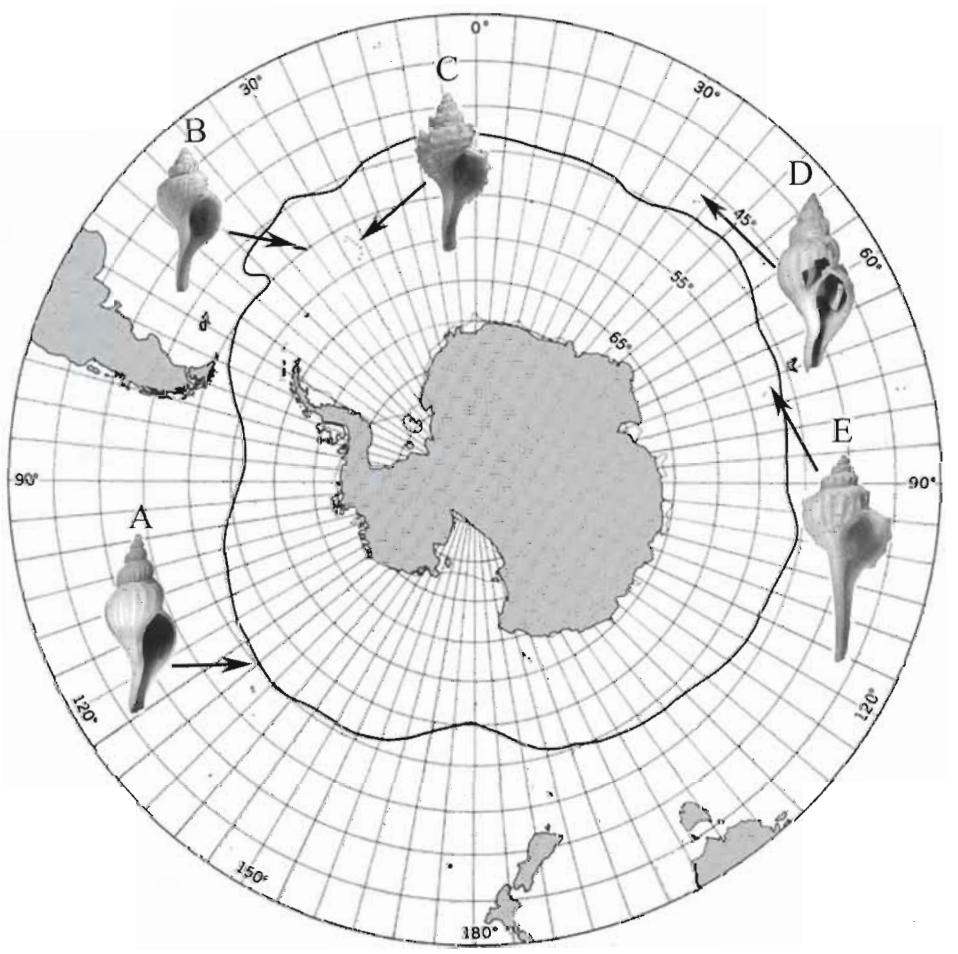



FIG. 43. Type localities of new species of *Trophon* and other species of the same genus with similar shell morphology: A = *T. emilyae*, new species; B = *T. cuspidarioides* Powell, 1951; C = *T. arnaudi*, new species; D = *T. declinans* Watson; 1882; E = *T. scolopax* Watson, 1882. The size is not relative. Arrows point to type localities. Thick line represents the Antarctic Convergence.

TABLE 1. Measurements (in mm), distribution, and depth range (in m) of *Trophon emilyae*, new species; *T. arnaudi*, new species; *T. septus* Watson, 1882; *T. scolopax* Watson, 1882; and *T. cuspidarioides* Powell, 1951.

| | Length | Width | Whorls | Depth range | Distribution | Source |
|---|---|---|---|---|---|---|
| *T. emilyae*, new species | | | | | | |
| USNM 896438 holotype | 12.1 | 3.2 | 5 | 549–1153 | NW Amundsen Sea | This paper |
| *T. arnaudi*, new species | | | | | | This paper |
| USNM 1003473 holotype | 11.0 | 5.8 | 4 | 355–468 | Off South Sandwich Island | |
| ZIN 59775 paratype | 13.5 | 5.5 | 4 | 370 | Off South Sandwich Island | |
| *T. septus* Watson | | | | | | |
| NHM 1887.2.9.578 lectotype | 21.1 | 10.5 | 5–6 | 30–620 | Off Kerguelen & Crozet Islands | Cantera & Arnaud, 1985 |
| NHM 1887.2.9.579 paralectotype | 20.0 | 9.9 | 5–6 | | | |
| *T. scolopax* Watson | | | | | | |
| NHM 1887.2.9.580 holotype | 23.4 | 10.4 | 6–7 | 60–620 | Off Kerguelen & Heard Islands | Cantera & Arnaud, 1985 |
| *T. declinans* Watson | | | | | | |
| NHM 1887.2.9.573 lectotype | 19.5 | 8.0 | 7 | 70–274 | Marion, Kerguelen & Crozet Islands | Watson, 1882 Arnaud (pers. com) |
| *T. cuspidarioides* Powell | | | | | | |
| NHM 1961547 holotype | 13 | 5.7 | 5 | 120–204 | South Georgia Island | Powell, 1951 |

a striking similarity with Antarctic species – for example, *T. barvicensis* (Johnston, 1825) with *T. arnaudi*. However, when these species are carefully studied they present sufficient features to ensure a different generic allocation. Crame (1996) discussed from a paleontological point of view the evolution of bipolarity of several groups of mollusks, including the genus *Trophon* as the southern counterpart of the northern *Boreotrophon* and *Trophonopsis*.

Despite the poor knowledge of fossil representatives of the genus *Trophon*, there is a good record of Paleogene and Neogene species in Patagonian deposits (Griffin & Pastorino, in prep.). The oldest record in Tertiary deposits from Patagonia is apparently early Oligocene in age. However, there is no formal citation of species of this genus in Tertiary deposits around Antarctica. Nevertheless, Jonkers (2000), in a non-taxonomic paper, illustrated a shell that apparently belongs to this genus.

The living species belonging to *Trophon* could be easily split based on the morphology of the soft parts into isolated Patagonian and Antarctic clades (Pastorino, in press). Further studies will show if the Antarctic clade justifies a new generic placement.

## ACKNOWLEDGEMENTS

This work was possible thanks to the material of *T. scolopax* and *T. declinans* collected by Dr. Patrick Arnaud from the Kerguelen Islands that he kindly offered during a trip to the Marine Station of Endoume, Marseille. This specimens are housed at the MACN. I thank the following people for access to material in their institutions: K. Way and J. Pickering (NHM); P. Bouchet and V. Heros (MNHN); A. Tablado (MACN), B. Hausdorf (Zoologisches Institut – Hamburg) and E. Egorova (ZIN). I am grateful to M. Griffin and F. Scarabino for thorough reviews and helpful suggestions that improved this paper. Finally R. Bieler, E. Coan and an anonymous reviewer proposed thoughtful suggestions that also improved it.

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