

Two new deep-sea muricids (Gastropoda) from Argentina

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ABSTRACT

Two new species of muricids belonging in the genus *Trophon* are described from the upper slope off the Atlantic coast of Argentina. Both species have a small size for the genus. The radulae show similarities with those of Antarctic species of the same genus. *Trophon columbarioides* new species has a smooth shell with spines pointed apically and was collected at 37–38° S, in 209–382 m. *Trophon fasciolaroides* new species has prominent spiral cords and was collected at Burwood Bank in 286–292 m depth and off Bahía Blanca in ca. 1000 m depth.

Additional Keywords: Mollusca, Muricidae, *Trophon*, Southwestern Atlantic, Gastropods, Taxonomy, Patagonia

INTRODUCTION

The genus *Trophon* includes a group of species of undoubtedly austral origin. The older species can be traced as far back as the Oligocene, from Patagonian deposits (Griffin and Pastorino, 2005). Pastorino (2005) re-described all known living species of *Trophon* from southern South America, and also some new species belonging in the genus. While the subfamilial affinities of this genus are discussed by several authors (e.g. Kool, 1993, 1993a; Vermeij and Carlson, 2000, among others), the genus is firmly established for all fusiform and/or lamellate gastropods—usually with spiral ornamentation—from the southwestern Atlantic. Two of the species characterize the shallow waters along the Patagonian coast, i.e., *Trophon geversianus* and *T. plicatus*. Both are sympatric in the southern part of Argentina; however only *T. geversianus* could be collected intertidally as far North as Buenos Aires province. All the other species are mostly subtidal. *Trophon* species, as far as it is known, are all predators, feeding on the mussel banks and barnacles that are fairly common along the coast of the southern part of South America.

Living in moderately deep waters are *Trophon acanthodes* Watson, 1882, and the recently rediscovered *T. clenchi* (Carcelles, 1953), a rare lamellose and spiny species originally assigned to the genus *Murex* (Pastorino, 2005). Both of them undoubtedly belong in *Trophon*. In

addition, Houart (1991) and Pastorino (1999) described *Trophon mucrone* and *T. veronicae* from deep waters off South America. The two species were included in *Trophon* despite some minor but distinctive differences in radulae, protoconchs and penises. Recently Houart (2003) and Houart and Sellanes (2006) described new species from deep waters off Chile.

In this paper two new deep water species from the southwestern Atlantic are described and compared with the other related ones living around the region.

MATERIALS AND METHODS

Specimens of *T. columbarioides* new species studied herein were collected by one of us (FS) on board the Uruguayan R/V ALDEBARAN. The other specimens are from the 2002 cruise to Antarctica of the German R/V POLARSTERN. Additional material was collected by Uruguayan fishing boats. Dissections were performed on these ethanol-preserved specimens to study radulae and male reproductive system when it was available. Radulae were cleaned with commercial bleach and ultrasound, and observed using a Philips XL 30 scanning electron microscope (SEM) at the Museo Argentino de Ciencias Naturales (MACN). Critical point drying of the penises (when available) was prepared at the MACN. Radular terminology follows Kool (1993: fig. 6B). Shell photographs were taken using a digital camera. All images were digitally processed. The material is housed at the MACN and the Museo Nacional de Historia Natural y Antropología, Montevideo (MNHNM).

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 columbarioides new species
(Figures 1–11, 15–18)

Diagnosis: Shell very small, thin, fusiform, chalky; axial ornamentation of 30–35 regular axial lamellae growing along the entire whorl surface, attached to the shell, producing open, long, regularly spaced spines along periphery, pointing upwards. Siphonal canal very long.

Description: Shell small (up to 14 mm), slender, thin profile, chalky, white, somewhat bright; protoconch of two whorls, slightly globose, symmetrical; teleoconch of five oblique, shouldered whorls; spire height less than $\frac{1}{4}$ of total shell height. Spire angle about 40° ; suture impressed; subsutural shelf well defined, oblique; aperture semicircular, interior chalky white; anterior siphonal canal very long (longer than aperture height), narrow, straight, open; outer lip sharp, rounded, inner lip adpressed. Axial ornamentation of 30–35 regular axial lamellae growing along the entire whorl surface, but attached to shell and producing open, long, regularly spaced spines along periphery (almost in the middle of the whorl), pointing adapically; last three whorls with ten lamellae each. A second obsolete series of spines appears to rise at the periphery of older specimens (Figure 11). Spiral ornamentation lacking. Growth lines present throughout shell.

Operculum subtriangular, nucleus terminal. External surface covered by concentric, irregular, growth lines. Inner surface attachment area reaching upper side or center, with horseshoe-shape scars (Figures 17–18).

Rachidian teeth of radula with thin, small central cusp; lateral cusps wider and larger than central cusp; denticle between central and lateral cusp rising from base. Base of rachidian tooth slightly curved. Lateral teeth with single, long cusps; attachment area thick (Figures 15–16).

Type Material: Holotype MACN-In 37380 (Figures 1–3, 7, 9–10) and two paratypes, MACN-In 37381 (Figures 4–6, 8) and MNHN 15540 (Figure 11).

Type Locality: R/V ALDEBARAN cruise 2003/01, station 37, $37^\circ 43' S$, $55^\circ 00' W$, 209 m, October 26 2003, $5.3^\circ C$ of bottom temperature, Piccard dredge; (holotype and one paratype); between $37^\circ 05' S$, $54^\circ 12' W$ in 255 m and $37^\circ 02' S$, $54^\circ 02' W$ in 382 m (one paratype).

Etymology: The general shell morphology reminds some species of the genus *Columbarium* (Caenogastropoda: Turbinellidae), to which it has no close relationship.

Distribution: Known only from three specimens from the type locality and vicinity.

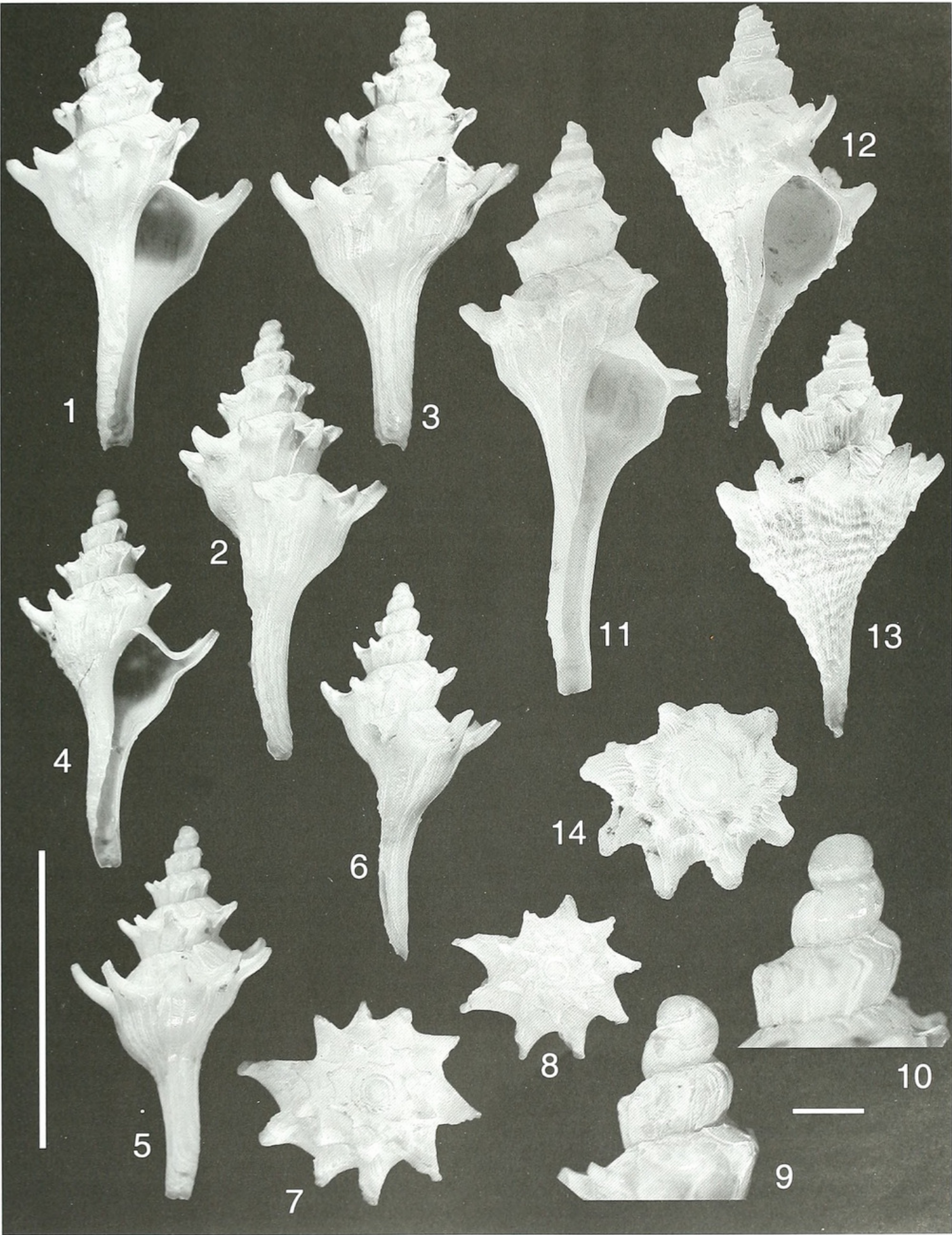
Remarks: At first glance the general morphology of the shell shows some similarities with juveniles of *Trophon acanthodes* Watson, 1882. However the typical spiral cords of the latter appear early in ontogeny (see Figures 12–13) and are completely absent in the new species. In addition both species have clear radular differences (see Pastorino, 2005:69). In addition, *T. plicatus* and *T. clenchi* are comparable species. The latter has unmistakable early developed spiral ornamentation; the former has complete lamellae and a shorter siphonal canal, besides radular differences.

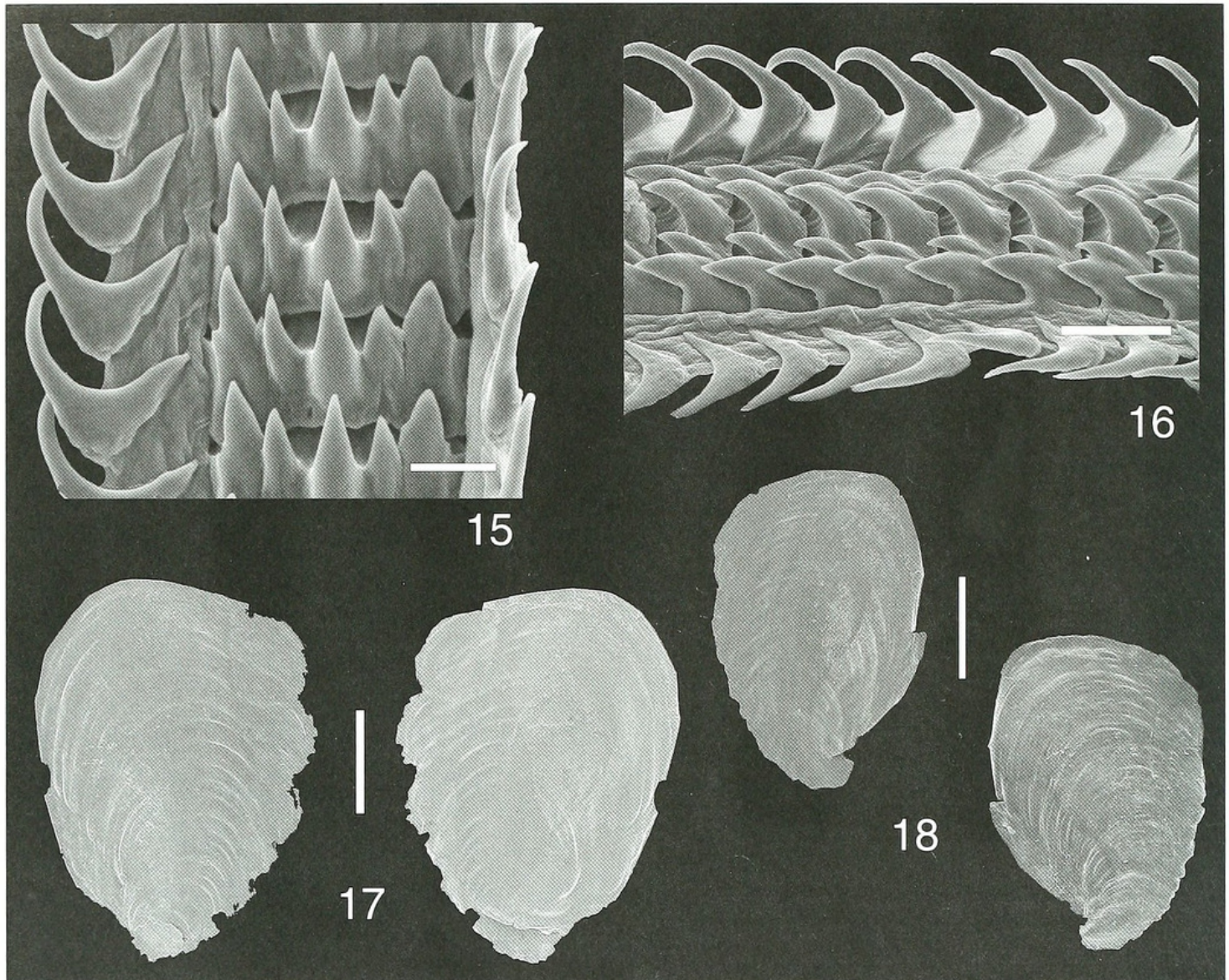
Despite the geographic distance separating them, *Trophon scolopax* and *T. septus* described by Watson (1882) are comparable species. They live around Kerguelen Is., in the southernmost Indian Ocean. As a main difference *Trophon columbarioides* new species has a higher spire and only one series of large and open spines pointing upwards, instead of the three series shown by *T. scolopax* or the triangular upturned ones of *T. septus*.

Trophon echinatus (Kiener, 1840), an extremely variable species (according to Bouchet and Warén, 1985: 141), from deep waters off Northeastern Atlantic and Mediterranean shows a remarkable shell similarity with *T. columbarioides* new species. Despite this, we do not support phylogenetic affinities between these and we made the comparison just for showing the existence of specific contrasting differences, particularly at radular level. As far as we can see in the material available there are no signs of spiral cords in the new species which are common in the deeper specimens of the northern one. However, some porcellaneous (not chalky) smooth specimens are in fact comparable. All morphs of *T. echinatus* have a shorter protoconch. Some grown specimens of *T. columbarioides* shows the apparently presence of a second rows of spines while *T. echinatus* has only one. In addition, the radulae (illustrated by Bouchet and Warén, 1985 figs. 333, 335, 336) shows a pair of almost obsolete intermediate denticles between the lateral cusps while in *T. columbarioides* new species they are slightly smaller than the central and lateral cusps. The base of the rachidian is sinuous in *T. echinatus* and somewhat straight in the new species. The intermediate denticles of the rachidian teeth rise from the internal side of the lateral cusps in a way that is typical of the southwestern Atlantic *Trophon* species. The attached portion of the marginal teeth are also different.

Houart (2001) considered *T. echinatus* as belonging in to the genus *Pagodula* Monterosato, 1884 despite the differences that Bouchet and Warén (1985) pointed out with the protoconch of the type species of *Pagodula*: the Pleistocene species *Murex vaginatus* Cristofori and Jan, 1832.

Figures 1–11. *Trophon columbarioides* new species. **1–3.** Holotype, MACN-In 37380, R/V ALDEBARAN cruise 2003/01, station 37, $37^\circ 43' S$, $55^\circ 00' W$ in 209 m. **4–6.** Paratype, MACN-In 37381. Same locality as holotype. **7.** Apical view of the holotype. **8.** Apical view of the paratype. **9–10.** Protoconch of the holotype, scale bar = 1 mm. **11.** Paratype, MNHN 15540, between $37^\circ 05' S$, $54^\circ 12' W$ in 255 m and $37^\circ 02' S$, $54^\circ 02' W$ in 382 m. **12–14.** *Trophon acanthodes* Watson, 1882, MACN-In 25165-2, $37^\circ 35' S$, $54^\circ 55' W$, 192 m. Scale bar = 1 cm for all figures except 9–10.





Figures 15–18. *Trophon columbarioides* new species. **15.** Radula frontal view, scale bar = 10 μ m. **16.** Radula lateral view, scale bar = 20 μ m. **17.** Operculum of the holotype and, **18.** Paratype in figs. 4–6. Scale bars = 1 mm.

Unfortunately both dissected specimens of the new species here described were females so nothing can be said about the morphology of the penises.

Trophon fasciarioides new species
(Figures 19–31)

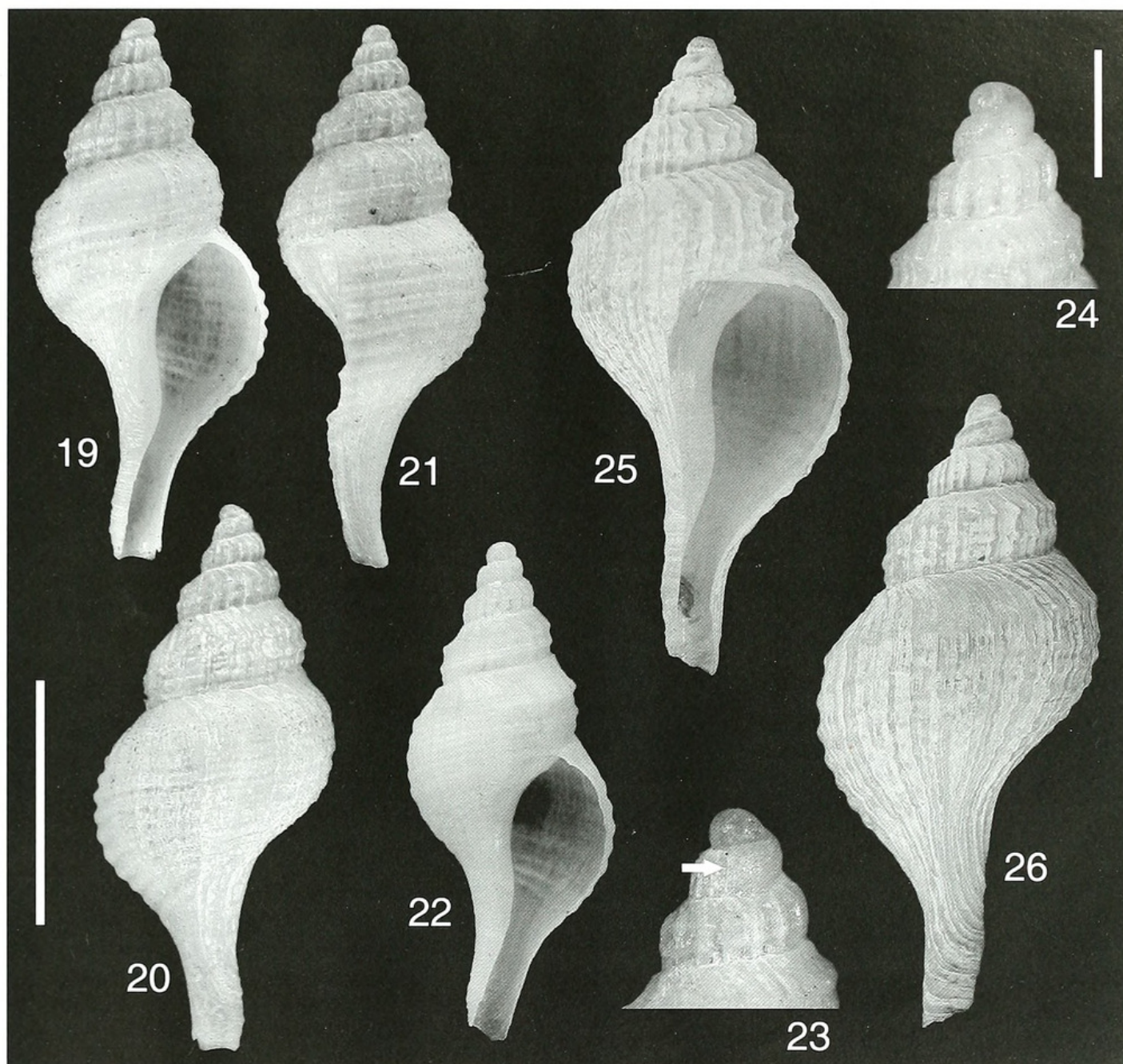
Diagnosis: shell very small, thin, translucent or chalky; very weakly developed axial ornamentation of regular, very low, varices attached to the shell. Spiral ornamentation of 2, 3 and 8 or 9 spiral rounded cords in the second, third and last whorl respectively; cords of similar width; intersection of spiral cords with axial varices conveying a slightly cancellate appearance to shell surface.

Description: shell small (up to 12 mm), slender, thin profile, translucent white or chalky; protoconch of 2 whorls, symmetrical; teleoconch of $4\frac{1}{2}$ tabular whorls; spire height less than $\frac{1}{5}$ of total shell height. Spire angle about 45° ; suture impressed, subsutural shelf very

oblique; aperture suboval; anterior siphonal canal long but never longer than aperture height, slightly curved adaxially, open; outer lip sharp, rounded, inner lip adpressed. Axial ornamentation of poorly developed varices, regular, very low, attached to the shell, growing along the entire whorl surface except the siphonal canal. Spiral ornamentation of 2, 3 and 8 or 9 spiral rounded cords in the second, third and last whorl respectively; cords of similar width; intersection of spiral cords with axial varices conveying a slightly cancellate appearance to shell surface; growth lines present throughout shell, becoming scaly at intersection with spiral cords.

Operculum suboval, nucleus terminal. External surface covered by concentric, irregular, extremely thin growth lines. Inner surface attachment area reaching upper side or center, with horseshoe-shaped scars (Figure 31).

Rachidian teeth of radula with thin central cusp, higher than laterals; denticle between central and lateral



Figures 19–26. *Trophon fasciarioides* new species. **19–21.** Holotype MACN-IN 37382, Banco Burwood, Polarstern St. 150, between 54°30.22' S, 56°08.58' W in 286 m and 54°29.64' S 56°08.09' W in 292 m. **22.** Paratype MACN-IN 37383, same locality as holotype. **23–24.** Protoconch of the paratype of figure 22, arrow head transition to teleoconch, scale bar = 1 mm. **25–26.** Paratype MACN-In 37384, off Bahía Blanca ca. 1000 m depth. Scale bar = 5 mm for all figures except 23 and 24.

cusps thin and long, rising from the base. Base of rachidian tooth curved. Marginal area with single cusp. Lateral teeth with single, long cusps; attachment area thick (Figures 27–29).

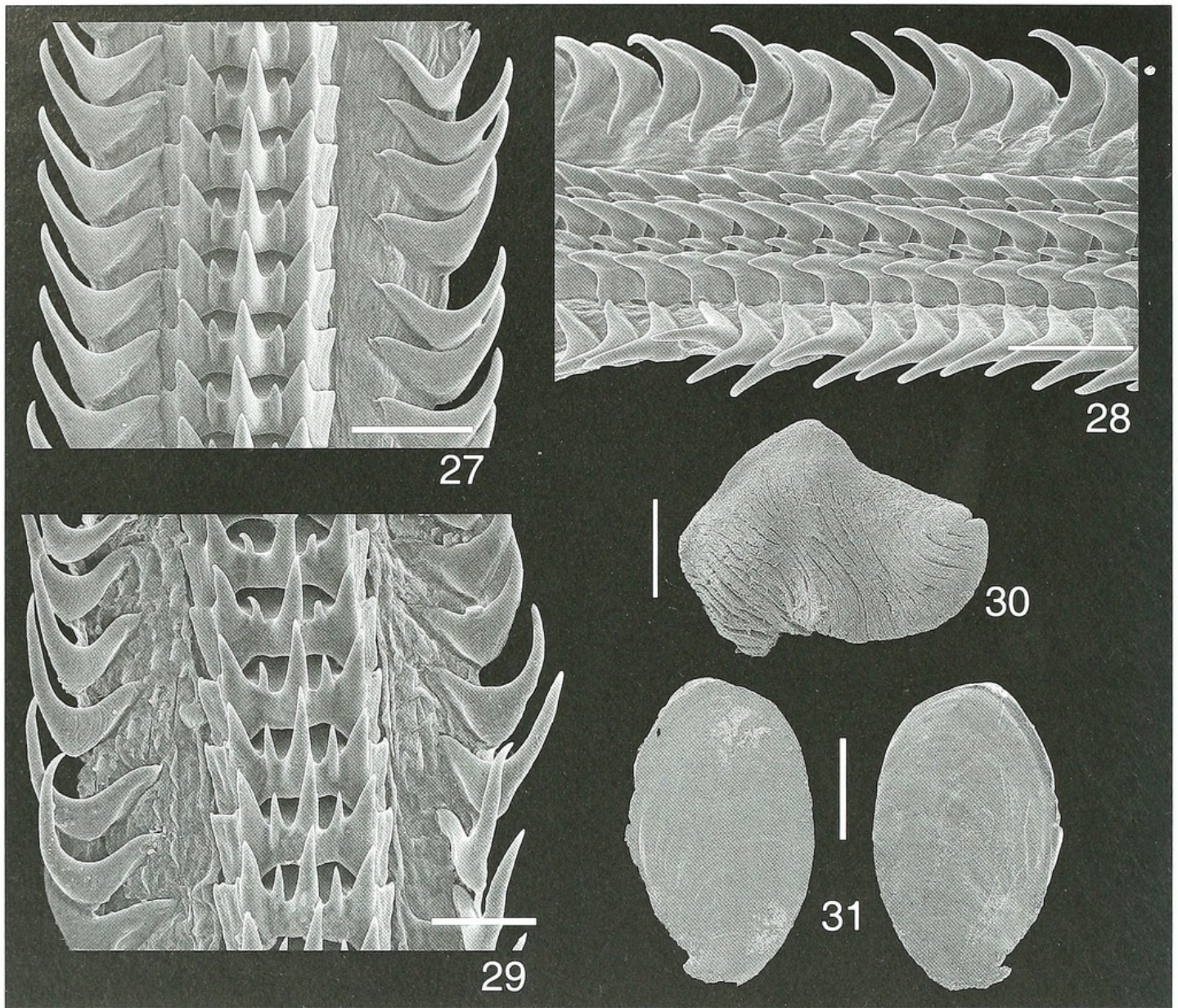
The penis shows an unusual morphology among the Patagonian species of the genus: it is wide, slightly curved and laterally flattened with a small slit at the tip (Figure 30).

Type Material: Holotype MACN-IN 37382 and two paratypes MACN-IN 37383 and MACN-In 37384.

Type Locality: Banco Burwood, Polarstern station 150, 6 Apr. 2002, AGT net, between 54°30.22' S, 56°08.58' W in 286 m and 54°29.64' S, 56°08.09' W in 292 m.

Etymology: The general shell morphology reminds some species of the genus *Fasciolaria* (Caenogastropoda: Fasciariidae).

Distribution: known from type locality and approximately off Bahía Blanca in ca. 1,000 m depth (MACN-In 37384).



Figures 27–31. *Trophon fasciarioides* new species. **27.** Radula of a paratype, MACN-In 37384, frontal view, scale bar = 40 μm . **28.** Lateral view of the same radula as 27, scale bar = 50 μm . **29.** Radula of the paratype MACN-In 37383, scale bar = 20 μm . **30.** Critical point dry of the penis, scale bar = 500 μm . **31.** Two views of the operculum of the paratype of figures 25–26, scale bar = 1 mm.

Remarks: The morphology of the shell and the radula match some of the Patagonian and Antarctic species of the genus *Trophon*. From the first group, *T. ohlini* Strebel, 1904, a rare species from the Magellanic area, has a similar profile. However, its distinctive protoconch points out a clear difference. In addition, the morphology of the penis is far from the typical Patagonian representatives of the genus. *Trophon emilyae* Pastorino, 2002, *T. declinans* Watson, 1882, and *T. cuspidarioides* Powell, 1951, are comparable Antarctic species (Pastorino, 2002a). The first two species differ from the new species in having well developed axial sculpture only. Also *T. cuspidarioides* has $5\frac{1}{2}$ whorls including the protoconch and five blunt spiral cords in the body whorl, while the new species has a larger spire and $6\frac{1}{2}$ whorls, and 8 or 9

rounded and well defined cords in the last whorl. The axial ornamentation in the new species is very irregular but higher in number than the 25 axials present in *T. cuspidarioides*.

DISCUSSION

In previous papers two groups of species belonging in the genus *Trophon*—i.e., from South America and Antarctica—were pointed out. The main differences between these two groups are several radular and anatomical features (Pastorino, 2002b, 2005). The shell morphology of the two new species described herein agrees with that of *Trophon* living off the South American coast. However,

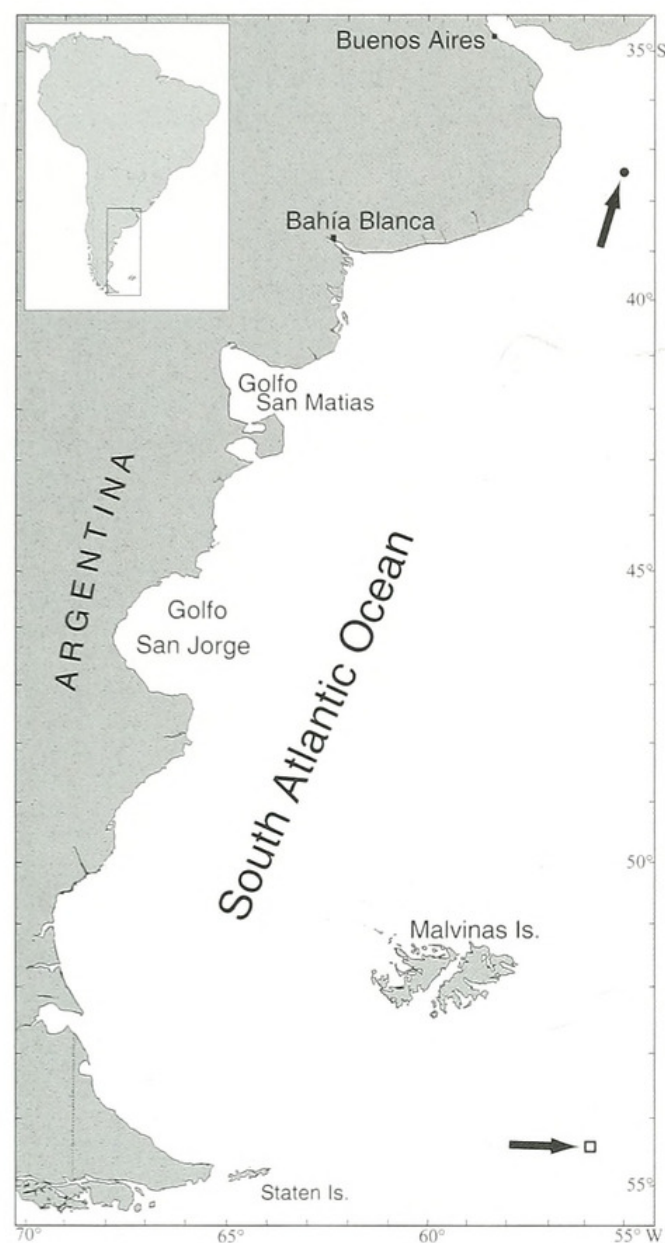


Figure 32. Map showing the type localities of *Trophon columbarioides* new species ● (filled circle) and *Trophon fasciolaroides* new species □ (blank square).

the radula has some features found in the Antarctic representatives of the genus—albeit the taxonomic status of the Antarctic species still needs confirmation. Like in the Antarctic group of species, the central cusp of the rachidian teeth is shorter and thinner than the laterals, the internal denticle rise from the base of the rachidian instead of the upper third of the internal side of the lateral cusp, and the lateral teeth have a wide attachment area. The geographic ranges of species of these two groups do not overlap. Therefore, the morphological features seem to be clearly separated geographically too. However, in the species described herein, this seems not to be the case. While there is no geographic overlapping of species, the morphological features that characterize the Antarctic group do appear in these two new Patagonian species. Contrarily, this does not occur in the case of

Patagonian species, the morphological features of which are restricted to South America. Moreover, they are better developed in species from the Magellanic among those described from southern South America (see Pastorino, 2005).

Recently, Houart (2003) introduced three new species he assigned to *Trophon* from off Chile: *T. ceciliae*; *T. condei* and *T. vangoethemi*. The morphology of the radula, only known for the last two species, together with that of *T. mucrone* Houart, 1991, *T. veronicae* Pastorino, 1999 and both new species described here, is that of the Antarctic group, despite the geographic distance separating them. All mentioned species were collected from more than 300 m depth and in most cases they reach more than 1,000 m (see Table 1). Most of the Patagonian species of *Trophon* were collected alive from the intertidal zone to about 300 m depth. Exceptions are some specimens of *T. acanthodes*, *T. clenchi*, and *T. bahamondei* that come from deeper areas. However, there is no Antarctic species—or with their characteristic radular and anatomical features—that live at shallower depths or closer to the continent. Both new species described here were collected from about 300 m depth, which is the shallowest for a *Trophon* with Antarctic features at South American latitudes.

Generic assignment in the whole Trophoninae group is actually under revision. The concept of the genus *Trophon* sensu stricto is easy to apply to the shelf species. However, when deeper species are studied, the presence of several features in common among the shallower species appear somewhat contradictory. Nevertheless, we think that biogeographic boundaries are hard to surpass for species without free larvae as both new species appears to be according to the shape and whorl number of the protoconch. Contrasting historical biogeographic processes must be considered when suggesting affinities between species and therefore comparison with species living far away from the Southwestern Atlantic area can be considered an empty exercise. Some exempli are cases like *T. columbarioides* new species—*T. echinatus* which have very few characters that clearly split both species. In

Table 1. Recently described South American species of *Trophon*.

	Depth (m)	Type locality
<i>T. condei</i> Houart, 2003	900–1350	Ancud, Chile
<i>T. ceciliae</i> Houart, 2003	434–1000, 1300	Antofagasta, Chile
<i>T. vangoethemi</i> Houart, 2003	About 350	Itata, North of Concepción, Chile
<i>T. mucrone</i> Houart, 1991	790–1575	Off Río de Janeiro, Brazil
<i>T. veronicae</i> Pastorino, 1999	298–1272	Subantarctic
<i>T. columbarioides</i> new species	209–382	37°43'S, 55°00'W
<i>T. fasciolaroides</i> new species	286–292	Burwood bank

the future molecular characters could add to the understanding of the evolution of morphological features in this group.

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