A review of Lyocyclidae Thiele, 1925 (Gastropoda: Caenogastropoda) from the Indo-Pacific, with the description of one new genus and twenty-eight new species

Revisión de los Lyocyclidae Thiele, 1925 (Gastropoda: Caenogastropoda) del Indo-Pacífico, con la descripción de un nuevo género y veintiocho nuevas especies

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ABSTRACT

Twenty-eight new upper-bathyal benthic species in Lyocyclidae (Caenogastropoda) from the Indo-Pacific are described, of which twenty-seven new species are assigned to the genus *Lyocyclus* Thiele, 1925 and one more in the new genus *Nescitus* n. gen, herein described. All species are illustrated by SEM micrographs and compared with the previously known ones. Photographs of the species described by Thiele (1925) from the Indian Ocean are provided for the first time. *Lyocyclus biconcavus* Thiele, 1925 is here assigned to the genus *Eudaronia* Cotton, 1945 and *Lyocyclus orientalis* Thiele, 1925 to the genus *Adeuomphalus* Seguenza, 1876, both in the Seguenzioidea superfamily.

RESUMEN

Se describen veintiocho nuevas especies del nivel batial superior de la familia Lyocyclidae (Caenogastropoda) del Indo-Pacífico, de las cuales veintisiete nuevas especies son asignadas al género *Lyocyclus* Thiele, 1925 y una más al nuevo género *Nescitus* n. gen., aquí descrito. Todas las especies son representadas por MEB micrografías y comparadas con las previamente conocidas. Fotografías de las especies descritas por Thiele (1925) en el Océano Índico se muestran por vez primera. *Lyocyclus biconcavus* Thiele, 1925 es asignada aquí al género *Eudaronia* Cotton, 1945 y *Lyocyclus orientalis* Thiele, 1925 al género *Adeuomphalus* Seguenza, 1876, ambos en la superfamilia Seguenzioidea.

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KEY WORDS: Gastropoda, Caenogastropoda, Lyocyclidae, *Lyocyclus*, *Nescitus*, Indo-Pacific, new genus, new species.

PALABRAS CLAVE: Gastropoda, Caenogastropoda, Lyocyclidae, *Lyocyclus*, *Nescitus*, Indo-Pacífico, nuevo género, nuevas especies.

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INTRODUCTION

We became interested in the family Lyocyclidae almost by chance, about three years ago, while examining a large material of "vitrinelliform" gastropods in MNHN Paris, from Indo-Pacific expeditions. The enigmatic appearance of these molluscs, recalling the partly uncoiled fossil species of ammonoid genera *Crioceratites* Léveillé, 1837 and *Ancyloceras* d'Orbigny, 1842 (Fig. 1), captured our attention, to the point that we took on studying the biodiversity of this poorly-known family based on the material available in MNHN Paris.

The genus *Lyocyclus* was described by Thiele (1925) to group five species from the Indian Ocean, collected during the German deep-sea expedition of the steamer "Valdivia" (1898-1899), all of them with loosely connected teleoconch whorls, usually with transverse folds. Thiele erected a new family Lyocyclidae and grouped it with the Solariidae (=Architectonicidae), placing also *Bifrontia? pernambucensis* Watson, 1886 in the new family. Later, Thiele (1929) transferred it to Trichotropidae.

No additional information on *Lyocyclus* was published until Warén (1989) placed it in Vanikoridae after having examined soft parts and radula from a species from New Caledonia. The details of the foot could not be observed because it was strongly folded in the preserved specimen, but the large epipodial folds characteristic of the family were conspicuous. The radula was typical of a vanikoroid with oar-shaped marginal teeth with fine comb-like denticles on the inside of the outer, and outside of the inner marginal teeth, and with numerous comb-like denticles on the lateral and central teeth. This was followed by Bouchet & Rocroi (2005: 253).

Barros, Santos, Santos, Cabral & Acioli (2001) found additional material of *L. pernambucensis* (Watson, 1886), an endemic species from the northeast coast of Brazil, and Lozouet (2012) provided for the first time SEM micrographs of that species.

Takano & Kano (2014), based on their molecular phylogeny, challenged the position of *Lyocyclus* in the Vanikoridae and noted that it formed a moderately supported clade with *Macrocypraea* Schilder, 1930 (Cypraeidae), therefore deserving its own family Lyocyclidae, and this was endorsed by Bouchet *et al.* (2017: 346, 473).

Rubio & Rolán (2018) and Fernández-Garcés, Rubio & Rolán (2019) described five new species of *Lyocyclus* from the Caribbean.

Therefore, there are eleven species currently known in the genus *Lyocyclus*; six from the Atlantic Ocean (Watson, 1886; Rubio & Rolán, 2018; Fernández-Garcés, Rubio & Rolán, 2019) and five from the Indian Ocean (Thiele, 1925).

Atlantic species:

Lyocyclus africaruedae Rubio & Rolán, 2018 from Guadeloupe.

Lyocyclus guadeloupensis Rubio & Rolán, 2018 from Guadeloupe.

Lyocyclus lluviamonzoae Rubio & Rolán, 2018 from Guadeloupe.

Lyocyclus mexicanus Rubio & Rolán, 2018 from the Gulf of Mexico.

Lyocyclus pernambucensis (Watson, 1886) from off Brazil.

Lyocyclus roselyae Fernández-Garcés, Rubio & Rolán (2019) from off Cuba.

Indian Ocean species:

Lyocyclus aethiopicus Thiele, 1925 from off Barawa, Somalia.

Lyocyclus biconcavus Thiele, 1925 from off Mogadiscio, Somalia.

Lyocyclus orientalis Thiele, 1925 from Zanzibar channel, Tanzania.

Lyocyclus solutus Thiele, 1925 from Zanzibar channel, Tanzania.

Lyocyclus spinosus Thiele, 1925 from off Dar-es-Salam, Tanzania.

Given that Lyocyclidae is a very little known family, we have here summarized existing knowledge on the taxonomy, biology and geographic dispersion, and at the same time, this paper is intended to be a review of its specific diversity in the Indo-Pacific.

MATERIAL AND METHODS

The material used for the present work was obtained during several expe-

Figure 1. Examples of partially uncoiled molluscs. A: *Crioceratites* sp., 43 cm, evolute coiling; B: *Ancyloceras* sp., 41 cm, heteromorph coiling; C: *Spirolaxis exornatus* Bieler, 1993 (Architectonicidae), 3.37 mm; D: *Lyocyclus dispulsus* n. sp. 4.11 mm; E: *Lyocyclus horroi* n. sp. 3.25 mm.

Figura 1. Ejemplos de moluscos parcialmente desenrollados. A: Crioceratites *sp., 43 cm, enrollamiento evoluto; B:* Ancyloceras *sp., 41 cm, enrollamiento heteromorpho; C:* Spirolaxis exornatus *Bieler, 1993 (Architectonicidae), 3,37 mm; D:* Lyocyclus dispulsus *n. sp. 4,11 mm; E:* Lyocyclus horroi *n. sp. 3,25 mm.*

ditions in the Indo-Pacific Oceans organized by MNHN and IRD from 1978 to 2014. All expeditions are listed on the MNHN website <https: //expeditions.mnhn.fr/>, some of which registered in the database of French research cruises <https: //campagnes.flotteoceanographique.fr/> are granted a doi (digital object identifier) as follows:

VAUBAN (1978-1979) around New Caledonia.

BIOGEOCAL (1987) on board R/V Coriolis around New Caledonia (10.17600/87001811).

BERYX 11 (1992) on board R/V Alis to explore the Norfolk Ridge, New Caledonia (10.17600/92005011).

SMIB8 (1993) on board R/V Alis to explore the Norfolk Ridge (Banc Éponge, Banc Stylaster, Banc Jumeau, Banc Antigonia and île des Pins)., New Caledonia, in search of bioactive products (10.17600/93000640).

BATHUS (1993) on board R/V Alis around New Caledonia (10.17I00/93000350).

MUSORSTOM 8 (1994) on board R/V Alis, explored the Vanuatu Archipelago (10.17600/94100040).

MUSORSTOM 10 cruise (1998) on board R/V Alis, explored the Fijian Archipelago (10.17600/98100080).

BORDAU 1 (1999) on board R/V Alis, explored the Fijian Archipelago (10.17600/99100020).

SALOMON 1 (2001) on board R/V Alis surveyed the central part of the Solomon Islands, from Guadalcanal to Malaita and Makira (10.17600/1100090).

NORFOLK 2 (2003) on board R/V Alis explored the seamounts of the Norfolk Ridge (10.17600/3100030).

SALOMON 2 (2004) on board R/V Alis explored the western part of the Solomon archipelago (10.17600/4100090).

AURORA (2007) explored the northeastern Philippines.

MAINBAZA (2009) on board R/V Vizconde de Eza to the study of the deep benthic fauna of Mozambique.

BIOPAPUA (2010) on board R/V Alis to take an inventory of the deep benthic biodiversity, off Papua New Guinea area (10.17600/10100040).

EXBODI (2011) on board R/V Alis around New Caledonia, to document the distribution of organisms from New Caledonia and the way they are dispersed (10.17600/11100080).

KAVIENG (2014) workshop and oceanographic campaign to explore the lagoon, surface and deep waters of this region of Papua New Guinea (10.17600/14004400).

MADEEP (2014) on board R/V Alis, dedicated to the study the benthic biodiversity in the Bismarck Sea and the Solomon Islands (10.17600/14004000)

Most of the material studied in the present work are empty shells, found in sediments samples. The shells were photographed at the Scanning Electron Microscopy Center (SEM) in the Centro de Apoyo Científico y Tecnológico a la Investigación (CACTI) of the University of Vigo and in the Centro de Apoyo Científico y Tecnológico of the University of Santiago de Compostela (CACTUS).

Abbreviations

IRD Institut de Recherche pour le Développement
ZMB Museum für Naturkunde, Berlin
MNHN Muséum national d'Histoire naturelle, Paris
NHMUK National History Museum United Kingdom, London
Stn station
m metres (depth)
spm live collected specimen
s empty shell

SYSTEMATICS

Family Lyocyclidae Thiele, 1925

Original description in Thiele (1929: 240).

Diagnosis: Shell very small to medium size with disjunct coiling and ornamentation of lamellae or axial ribs; protoconch paucispiral not exceeding 1 ½ whorls. The family is currently placed in Subclass Caenogastropoda, but its precise systematic position remains unassigned (MolluscaBase, 2020).

Genus *Lyocyclus* Thiele, 1925

Lyocyclus Thiele, 1925: 116.

Type species by original designation: *Lyocyclus solutus* Thiele, 1925 [Recent, Zanzibar channel].

Description (Rubio & Rolán, 2018): Protoconch with mammillate nucleus, which protrudes slightly above the remaining whorls, with weakly granulated microsculpture and usually clearly separated from the teleoconch by a flange-like lip.

Teleoconch sculpture formed by strong oblique axial lamellae and a secondary sculpture of fine spiral cords. Coiling of the teleoconch partly or totally disjunct, the whorls being connected only very loosely and mainly along the axial ribs which are continuous around the whorls. Last quarter whorl slightly deviating from the previous one.

Remarks: The protoconch is, in our opinion, one of the main diagnostic morphological characteristics of the genus *Lyocyclus*, next to the axial ribs (lamellae) and the disjunct coiling of the shell.

The protoconch is conformed by an embryonic shell or mammillate nucleus, usually large (in some species it represents almost 50% of the maximum diameter of the protoconch) and a larval shell, more or less elongated, ending in a lip which is not thickened, but is usually flaring and forms a funnel-like collar, reaching over the initial part of the teleoconch. The surface of the protoconch is sculptured by small, irregular, star-shaped granules often interconnected to form a net-like pattern, which give it a finely rugose appearance. The variability of these characters has allowed us to differentiate several types of protoconch (Figs. 2, 3). There may be numerous randomly scattered pores or microperforations, which, in some species, were well defined and apparently aligned. The latter observation would support the hypothesis of a possible predation instead of being considered as species-specific morphological characters.

The axial lamellae on the teleoconch are usually strongly inclined over the surface of the whorl, in the same way as the flaring lip of the protoconch reaches over the initial part of the teleoconch. In such case they are here called "procumbent", borrowing a term commonly used to describe a growth pattern of terrestrial plants. When the whorls are disjunct, the axial lamellae are continuous around the whorls and do not stop at the suture and at the umbilicus like in most coiled gastropods. The peristome is usually continuous, and may be expanded towards the adapical and abapical sides.

The radula (Fig. 4A-D) has a formula 2+1+1+1+2. Central tooth with very broad, V-shaped, basal supports; a large central cusp and 8-9 long and slender lateral denticles on each side. Denticles are not present on basal support. The central cusp is very prominent, protrudes from the center of the basal support and is shaped like a bird's beak.

The radula is typically vanikoroid, and its general pattern it is rather similar to species of *Megalomphalus* Brusina, 1871 (see Warén & Bouchet (1988: 80, figs. 16-17, radula of *Megalomphalus disciformis* (Granata-Grillo, 1877)). However, the bird's beak shape of the central cusp of the central tooth, protruding from the center of the basal support, makes it different.

The operculum (Fig. 4E) is thin, simple, oval, paucispiral with an eccentric nucleus and a rudimentary peg

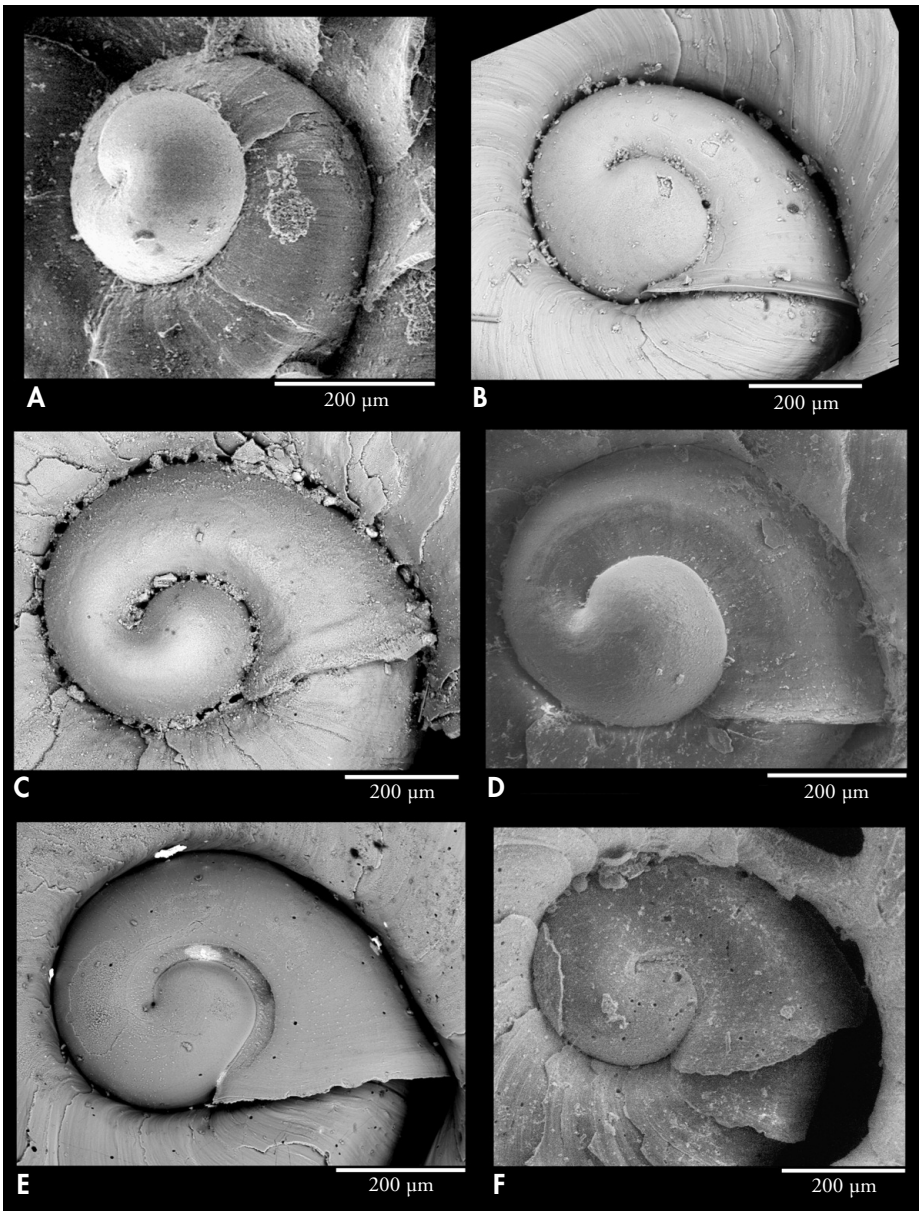

Figure 2. Diversity of protoconchs of Lyocyclidae from the Indo-Pacific and the Caribbean. A: *Nescitus laminarum,* New Caledonia, with rounded whorl and elevated spire; B: *Lyocyclus tubae,* Papua New Guinea, with rounded whorl, planispiral; C: *L. protampla,* Solomon; D: *L. lluviamonzoae* Rubio & Rolán, 2018, Guadeloupe, with angular spiral ridge on the protoconch; E: *L. wareni,* New Caledonia, with furrow bordering suture; F: *L. valdesquameus,* New Caledonia, with microperforations (artifact?). *Figura 2. Diversidad de protoconchas de Lyocyclidae del Indo-Pacífico y del Caribe. A:* Nescitus laminarum*, Nueva Caledonia, con vuelta redondeada y espira elevada. B:* Lyocyclus tubae*, Papua Nueva Guinea, con vuelta redondeada, planispiral; C:* L. protampla*, Salomon; D:* L. lluviamonzoae *Rubio & Rolán, 2018, Guadalupe, con cresta espiral angular sobre la protoconcha; E:* L. wareni*, Nueva Caledonia, con surco bordeando la sutura; F:* L. valdesquameus*, Nueva Caledonia, con microperforaciones (¿artefacto?).*

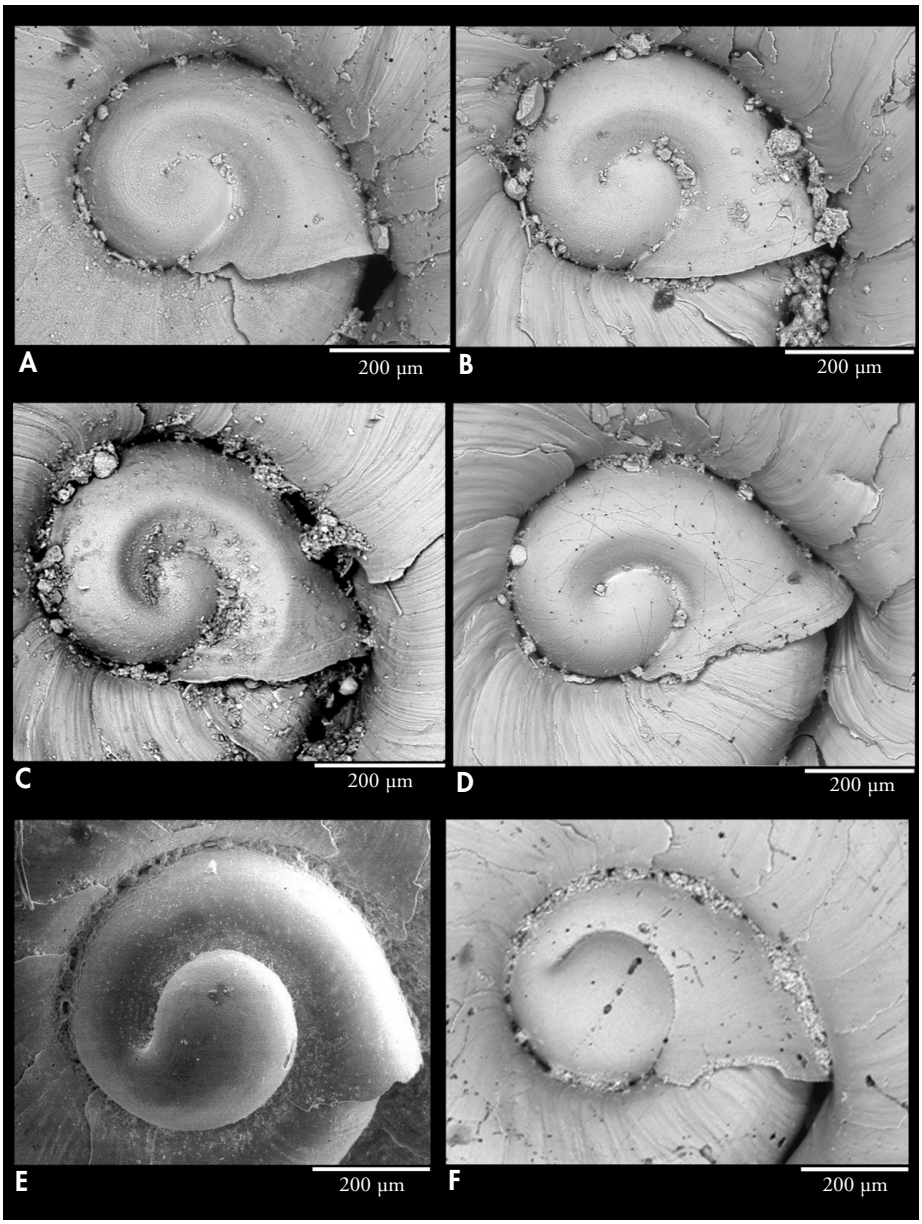

Figure 3. Diversity of protoconchs of Lyocyclidae from the Indo-Pacific and the Caribbean; A-D with angular spiral ridge on the protoconch. A: *L. microtuber,* New Caledonia; B: *L. similis,* New Caledonia; C: *L. funiculatus,* New Caledonia; D: *L.elephantus,* New Caledonia. E, F with large nucleus. E: *L. roselyae* Fernández-Garcés, Rubio & Rolán, 2019, Cuba; F: *L. glaber*, New Caledonia.

Figura 3. Diversidad de protoconchas de Lyocyclidae del Indo-Pacífico y del Caribe; A-D con cresta espiral angular sobre la protoconcha. A: L. microtuber*, Nueva Caledonia; B:* L. similis*, Nueva Caledonia; C:* L. funiculatus*, Nueva Caledonia; D:* L. elephantus*, Nueva Caledonia. E, F con núcleo grande. E:* L. roselyae *Fernández-Garcés, Rubio & Rolán, 2019, Cuba; F:* L. glaber*, Nueva Caledonia.*

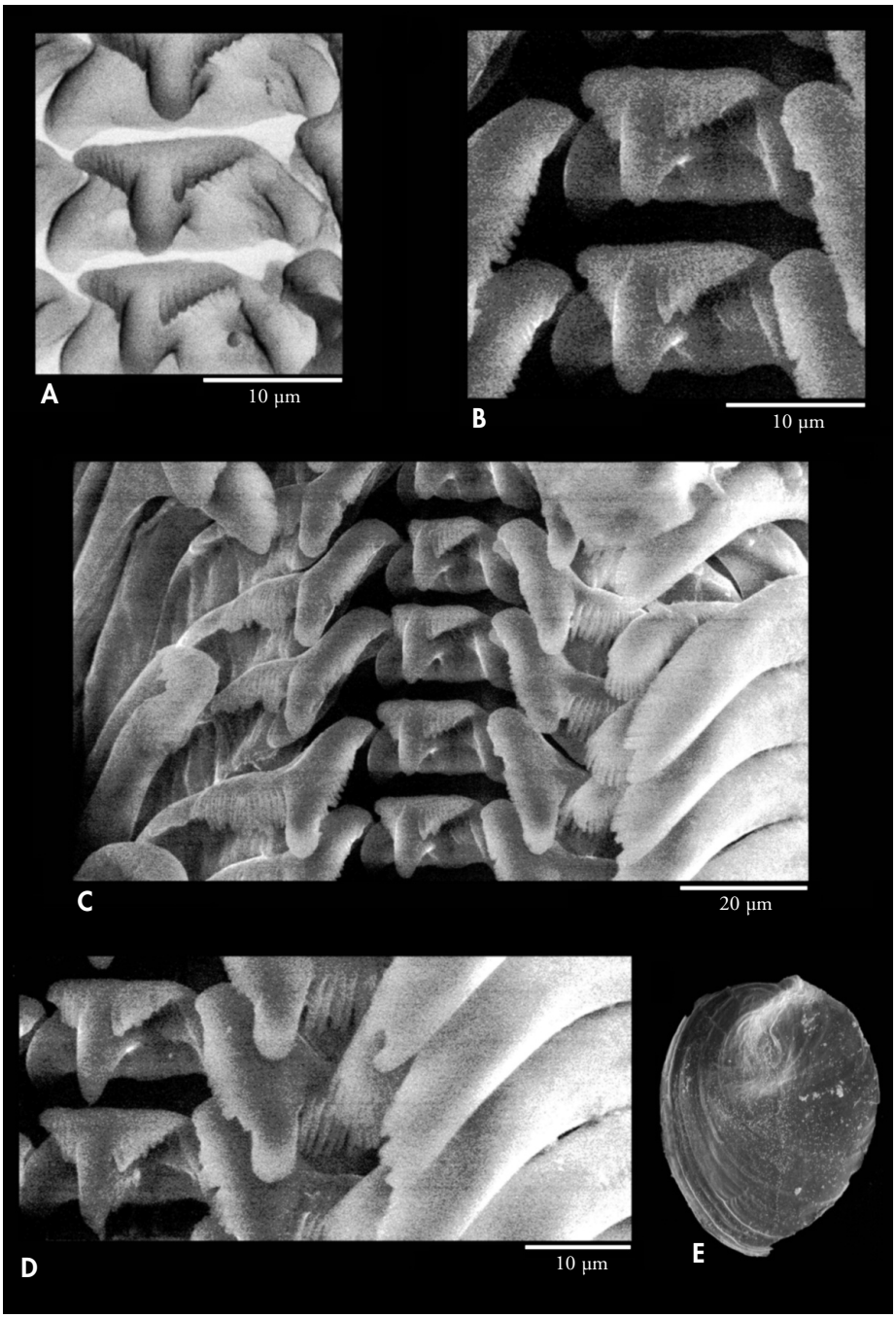

Figure 4. Radula and operculum of *Lyocyclus separatus* n. sp. A: radula in negative; B-D: radula in different views; E: operculum.
Figura 4. Rádula y opérculo de Lyocyclus separatus *n. sp. A: rádula en negativo; B-D: rádula en diferentes vistas; E: opérculo.*

located at the basal end on the inner side; last whorl large. The operculum is similar in shape to some species of the genus *Schwartziella* G. Nevill, 1881 (as *Schwartziella (S.) bryerea* (Montagu, 1803) from Sta. Rosa, NW Cuba) and *Zebina* H. Adams & A. Adams, 1854 (*Zebina (Zebina) browniana* (d'Orbigny, 1842) from Bahia Honda, Cuba (Rissooidea: Zebinidae Coan, 1964).

Pseudotorellia Warén, 1989 is a genus in Vanikoriidae Gray, 1840 whose only species *Pseudotorellia fragilis* Warén, 1989 has protoconch characters very similar to those of some species of *Lyocyclus* (aperture of the larval shell expanded; last part of protoconch forming a funnel-like collar protruding over the initial part of the teleoconch). *Pseudotorellia* is currently placed in the family Velutinidae Gray, 1840, superfamily Cypraeoidea Rafinesque, 1815 coinciding with the results of the molecular phylogeny of Takano & Kano (2014), who concluded that *Lyocyclus* is sister to genera in Cypraeoidea.

Lyocyclus solutus Thiele, 1925 (Figure 5A-D)

Lyocyclus solutus Thiele, 1925: 116, pl. 9, figs. 10-11.

Type material: *Holotype*, TANZANIA • 1 s (Fig. 5 C-D); Zanzibar Channel; 5°27.9'S, 39°18.8'E; 463 m; Deutsche Tiefsee-Expedition "Valdivia" Stn 245; Museum für Naturkunde, Berlin (ZMB/Moll-109251). Examined from photographs.
Type locality: Tanzania, Zanzibar Channel, 5°27.9'S, 39°18.8'E, 463 m.

Description: See Thiele, 1925.

The holotype is 3.5 mm in diameter and its aperture 1.5 mm in height.

Habitat: Bathyal species dredged on a blue clay bottom with *Globigerina* ooze at 463 m deep.

Distribution: Only known from the type locality.

Lyocyclus spinosus Thiele, 1925 (Figure 5E-G)

Lyocyclus spinosus Thiele, 1925: 117, pl. 9, figs. 14-15.

Type material: *Holotype*, TANZANIA • 1 s (Fig. 5B); off Dar-es-Salam; 6°39.1'S, 39°30.8'E; 400 m; Deutsche Tiefsee-Expedition "Valdivia" Stn 243; Museum für Naturkunde, Berlin (ZMB/Moll-109248). Examined from photographs.
Type locality: Tanzania, off Dar-es-Salam, 6°39.1'S, 39°30.8'E, 400 m.

Description: See Thiele, 1925.

The holotype is 4 mm in diameter and 1.8 mm in height of aperture.

Habitat: Bathyal species dredged at 400 m deep on a clay ground bottom with worm tubes.

Distribution: Only known from the type locality.

Lyocyclus aethiopicus Thiele, 1925 (Figure 5H-J)

Lyocyclus aethiopicus Thiele, 1925: 116-117, pl. 9, figs. 12-13

Type material: *Syntype*, SOMALIA • 1 s (Fig. 5A); off Barawa; 1°40.6'S, 41°47.1'E; 693 m; Deutsche Tiefsee-Expedition "Valdivia" Stn 251; Museum für Naturkunde, Berlin (ZMB/Moll-109247). Examined from photographs.
Type locality: Somalia, off Barawa, 1°40.6'S, 41°47.1'E, 693 m.

Description: See Thiele, 1925.

The syntype is 3.3 mm in diameter and 1.8 mm in height of the aperture.

Habitat: Bathyal species dredged at 693 m in blue muddy clay bottom with pteropods.

Distribution: Only known from the type locality.

Lyocyclus simplex n. sp. (Figure 6)

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Type material: *Holotype*, MOZAMBIQUE • 1 s (Figs 6 A-G); Inhambane transect; 23°33'S, 35°55'E; 684-698 m; 11 Apr. 2009; MAINBAZA Stn CP3141; MNHN, IM-2000-35422.
Material examined (1 s): the holotype.
Type locality: Mozambique Channel, Inhambane transect, 23°33'S, 35°55'E, 684-698 m.
Etymology: The specific name alludes the simple morphology of this species, which are typical of the genus but not outstanding.

Description: Shell small (<3.00 mm), planispiral, formed by 2 ¾ disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 560 μm; it begins with a rounded, mammillate nucleus, which is 170 μm in diameter and whose rough surface is completely covered by micro-pits. After the nucleus, the protoconch has only a little more than half whorl ending in a flaring lip which covers the initial part of the teleoconch.

The teleoconch has 1.7 disjunct whorls; adapically the whorls are nearly planispiral, whereas the last half whorl protrudes abapically. The whorls are connected only very loosely and mainly along the axial ribs which circle the whorls; the last quarter of the body whorl is more distinctly detached from the previous one.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are slightly inclined, equidistant and obliquely circling the whorls; their edge is irregular; 16 lamellae are observed on the first whorl and 25 on the last one. There are two thick spiral cords or carinae forming a slight angle above and below the periphery; the last quarter whorl has 4-6 additional weaker spiral cords.

The aperture is oval, somewhat expanded adapically and abapically, with a continuous peristome; with slight angles at the termination of the spiral carinae. The outer lip is thin with its edge not modified by the minor spiral cords.

Dimensions: the holotype size is 2.95 mm in diameter and 1.58 mm in height of the aperture (H/D: 0.54).

Habitat: Bathyal species dredged at 684-698 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus simplex* n. sp. is characterized by the flaring lip on the protoconch; by the presence of spiral cords next to carinae and the nearly planispiral adapical side of the whorl.

Lyocyclus angularis n. sp. (Figure 7)

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Type material: *Holotype*, MOZAMBIQUE • 1 s (Figs. 7A, B); Maputo transect; 25°59´S, 34°42'E; 771-776 m; 16 Apr. 2009; MAINBAZA Stn CC3171; MNHN, IM-2000-35423. *Paratypes*, MOZAMBIQUE • 10 s; same data as for holotype; MNHN, IM-2000-35424.
Material examined (16 s): the type material and MOZAMBIQUE • 1 s; Maputo transect; 25°59'S, 34°35'E; 630-638 m; 16 Apr. 2009; MAINBAZA Stn CC3172; MNHN • 4 s; Maputo transect; 25°58'S, 34°47'E; 949-952 m; 16 Apr. 2009; MAINBAZA Stn CC3170; MNHN.

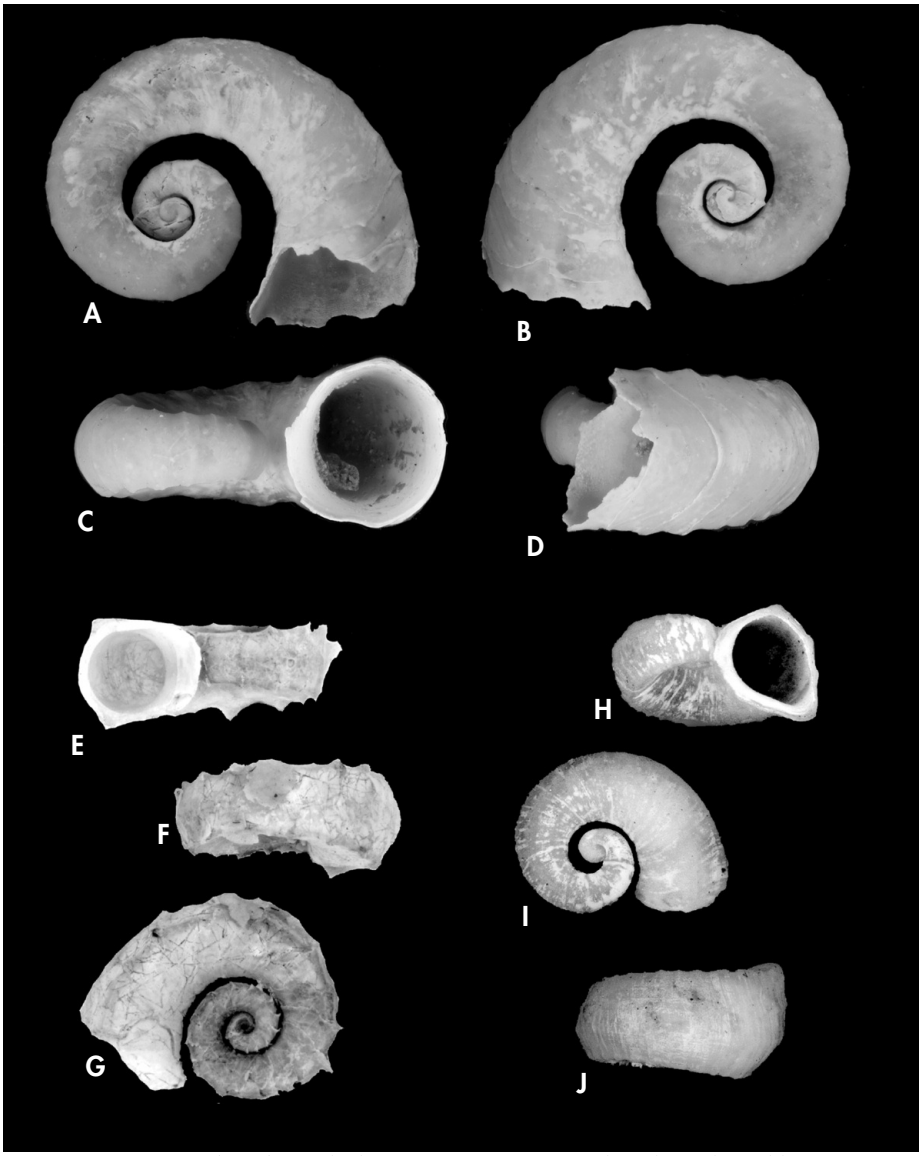

Figure 5. A-D: *Lyocyclus solutus* Thiele, 1925, Tanzania, Zanzibar channel, "Valdivia" Stn 245, 5°27.9'S, 39°18.8'E, 463 m. Holotype, diameter 3.5 mm (ZMB/Moll-109246). E-G: *Lyocyclus spinosus* Thiele, 1925, Tanzania, off Dar-es-Salam, "Valdivia" Stn 243, 6°39.1'S, 39°30.8'E, 400 m. Holotype, diameter 4 mm (ZMB/Moll-109248). H-J: *Lyocyclus aethiopicus* Thiele, 1925, off East Africa near Barawa, "Valdivia" Stn 251, 1°40.6'S, 41°47.1'E, 693 m. Syntype, diameter 3.3 mm (ZMB/Moll-109247).

Figura 5. A-D: Lyocyclus solutus *Thiele, 1925, Tanzania, canal de Zanzibar, "Valdivia" Stn 245, 5°27,9'S, 39°18,8'E, 463 m. Holotipo, diámetro 3,5 mm (ZMB/Moll-109246). E-G:* Lyocyclus spinosus *Thiele, 1925, Tanzania, frente a Dar-es-Salam, "Valdivia" Stn 243, 6°39,1'S, 39°30,8'E, 400 m. Holotipo, diámetro 4 mm (ZMB/Moll-109248). H-J:* Lyocyclus aethiopicus *Thiele, 1925, frente a África Oriental cerca de Barawa, "Valdivia" Stn 251, 1°40,6'S, 41°47,1'E, 693 m. Sintipo, diámetro 3,3 mm (ZMB/Moll-109247).*

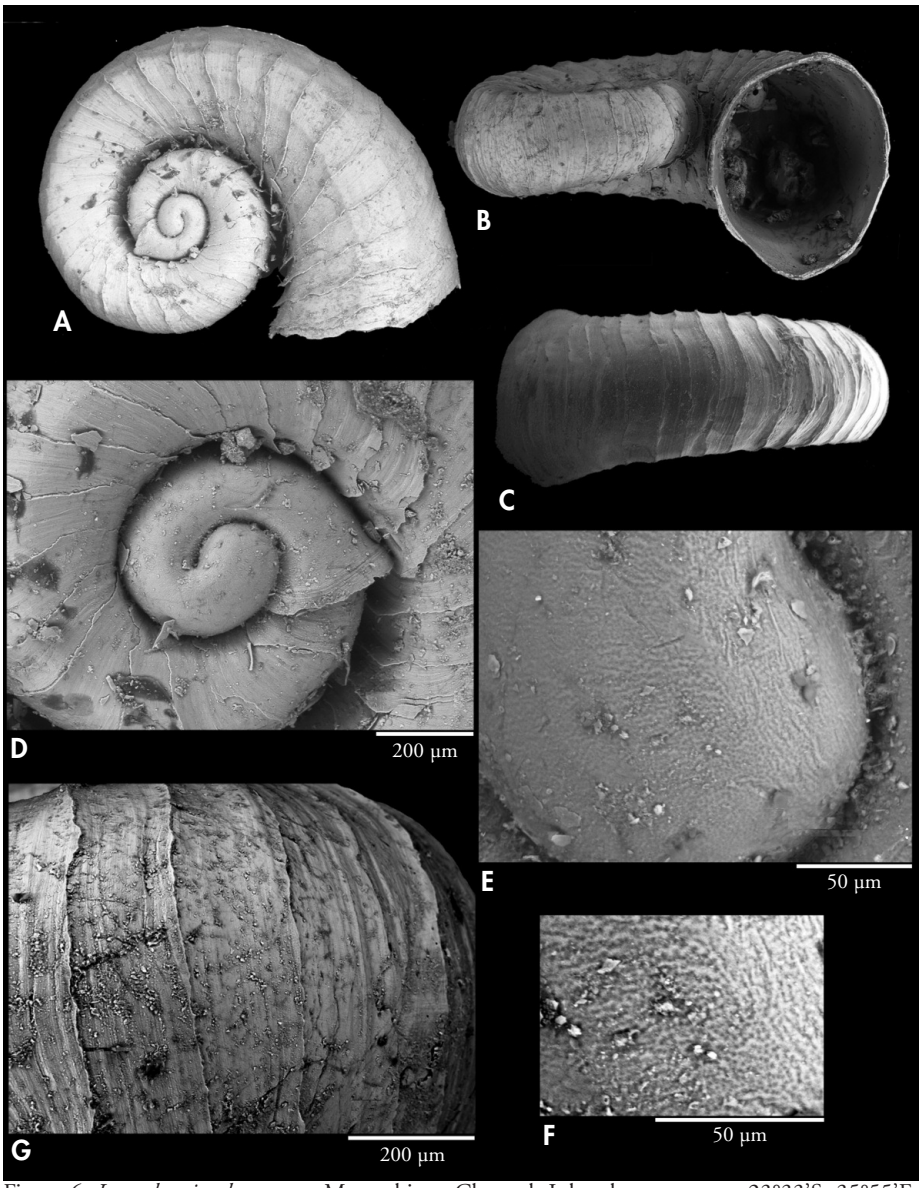

Figure 6. *Lyocyclus simplex* n. sp., Mozambique Channel, Inhambane transect, 23°33'S, 35°55'E, 684-698 m. A-C: holotype, diameter 2.95 mm (MNHN); D-F: protoconch of the holotype, detail and microsculpture of nucleus; G: detail of the teleoconch sculpture.

Figura 6. Lyocyclus simplex *n. sp., Canal de Mozambique, transecto de Inhambane, 23°33'S, 35°55'E, 684-698 m. A-C: holotipo, diámetro 2,95 mm (MNHN); D-F: protoconcha del holotipo, detalle y microescultura del núcleo; G: detalle de escultura de la teleoconcha.*

Type locality: Mozambique Channel, Maputo transect, 25°59´S, 34°42´E, 771-776 m.
Etymology: The specific name alludes the two angulations above and below periphery.

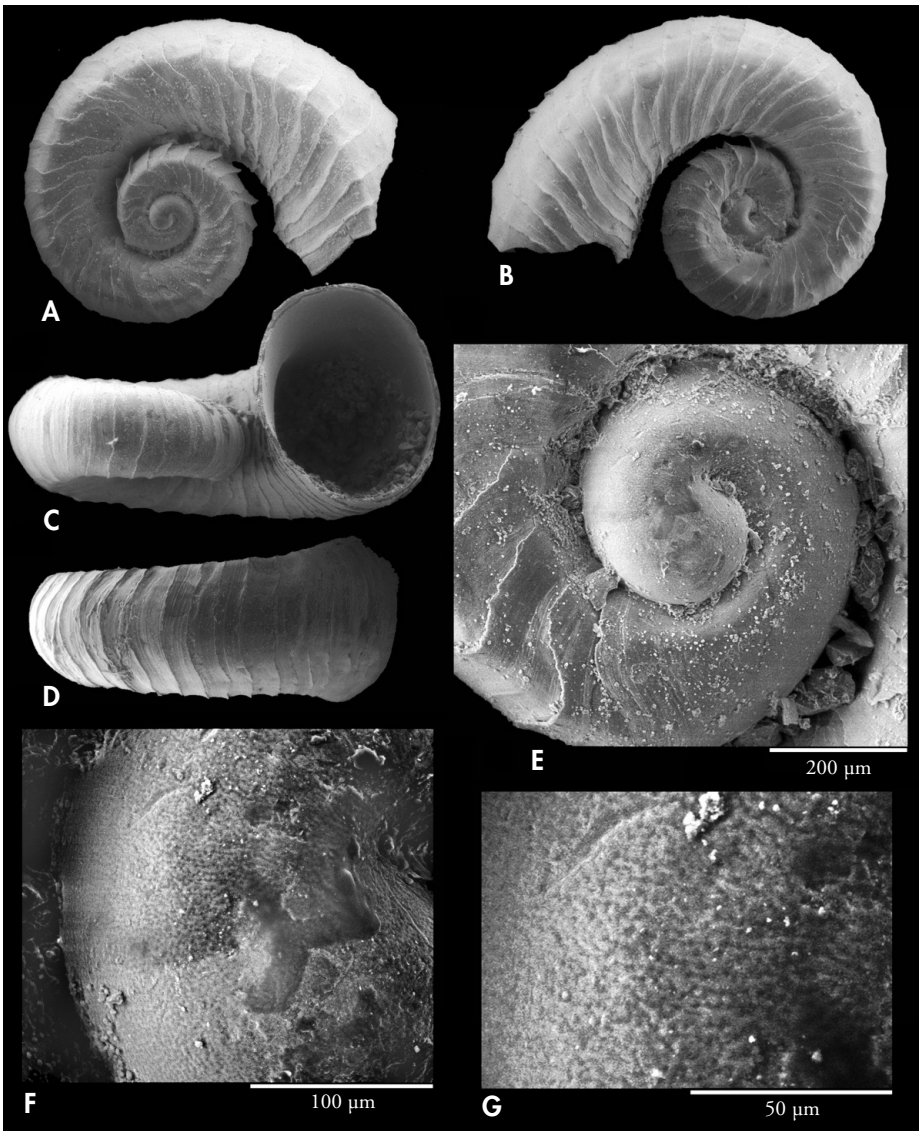

Figure 7. *Lyocyclus angularis* n. sp. Mozambique Channel, Maputo transect, 25°59'S, 34°42'E, 771-776 m. A, B: holotype, diameter 3.73 mm (MNHN); C, D: paratypes, diameter 3.03 and 2.9 mm the type locality (MNHN); E: protoconch of the holotype; F, G: protoconch sculpture of nucleus.
Figura 7. Lyocyclus angularis *n. sp. Canal de Mozambique, transecto de Maputo, 25°59'S, 34°42'E, 771-776 m. A, B: holotipo, diámetro 3,73 mm (MNHN); C, D: paratipos, diámetro 3,03 y 2,9 mm de la localidad tipo (MNHN); E: protoconcha del holotipo; F, G: escultura del núcleo de la protoconcha.*

Description: Shell small (<3.80 mm), planispiral, formed by 2 ¾ disjunct whorls, markedly carinate above and below the rounded periphery.

The protoconch has a single whorl and a maximum diameter of about 575 µm; it begins with a rounded, mammillate nucleus, which is 190 µm in diame-

ter and whose rough surface is completely covered by micro-pits. The nucleus is followed by a coiled part which terminates neither flaring nor thickened.

The teleoconch has 1.7 disjunct whorls and is strongly bicarinate, above and below the periphery. Starting from the first one, the whorls are loosely connected; the only area of contact with the previous whorl being along the axial ribs, and the last half whorl is distinctly separated and raised adapically.

Ornamentation is formed by oblique axial lamellae and marked growth lines. The lamellae are slightly procumbent, not equidistant and obliquely circling the whorls; their edge is irregular; 20 lamellae are observed on the first whorl and more than 30 on the last one, with growth lines in the interspaces.

The aperture is oval, expanded, with a continuous peristome, not angled at the termination of spiral carinae. The outer lip is thin with a smooth edge.

Dimensions: the holotype is 3.73 mm in maximum diameter and 1.91 mm in the height of the aperture (H/D: 0.51). A paratype is 3.03 mm in maximum diameter.

Habitat: Bathyal species dredged between 638-949 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus angularis* n. sp. is characterized by its protoconch not terminating in a flaring edge; its periphery is delimited by a strong angle above and below and the last whorl of the spire is raised adapically in all the examined specimens.

Lyocyclus simplex differs by ending its flaring, funnel-shaped protoconch which covers the initial part of the teleoconch, and by having 4-6 weak spiral cords on the adapical part of body whorl.

Lyocyclus tubae n. sp. (Figure 8)

urn: lsid: zoobank.org: act: 8389d80b-0598-46f5-b697-d5c4b77d1967

Type material: *Holotype*, PAPUA NEW GUINEA • 1 s (Figs. 8A, B); Southeastern Point of Manus Island; 02°10′S, 147°17′E; 300 m; 29 Sep. 2010; BIOPAPUA Stn CP3693; MNHN, IM-2000-35425.
Material examined (1 s): the holotype.
Type locality: Papua New Guinea, Southeast of Manus Island, 02°10′S, 147°17′E, 300 m.
Etymology: The specific name comes from the Latin whorl *tuba*, *ae*, "trumpet" alluding the form of the musical instrument which is similar to the outline of the shell.

Description: Shell of medium size (<9.00 mm), solid, formed by 3 ¼ whorls. Protoconch and first teleoconch whorls nearly planispiral, last whorl strongly disjunct.

The protoconch has less than one whorl and a maximum diameter of 610 μm. It is formed by a very thick and prominent nucleus, after which it is coiled and terminates with a narrow flaring lip; its surface is completely covered by very fine micro-granules that give it a rough appearance; growth lines are observed next to the lip.

The teleoconch has 2 ¼ disjunct whorls, the last one markedly deviating.

Ornamentation of grooves and marked growth lines, which form a V-shaped angle with the suture. On the periphery, there are three wide and deep spiral grooves, in which the growth lines are deflected in a V-shaped pattern.

The aperture is oval, expanded adapically and abapically.

Dimensions: the holotype is 8.33 mm in maximum diameter.

Habitat: Bathyal species dredged at 300 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus tubae* n. sp. is characterized by lacking axial lamellae, by growth lines that are V-shaped in the sutural and peripheral areas and by the three wide grooves located on the periphery. This ornamentation differentiates it from the remaining species.

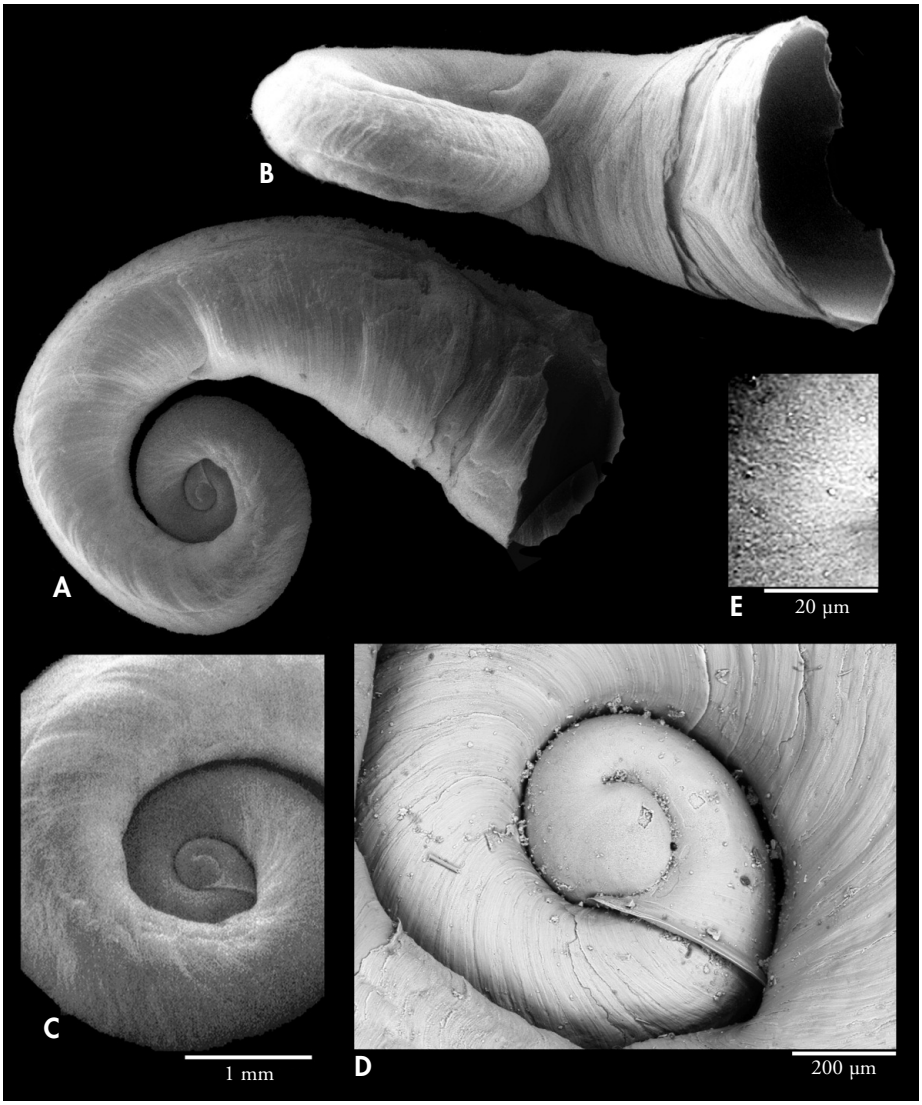

Figure 8. *Lyocyclus tubae* n. sp. Papua New Guinea, Southeast Point of Manus Island, 02°10'S, 147°17'E, 300 m. A, B: holotype, diameter 8.33 mm (MNHN); C, D: protoconch; E: microsculpture of nucleus. *Figura 8.* Lyocyclus tubae *n. sp. Papúa Nueva Guinea, Punta Sudeste, Isla Manus, 02°10'S, 147°17'E, 300 m. A, B: holotipo, diámetro 8,33 mm (MNHN); C, D: protoconcha; E: microescultura del núcleo.*

Lyocyclus magnioris n. sp. (Figure 9)

urn: lsid: zoobank.org: act: 5f29185a-abed-44af-a2e1-fc862a4b899a

Type material: *Holotype,* PAPUA NEW GUINEA • 1 s (Figs. 9A, B); SW point of Manus Island; 02°16′S, 147°29′E; 679-685 m; 29 Sep. 2010; BIOPAPUA Stn CP3689; MNHN, IM-2000-35426. *Paratype*, PAPUA NEW GUINEA • 1 s (Fig. 9C); same data as for holotype; MNHN, IM-2000-35427.

Material examined (4 s): the type material and PAPUA NEW GUINEA • 1 s (Fig. 9D-E, broken accidentally); same data as for holotype • 1 s; New Ireland; 02°41'S, 150°04'E; 761-825 m; 05 Sep. 2014; KAVIENG 2014 Stn CP4482; MNHN.
Type locality: Papua New Guinea, SW point of Manus Island, 02°16'S, 147°29'E, 679-685 m.
Etymology: The species' name is formed by two Latin words: *magnus*, *a*, *um* and *os*, *oris*, meaning that the species has a relatively large mouth.

Description: Shell small (<4.00 mm), planispiral, formed by 2 ¾ disjunct whorls, nodose on the periphery.

The protoconch has a single whorl and a maximum diameter of about 582 µm; it begins with a rounded and elevated mammillate nucleus, which is 190 µm in diameter and whose rough surface is completely covered by micro-perforations. Then, it is coiled and terminates with a slightly flaring lip.

The teleoconch has 1.7 disjunct whorls. The early teleoconch rises and twists adapically, then descends to form the planispiral last whorl. The teleoconch whorls are markedly detached; only a small area is connected to the previous whorl by axial lamellae.

Ornamentation is formed by oblique axial lamellae, marked growth lines and nodulous spiral cords. There are two thick spiral cords, one on each side, delimiting the periphery but without forming an angle. Axial lamellae form an elongated nodule where crossing peripherals cords. The lamellae are slightly inclined, not equidistant and obliquely circling the whorls; their edge is irregular; 18-19 lamellae are observed on the last whorl, with growth lines in their interspaces.

The aperture is oval-rounded, with a continuous peristome. The outer lip has a smooth edge, not angled by the spiral cords.

Dimensions: the holotype is 3.80 mm in maximum diameter. The figured paratype is 3.14 mm in diameter and 1.76 mm in the height of the aperture. The other paratype figured is 2.88 mm in maximum diameter.

Habitat: Bathyal species dredged at 679-825 m deep.

Distribution: Only known from Manus Island and New Ireland in Papua New Guinea.

Remarks: The main characters of the present species are the relatively wide aperture, and the very markedly disjunct last part of the spire.

The two thick spiral cords, one on each side, delimit the periphery but without forming an angle.

Lyocyclus distortus n. sp. (Figure 10)

urn: lsid: zoobank.org: act: 5ed055fe-ce5d-420f-a959-0b5f0357518f

Type material: *Holotype*, VANUATU • 1 s (Fig. 10A); SW Ile Anatom; 20°33'S, 169°36'E; 1175-1210 m; 20 Sep. 1994; MUSORSTOM 8 Stn CP956; MNHN, IM-2000-35428. *Paratype*, • 1 s (Fig. 10B); same data as for holotype; MNHN, IM-2000-35429.
Material examined (4 s): The type material and VANUATU • 2 s; NE Santo; 14°53'S, 167°06'E; 700-736 m; 08 Oct. 1994; MUSORSTOM 8 Stn DW1113; MNHN.
Type locality: Vanuatu, 20°33'S, 169°36'E, 1175-1210 m.
Etymology: The specific name is from the Latin word *distortus*, *a*, *um* alluding that the spire is not in just one plane.

Description: Shell small (<4.80 mm) formed by three disjunct whorls, nodose on the periphery.

The protoconch has just one whorl and a maximum diameter of about 730 µm; it begins with a rounded and elevated mammillate nucleus, which is 206 µm in diameter and whose rough surface is completely covered by micro-perforations. Then, it is coiled and terminates in a distinctly flaring, but not thickened lip.

The teleoconch, starting beneath the protoconch lip, has two loosely disjunct whorls and its periphery is rounded. The

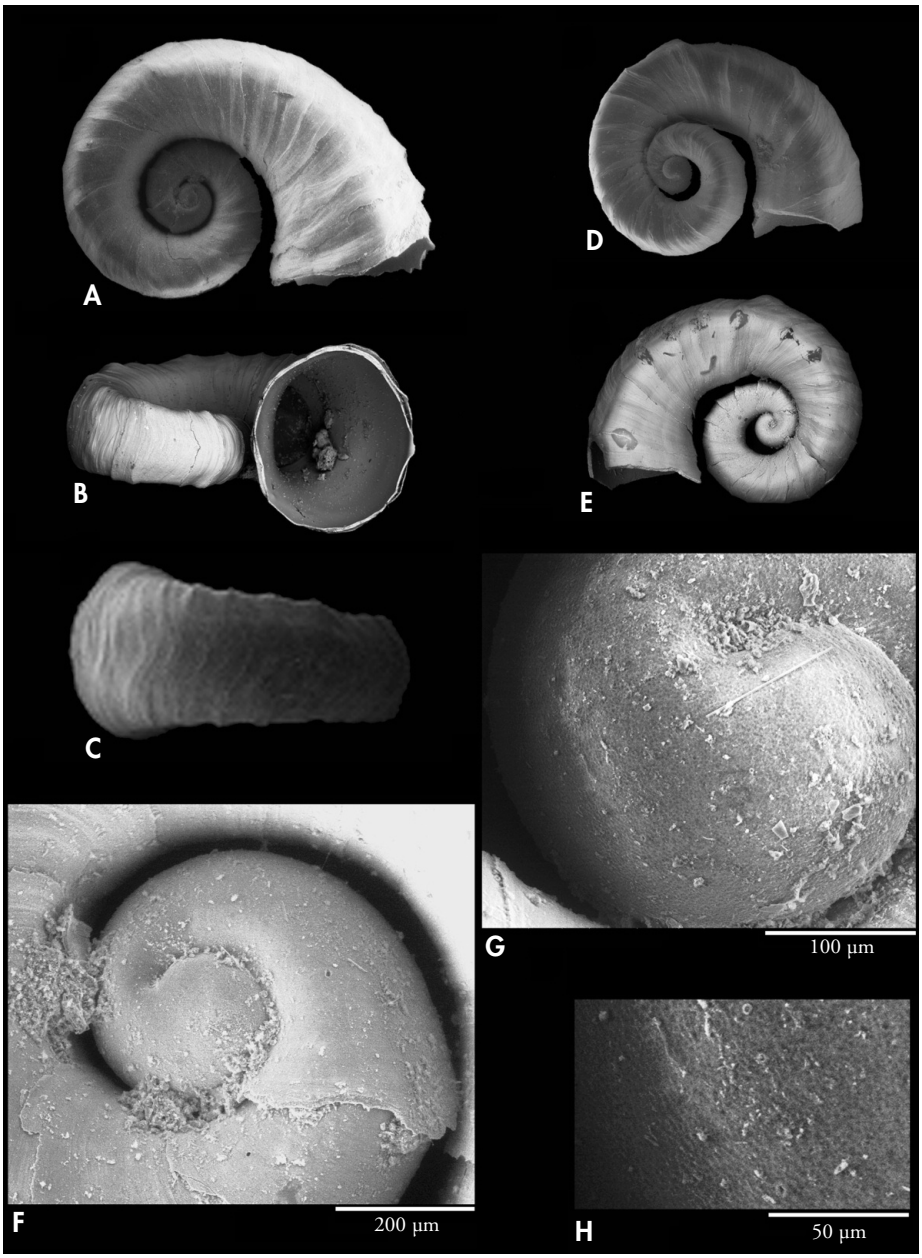

Figure 9. *Lyocyclus magnioris* n. sp. Papua New Guinea, Southeast Point, Manus Island, 02°16'S, 147°29'E, 679-685 m (MNHN). A, B: holotype, diameter 3.8 mm; C: paratype, diameter 3.14 mm (MNHN); D, E: shell, 2.88 mm (lost); F-H: protoconch of the holotype, detail and microsculpture.

Figura 9. Lyocyclus magnioris *n. sp. Papúa Nueva Guinea, Punta Sudeste, Isla Manus, 02°16'S, 147°29'E, 679-685 m (MNHN). A, B: holotipo, diámetro 3,8 mm; C: paratipo, diámetro 3,14 mm (MNHN); D, E: concha, 2,88 mm (perdido); F-H: protoconcha del holotipo, detalle y microescultura.*

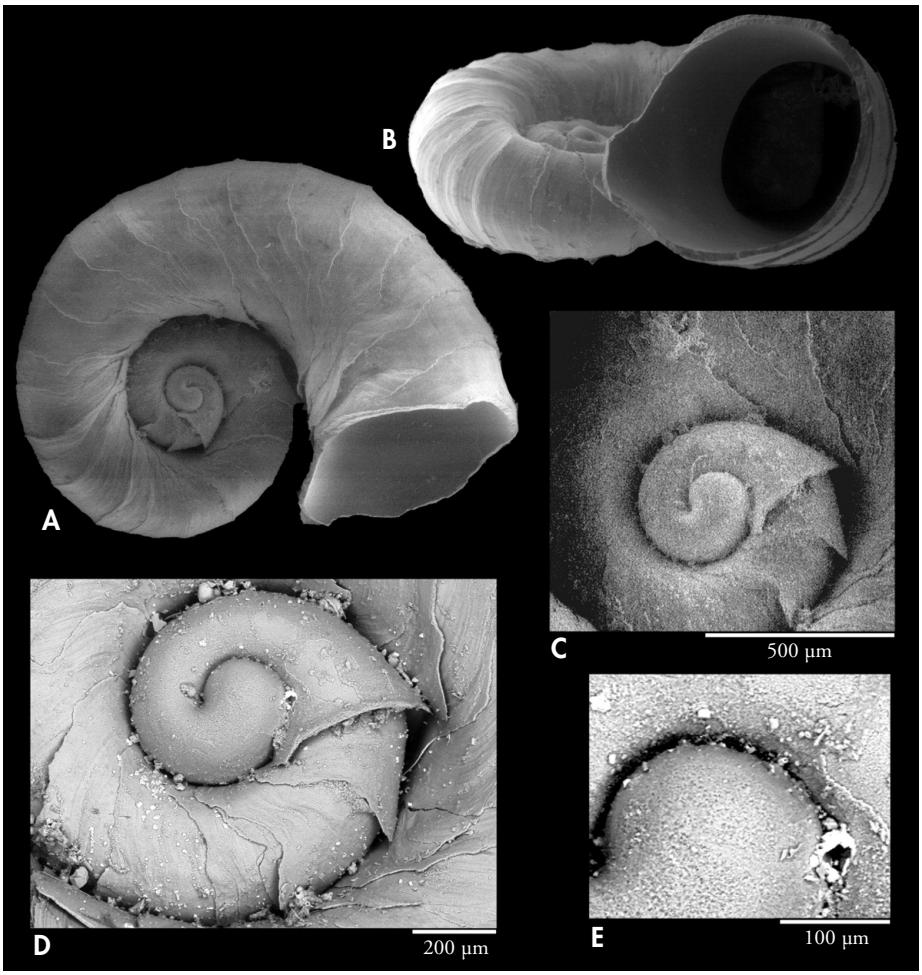

Figure 10. *Lyocyclus distortus* n. sp. Vanuatu, 20°33'S, 169°36'E, 1175-1210 m. A: holotype, diameter 4.52 mm (MNHN); B: paratype, diameter 4.02 mm (MNHN); C-E: protoconch, detail and microsculpture.

Figura 10. Lyocyclus distortus *n. sp. Vanuatu, 20°33'S, 169°36'E, 1175-1210 m. A: holotipo, diámetro 4,52 mm (MNHN); B: paratipo, diámetro 4,02 mm (MNHN); C-E: protoconcha, detalle y microescultura.*

teleoconch whorls are weakly separated and the axial lamellae are the only contact points; the last whorl rises adapically, separating completely from the previous whorl in the last quarter whorl.

Ornamentation is formed by oblique axial lamellae and marked growth lines in the interspaces; no trace of spiral cords nor carinae. Axial lamellae form an elongated nodule at the border of the periphery, on both apical and basal sides.

The lamellae are slightly procumbent, not equidistant and obliquely circling the whorls; their edge is irregular. There are 35 lamellae, 14 of which on the first whorl and 21 on the second.

The aperture is nearly circular, with a continuous peristome. The outer lip has a smooth edge.

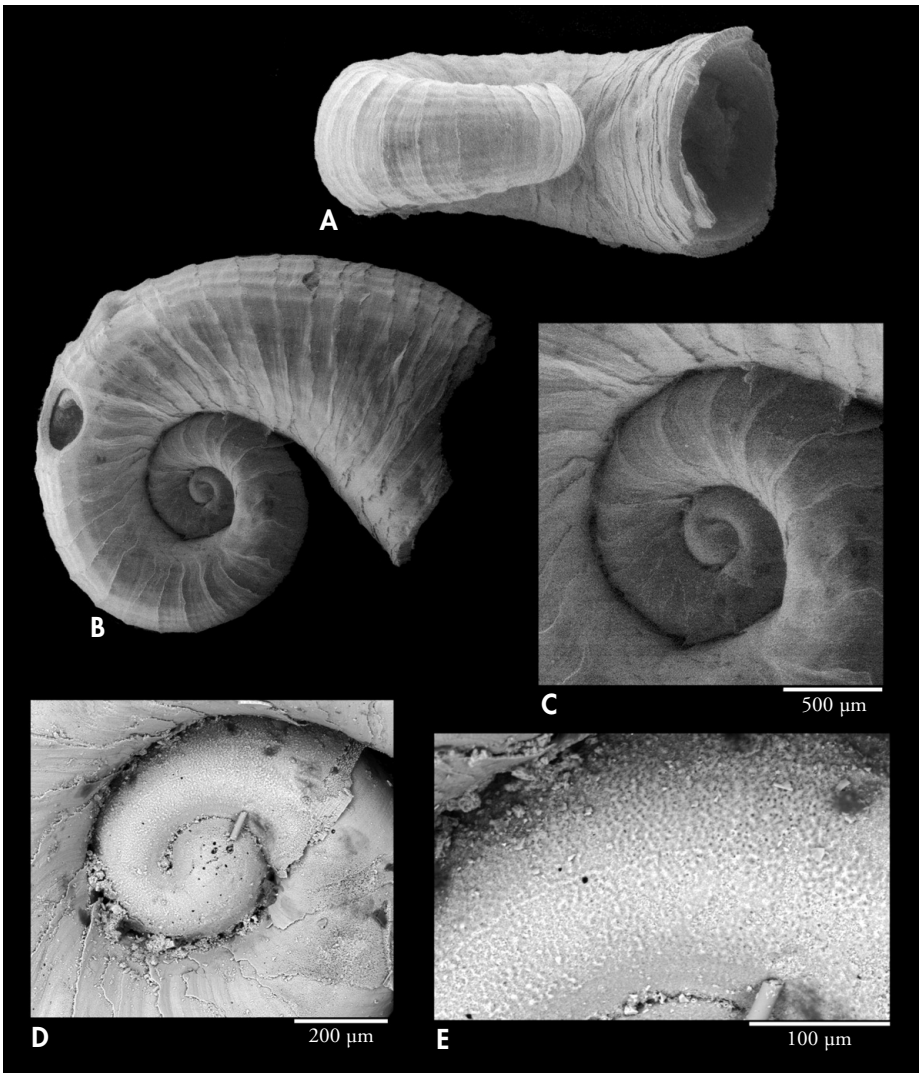

Figure 11. *Lyocyclus micro* n. sp. Solomon Islands, NW Vella Labella Island, 7°26'S, 156°15'E, 1200-1218 m. A, B: holotype, diameter 5.53 mm (MNHN); C: details of the protoconch and beginning of the teleoconch; D, E: protoconch and microsculpture.
Figura 11. Lyocyclus micro *n. sp. Islas Salomón, NW Isla Vella Labella, 7°26'S, 156°15'E, 1200-1218 m. A, B: holotipo, diámetro 5,53 mm (MNHN); C: detalle de la protoconcha y comienzo de la teleoconcha; D, E: protoconcha y microescultura.*

Dimensions: the holotype is 4.52 mm in maximum diameter and 1.9 mm in height of the aperture. The paratype is 4.02 mm in diameter.

Habitat: Bathyal species dredged between 700-1210 m deep.

Distribution: Only known from Vanuatu.

Remarks: *Lyocyclus distortus* n. sp. is characterized by the funnel shaped lip of the protoconch, the rounded periphery and the last whorl of the teleoconch expanding adapically.

Lyocyclus micro n. sp. (Figure 11)

urn: lsid: zoobank.org: act: d0b2d331-bec7-42aa-88d1-70b206d15ae7

Type material: *Holotype*, SOLOMON ISLANDS • 1 s (Figs. 11A, B); NW Vella Labella Island; 7°27′S, 156°15′E; 1200-1218 m; 02 Nov. 2004; SALOMON 2 Stn CP2253; MNHN, IM-2000-35430. *Paratype*, SOLOMON ISLANDS • 1 s; same data as for holotype; MNHN, IM-2000-35645.
Material examined (3 s): the type material and SOLOMON ISLANDS • 1 s; Rendova; 08°41′S, 157°24′E; 248-253 m; 06 Nov. 2004; SALOMON 2 Stn CP2286; MNHN.
Type locality: Solomon Islands, NW Vella Labella Island, 7°27′S, 156°15′E, 1200-1218 m.
Etymology: The specific name alludes the very small microsculpture of the protoconch.

Description: Shell small (<6.00 mm), planispiral, formed by 2.8 disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 650 μm. It begins with a rounded, mammillate nucleus, which is 230 μm in diameter; then, it is coiled an terminates in a simple lip, not flaring. It is sculptured by small, irregular, star-shaped granules that often interconnect to form net-like pattern, with a thin spiral cordlet and numerous randomly scattered pores.

The teleoconch has 1.9 loosely disjunct whorls; the first half whorl of teleoconch is placed at the same level as the protoconch, then the spire rises adapically, and also protrudes abapically on the last quarter whorl. The whorls are connected mainly along the axial lamellae; the last quarter whorl is diverging and disconnected from the previous whorl.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are slightly procumbent, not equidistant and obliquely circle the whorl; their edge is irregular; 15 lamellae are observed on the first whorl and 30-31 on the last one, with growth lines in the interspaces. There are numerous spiral cords on the periphery, which raise and undulate the edge of the lamellae.

The aperture is nearly circular, with a continuous peristome. The outer lip is thin with its edge not modified by the spiral cords.

Dimensions: the holotype is 5.53 mm in diameter and 1.45 mm in the height of the aperture.

Habitat: Bathyal species dredged between 248 and 1218 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus micro* n. sp. is characterized by the peculiar ornamentation of the protoconch and by the peripheral cordlets which undulate the edge of the lamellae.

Lyocyclus squamosus n. sp. (Figure 12)

urn: lsid: zoobank.org: act: bd68a5ea-8dac-4a1d-a183-7e2595f86d1e

Type material: *Holotype*, SOLOMON ISLANDS • 1 s (Fig. 12A-C); off Marshall Bennett Island, W Woodlark Island; 08°37′S, 151°46′E; 680 m; 04 May 2014; MADEEP Stn DW4322; MNHN, IM-2000-35431.
Material examined (1 s): the holotype.
Type locality: Solomon Islands, off Marshall Bennett Island, W Woodlark Island, 08°37′S, 151°46′E, 680 m.
Etymology: The specific name alludes the prominent peripheral lamellae.

Description: Shell very small (<2.50 mm), nearly planispiral, formed by 2.3 hardly disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 690 μm. It begins with a rounded, mammillate nucleus, which is 210 μm in diameter; then it is coiled and terminates in a flaring, funnel-shaped lip, which covers the initial part of the teleoconch. It is sculptured by small,

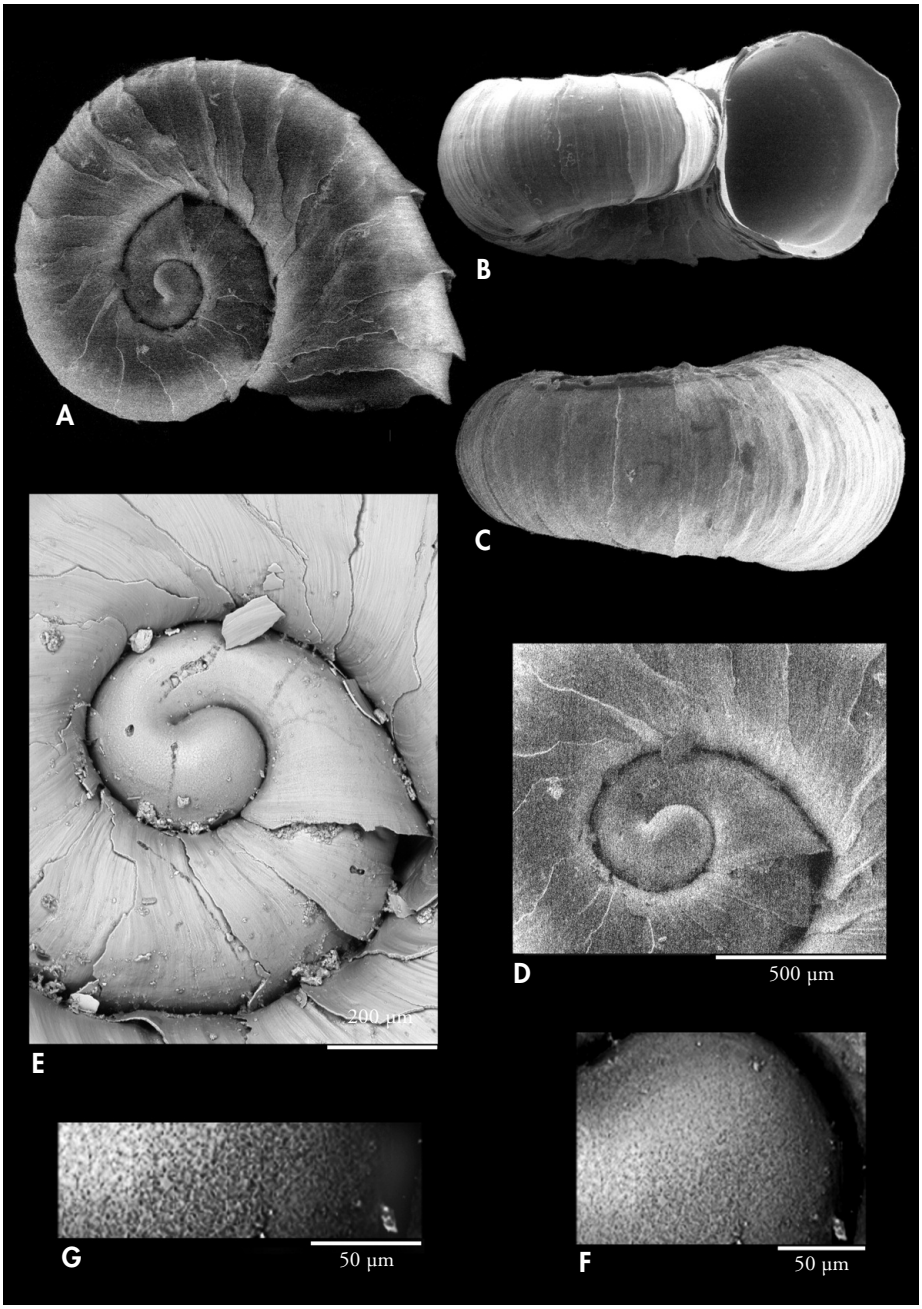

Figure 12. *Lyocyclus squamosus* n. sp. Solomon Islands, off Marshall Bennett Island, W Woodlark Island, 08°37'S, 151°46'E, 680 m. A-C: holotype, diameter 2.36 mm (MNHN); D, E: protoconch and detail; F, G: microsculpture and detail.

Figura 12. Lyocyclus squamosus *n. sp. Islas Salomón, frente a la isla Marshall Bennett, al Oeste de la Isla Woodlark, 08°37'S, 151°46'E, 680 m. A-C: holotipo, diámetro 2,36 mm (MNHN); D, E: protoconcha y detalle; F, G: microescultura y detalle.*

irregular granules that often interconnect to form net-like pattern, with some thin and short spiral cordlets and numerous growth lines near the lip. Surface covered by numerous randomly scattered pores.

The teleoconch has 1.3 disjunct whorls starting beneath the protoconch lip, the first one situated at the same level as the protoconch; the whorls are hardly disjunct; being connected mainly along the lamellae, which continue all around the whorls.

Ornamentation is formed by oblique axial lamellae and marked growth lines. There are 22 lamellae, 17 of which are on the last whorl. The lamellae are slightly inclined, equidistant and obliquely circling the whorls; their edge is irregular and, on the periphery of the last quarter whorl, forms nail-like projections.

The aperture has a continuous peristome, nearly circular except for a short flattened inner lip. The outer lip is slightly flaring.

Dimensions: the holotype size is 2.36 mm in diameter and 1.15 mm in height of the aperture (H/D: 0.49).

Habitat: Bathyal species dredged at 680 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus squamosus* n. sp. is characterized by the ornamentation of the protoconch, by an almost planispiral coiling and by the nail-shaped projections of the lamellae.

Lyocyclus protangulata n. sp. (Figure 13)

urn: lsid: zoobank.org: act: 4bb82b11-6965-455e-aed9-e5419732de50

Type material: *Holotype*, SOLOMON ISLANDS • 1 s (Fig. 13A); W Buka Island; 05°44′S,154°02′E; 405-410 m; 28 Apr. 2014; MADEEP Stn DW4276; MNHN, IM-2000-35432. *Paratypes*, SOLOMON ISLANDS • 9 s (Figs. 13B-E); same data as for holotype; MNHN, IM-2000-35433.
Material examined (10 s): the type material.
Type locality: Solomon Islands, W Buka Island, 05°44′S, 154°02′E, 405-410 m.
Etymology: The specific name alludes the central spiral ridge of the protoconch.

Description: Shell very small (<2.50 mm), nearly planispiral, formed by 2.7 disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 512 μm. It begins with a rounded and elevated mammillate nucleus, which is 163 μm in diameter; then it is coiled, shows a blunt, elevated spiral ridge and terminates in a thickened, slightly flaring lip. It is sculptured by small granules irregularly aligned, which are distributed from the nucleus to the lip; on its surface, there are randomly scattered pores.

The teleoconch has 1.7 disjunct whorls, starting beneath the protoconch lip, the first one situated at the same level as the protoconch; the first whorl is hardly disjunct, being connected mainly along the lamellae, which continue all around the whorls; in some specimens, the last half whorl sharply rises adapically, separating completely from the previous whorl.

Ornamentation is formed by oblique axial lamellae and growth lines. There are 32 lamellae, 18 of which are on the last whorl, with faint growth lines in the interspaces. The lamellae are triangular in cross-section, wider near the periphery, equidistant and obliquely circling the whorls. No trace of spiral cords or carinae.

The aperture is oval, with a continuous peristome and a smooth edge.

Dimensions: the holotype is 2.42 mm in maximum diameter.

Habitat: Bathyal species dredged at 405-410 m deep.

Distribution: Only known from the type locality.

Remarks: The main morphological characters are the angular spiral ridge on the protoconch, the prominent, elevated and oblique axial lamellae, and disjunct and frequently distorted end of the spire.

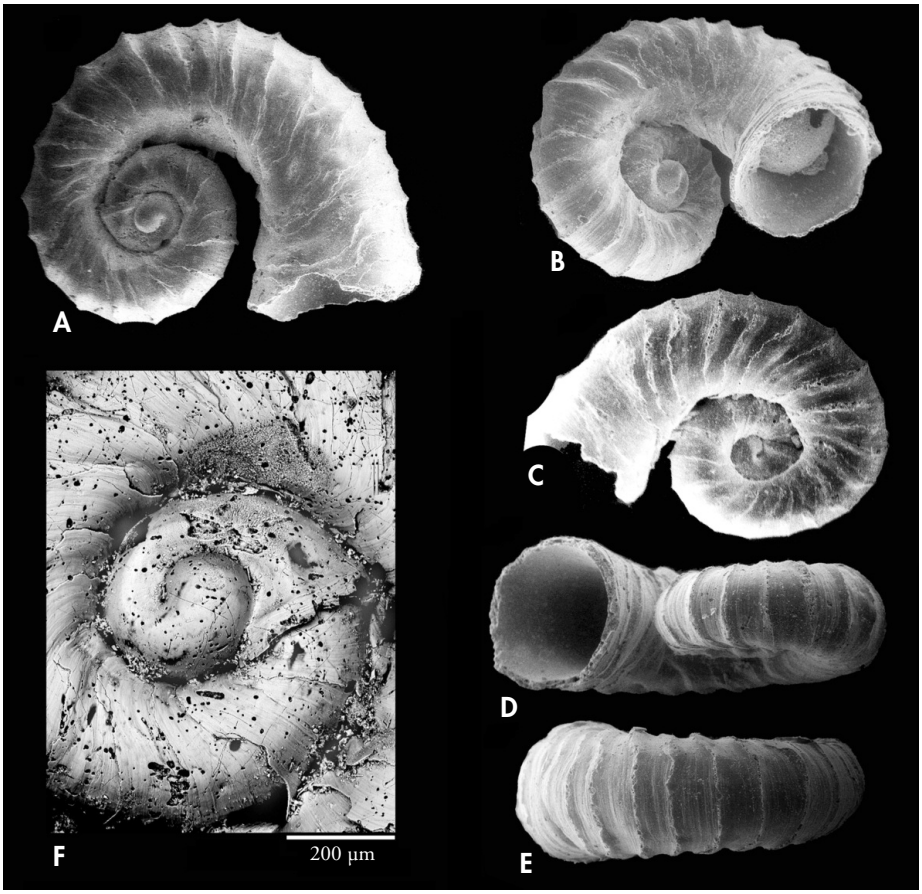

Figure 13. *Lyocyclus protangulata* n. sp. Solomon Islands, W Buka Island, 05°44'S, 154°02'E, 405-410 m. A: holotype, diameter 2.42 mm (MNHN); B, C: paratype, 2.2 mm, with lateral deviation of the spiral end (MNHN); D, E: paratype without any lateral deviation, diameter 2.4 mm (MNHN); F: protoconch of the holotype.
Figura 13. Lyocyclus protangulata *n. sp. Islas Salomón, Oeste de Isla Buka, 05°44'S, 154°02'E, 405-410 m. A: holotipo, diámetro 2,42 mm (MNHN); B, C: paratipo, 2,2 mm, con desviación lateral de final de la espira (MNHN); D, E: paratipo sin desviación lateral, diámetro 2,4 mm (MNHN); F: protoconcha del holotipo.*

Lyocyclus protampla n. sp. (Figure 14)

urn: lsid: zoobank.org: act: 532fc075-0d1f-486e-b116-23c42f05e5cd

Type material: *Holotype*, SOLOMON ISLANDS • 1 s (Fig. 14A); NW Malaita; 8°31'S, 160°38'E; 1036-1138 m; 29 Sep. 2001; SALOMON 1 Stn CP1781; MNHN, IM-2000-35434. *Paratypes*, SOLOMON ISLANDS • 4 s (Figs. 14B-E); same data as for holotype; MNHN, IM-2000-35435.
Material examined (5 s): the type material.
Type locality: Solomon Islands, NW Malaita, 8°31'S, 160°38'E, 1036-1138 m.
Etymology: The specific name combines the two words: "protoconch" and *amplus*, *a*, *um* which means "wide", alluding to the large protoconch.

Description: Shell minute (<2.00 mm), nearly planispiral, formed by 2.0 hardly disjunct whorls.

The protoconch has hardly more than one whorl and a maximum diameter of about 730 μm. It begins with a rounded, mammillate nucleus, which is 225 μm in diameter; then is coiled and shows a blunt subsutural ridge, ending on a thick labial varix, before the protoconch lip, which is slightly flaring. It is sculptured by small, irregular granules that often interconnect to form a net-like pattern and a surface covered by numerous randomly scattered pores.

The teleoconch has only one whorl, starting beneath the protoconch lip; the whorl is situated at the same level as the protoconch and hardly disjunct, being connected mainly along the lamellae.

Ornamentation is formed by oblique axial lamellae and marked growth lines; there are 19 lamellae on the unique whorl, with growth lines in the interspaces. The lamellae are slightly leaning, equidistant and obliquely circling the whorls and their edge is irregular.

The aperture has a continuous peristome, nearly circular except a short flattened inner lip. The outer lip is protruding.

Dimensions: the holotype size is 1.84 mm in diameter and the figures paratype 1.8 mm in height.

Habitat: Bathyal species dredged at 1036-1138 m deep.

Distribution: Only known from Solomon Islands, its type locality.

Remarks: The main characters of the present species are the large protoconch with 730 μm in diameter, with only one whorl after the nucleus; and the spire with all whorls connected and generally planispiral.

Lyocyclus separatus n. sp. (Figure 15)

urn: lsid: zoobank.org: act: 52d6878b-2627-4f3e-856d-fd04fb07c3d9

Type material: *Holotype*, SOLOMON ISLANDS • 1 spm (Figs. 15A-C); off Marshall Bennett Island, W Woodlark Island; 08°38'S, 151°46'E; 720 m; 04 May 2014; MADEEP Stn DW4323; MNHN, IM-2000-35436. *Paratype*, SOLOMON ISLANDS • 1 spm; same data as for holotype; MNHN, IM-2000-35437.
Material examined (2 s): the type material
Type locality: Solomon Islands, off Marshall Bennett Island, W Woodlark Island, 08°38'S,151°46'E, 720 m.
Etymology: The specific name is from the past participle of the verb *separo* alluding to the disjunct whorls.

Description: Shell small (<3.05 mm), nearly planispiral, solid, formed by 2.6 disjunct whorls.

The protoconch has nearly one whorl and a maximum diameter of 620 μm. It begins with a rounded, mammillate nucleus, which is about 220 μm in diameter; then it is coiled and shows a blunt subsutural ridge before terminating with a distinctly flaring lip; numerous growth lines are observed next to the lip. It is scarcely sculptured with very small, irregular granules that often interconnect to form net-like pattern; the surface is covered by numerous randomly scattered pores.

The teleoconch has 1.6 whorls, starting beneath the protoconch lip; the first whorl is placed at the same level as the protoconch, loosely disjunct, being connected mainly along the lamellae; the last half whorl is completely disjunct.

Ornamentation is formed by axial lamellae and growth lines. The lamellae are slightly procumbent, obliquely circling the whorls and their edge is irregular; there are about 20 lamellae, with faint growth lines in the interspaces. No trace of spiral cords or carinae.

The aperture is oval-trapezoidal, with a continuous peristome. The outer lip has a smooth edge, not angulated.

Dimensions: the shell size is 3.1 mm in maximum diameter and 1.2 mm in height of aperture (H/D: 0.39).

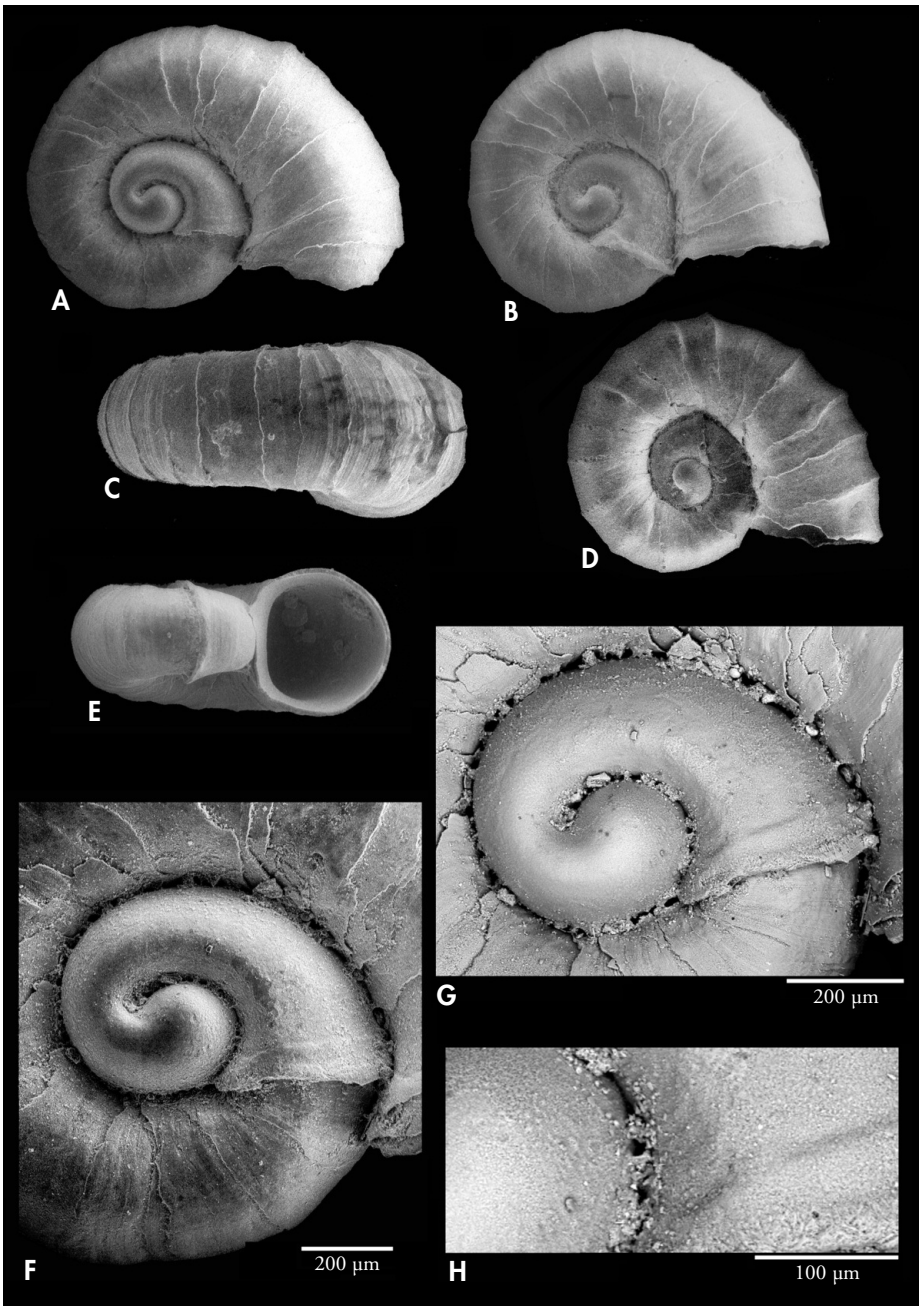

Figure 14. *Lyocyclus protampla* n. sp. Solomon Islands, 8°31'S, 160°38'E, 1036-1138 m. A: holotype, diameter 1.84 mm (MNHN); B-E: paratypes, 1.8, 2.4, 1.61 and 1.56 mm (MNHN); F-H: protoconch and microsculpture.

Figura 14. Lyocyclus protampla *n. sp. Islas Salomón, 8°31'S, 160°38'E, 1036-1138 m. A: holotipo, diámetro 1,84 mm (MNHN); B-E: paratipos, 1,8, 2,4, 1,61 y 1,56 mm (MNHN); F-H: protoconcha y microescultura*

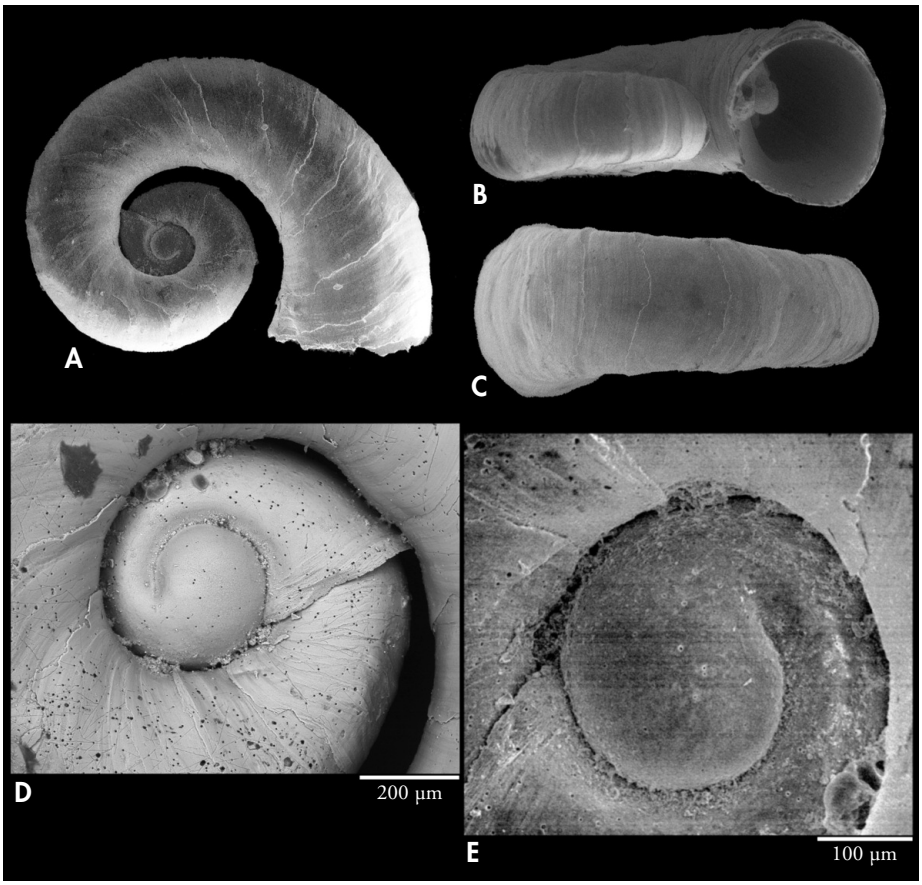

Figure 15. *Lyocyclus separatus* n. sp. Solomon Is., off Marshall Bennett, W Woodlark Island, 08°38'S, 151°46'E, 720 m. A-C: holotype, diameter 3.1 mm (MNHN); D, E: protoconch and detail.
Figura 15. Lyocyclus separatus *n. sp. Islas Salomón, frente a Marshall Bennett, al Oeste de la Isla Woodlark, 08°38'S, 151°46'E, 720 m. A-C: holotipo, diámetro 3,1 mm (MNHN); D, E: protoconcha y detalle.*

Radula (Figs. 4A-D) and operculum (Fig. 4E).

Habitat: Bathyal species dredged at 720 m deep.

Distribution: Only known from the type locality.

Remarks: The main characters of the present species are the rather large protoconch, with a ridge bordering a depression near the suture, the scarcely marked axial sculpture and disjunct spire of the teleoconch.

Lyocyclus juanchii n. sp. (Figure 16)

urn: lsid: zoobank.org: act: 7f9536af-2121-4eaa-9073-92d1937b16b5

Type material: *Holotype*, PHILIPPINES • 1 s (Figs. 16A, B); 14°55'N, 123°12'E; 944-1004 m; 27 May 2007; AURORA 2007 Stn CC2702; MNHN, IM-2000-35438. *Paratypes*, PHILIPPINES • 7 s (Figs. 16B-C); same data as for holotype; MNHN, IM-2000-35439.

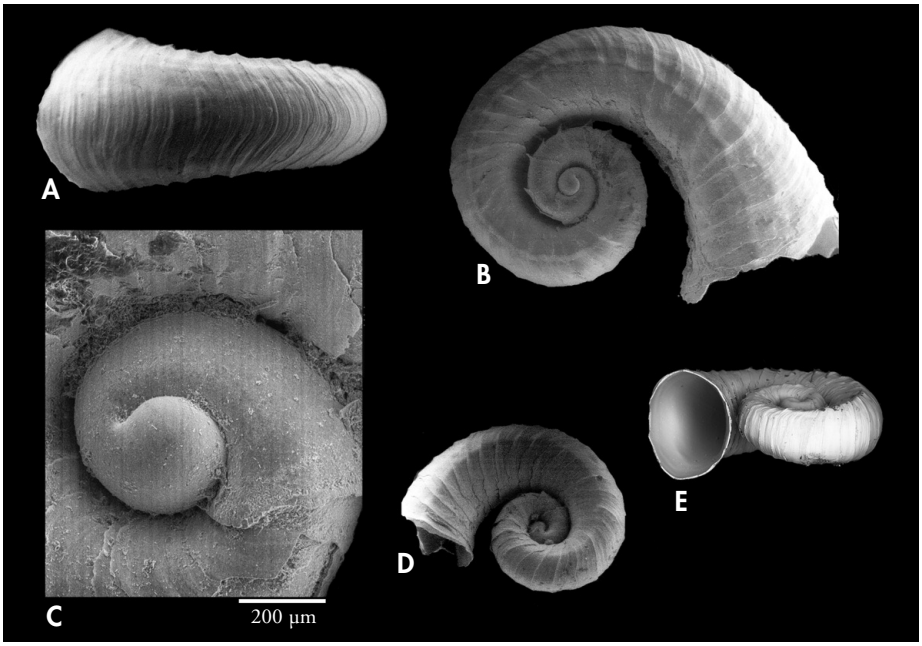

Figure 16. *Lyocyclus juanchii* n. sp. Philippines, 14°55'N, 123°12'E, 944-1004 m. A, B: holotype, 4.96 mm (MNHN); C: protoconch of the holotype; D, E: paratypes, diameter 2.87 and 3.0 mm (MNHN).

Figura 16. Lyocyclus juanchii *n. sp. Filipinas, 14°55'N, 123°12'E, 944-1004 m. A, B: holotipo, 4,96 mm (MNHN); C: protoconcha del holotipo; D, E: paratipos, diámetro 2,87 y 3,0 mm (MNHN).*

Material examined (8 s): the type material.
Type locality: Philippines, 14°55'N, 123°12'E, 944-1004 m.
Etymology: The species name is after Juan José Rojas Mosquera ("Juanchi") cousin of the second author.

Description: Shell small (<5.00 mm), nearly planispiral, formed by 2.9 disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 746 µm. It begins with a rounded, mammillate nucleus, which is 400 µm in diameter; then, it is coiled and terminates with a simple lip, neither thickened nor flaring. It is sculptured by small, irregular granules that often interconnect to form a net-like pattern, and the surface is wrinkled.

The teleoconch has 1.9 markedly disjunct whorls, the first one placed at the same level as the protoconch, being connected only through the peripheral edge of the lamellae; the last quarter whorl is divergent and increasingly disjunct.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are slightly inclined, not equidistant and obliquely circling the whorls; their edges are irregular; the peripheral edge of the lamellae on the first whorl is high and shaped like a nail; 15 lamellae are observed on the first whorl and 25-26 on the last one, with growth lines in the interspaces. Starting on the first half whorl, on both adapical and abapical sides, a thick spiral cord (carina) appears and forms nodules at the intersections with the axial lamellae; it bifurcates on the last half whorl, forming 1-2 carinae of nodules at each side, which delimit the periphery.

The aperture is oval – trapezoidal (no angles), with a continuous peristome; the diameter strongly increases on the last quarter of whorl preceding the aperture. Thin outer lip with edge not modified by the spiral cords.

Dimensions: the holotype is 4.96 mm in maximum diameter, with 2.0 mm in apertural diameter. The paratype in figure16D is 2.87 mm in maximum diameter and the one in fig. 16E is 3.0 mm and the height of the aperture is 1.28 mm (H/D: 0.42).

Habitat: Bathyal species dredged at 944-1004 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus juanchii* n. sp. is characterized by its totally disjunct whorls; the large protoconch, the nodulous carinae and a strong increase of diameter preceding the aperture.

Lyocyclus disjunctionis n. sp. (see below) differs in lacking spirals on the last whorl.

Lyocyclus intortus n. sp. differs by its short and very bulbous protoconch, sculptured with irregular granules and by its 1-2 nodulous carinae which delimit the periphery.

Lyocyclus disjunctionis n. sp. (Figure 17)

urn: lsid: zoobank.org: act: c4078652-98fc-46f7-8175-f9243ecbbcb9

Type material: *Holotype*, PHILIPPINES • 1 s (Figs. 17A, B); 14°56′N, 123°9′E; 996-1037 m; 24 May 2007; AURORA 2007 Stn CP2686; MNHN, IM-2000-35440. *Paratypes*, PHILIPPINES • 12 s (Figs. 17C-D); same data as for holotype; MNHN, IM-2000-35441.
Material examined (13 s): the type material.
Type locality: Philippines, 14°56′N, 123°9′E, 996-1037 m.
Etymology: The species name is from the Latin word *disjunctio*, *onis*, which means "separation" alluding that the whorls are distinctly separated at the end of the spire.

Description: Shell small (<5.5 mm), nearly planispiral, formed by 2.9 disjunct whorls.

The protoconch has a single whorl and a maximum diameter of about 656 μm. It begins with a rounded, mammillate nucleus, which is 210 μm in diameter; then, the protoconch is coiled and terminates with a simple lip, which is not thickened and is hardly flaring. It is covered by numerous randomly scattered pores and sculptured by small, irregular granules that often interconnect to form a net-like pattern. The microsculpture also forms, in the section to the preceding the lip, weak and irregular spiral lines.

The teleoconch has 1.9 markedly disjunct whorls, situated almost at the same level as the protoconch except for the last whorl which protrudes adapically. The whorls are connected only through the peripheral edge of the lamellae; the last half whorl is divergent and increasingly disjunct.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are slightly tilted, not equidistant and obliquely circling the whorls; their edge is irregular; 15 lamellae are observed on the first whorl and 37-38 on the last one, with growth lines in the interspaces. Adapically and abapically, a thick spiral cord (carina) forms a spiral series of nodules at the intersections with the axial lamellae, at each side, delimiting the periphery.

The aperture is oval, with a continuous peristome. The outer lip has a thin edge, not modified by the spiral cords.

Dimensions: the holotype is 5.1 mm in maximum diameter and 2.04 mm in height of aperture (H/D: 0.4). The paratype figured is 4.1 mm in maximum diameter and 2.0 mm in the height of the aperture (H/D: 0.49).

Habitat: Bathyal species dredged at 996-1037 m deep.

Distribution: Only known from the type locality.

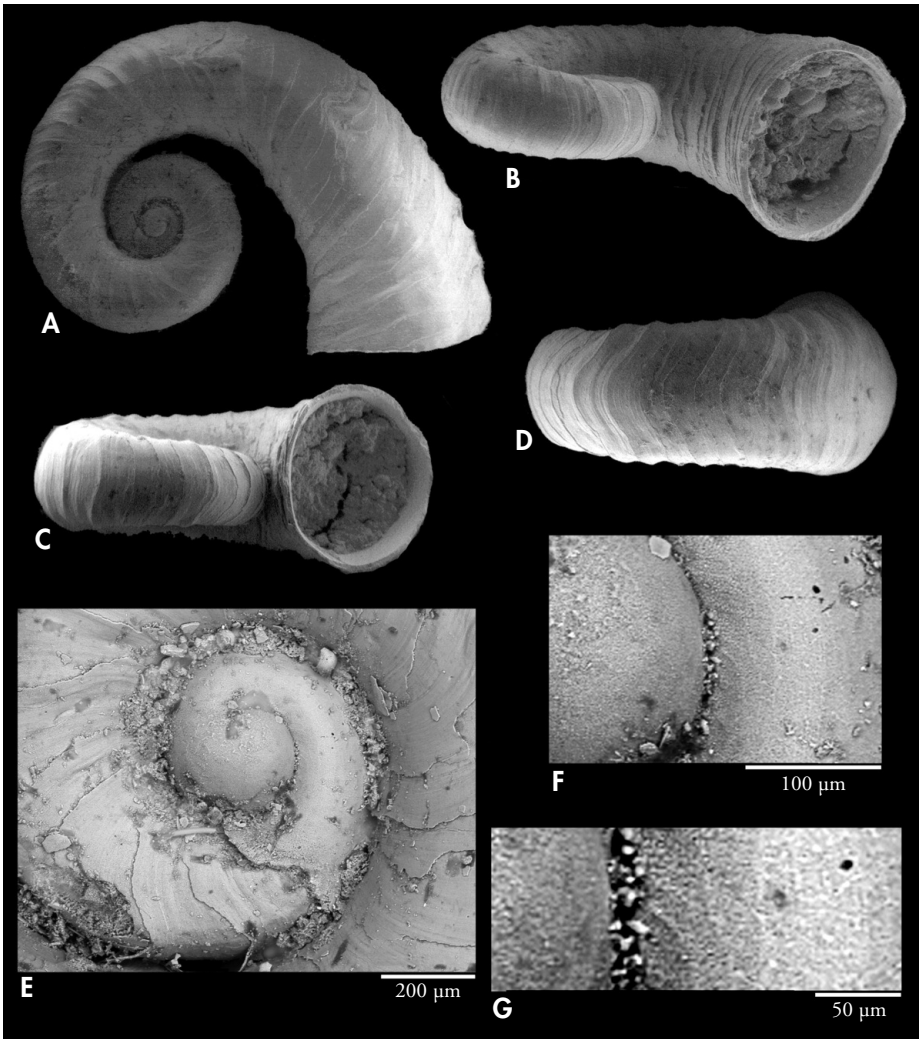

Figure 17. *Lyocyclus disjunctionis* n. sp. Philippines, 14°56'N, 124°9'E, 996-1037 m. A, B: holotype, diameter 5.1 mm (MNHN); C, D: paratype, diameter 4.1 mm (MNHN); E: protoconch of the holotype; F, G: microsculpture and detail.

Figura 17. Lyocyclus disjunctionis *n. sp. Filipinas, 14°56'N, 124°9'E, 996-1037 m. A, B: holotipo, diámetro 5,1 mm (MNHN); C, D: paratipo, diámetro 4,1 mm (MNHN); E: protoconcha del holotipo; F, G: microescultura y detalle.*

Remarks: *Lyocyclus disjunctionis* n. sp., like the preceding species *L. juanchii* n. sp. is characterized by a strongly increasing divergence of the spire in the last quarter of whorl.

Lyocyclus intortus n. sp. differs by its short and very bulbous protoconch, sculptured with irregular granules and by its 1-2 nodulous carinae which delimit the periphery.

L. juanchii n. sp. differs by the larger protoconch (746 µm vs 620 µm) and by its totally disjunct shell whorls.

Lyocyclus intortus n. sp. (Figure 18)

urn: lsid: zoobank.org: act: 1c891464-1680-4aa4-8600-7c1ce96fb36c

Type material: *Holotype*, PHILIPPINES • 1 s (Figs. 18A, B); 14°58'N, 123°3'E; 1071-1147 m; 24 May 2007; AURORA 2007 Stn CP2690; MNHN, IM-2000-35442. *Paratypes*, PHILIPPINES • 14 s (Fig. 18C); same data as for holotype; MNHN, IM-2000-35443.
Material examined (15 s): the type material.
Type locality: Philippines, 14°58'N, 123°3'E, 1071-1147 m.
Etymology: The specific name derives from the Latin verb *intorqueo*, which means "to twist" referring to the form of the protoconch.

Description: Shell small (<5.00 mm), nearly planispiral, formed by three disjunct whorls.

The protoconch has a single whorl and a maximum diameter of about 620 μm. It begins with a rounded, mammillate nucleus, which is 257 μm in diameter; then, it is coiled and terminates in a lip which is neither thickened not flaring. It is covered by numerous randomly scattered pores and sculptured by small and irregular granules that often interconnect to form a net-like pattern, and the surface is wrinkled.

The teleoconch has two disjunct whorls and its periphery is convex; its coiling is nearly planispiral and placed at the same level as the protoconch.

The whorls are connected only at some points through the peripheral edge of the lamellae; the last half whorl is disconnected from the previous ones.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are slightly inclined, not equidistant and obliquely circling the whorls; their edge is irregular; the peripheral edge of the lamellae on the first whorl is high and shaped like a nail; 15 lamellae are observed on the first whorl and 29 on the last one, with growth lines in the interspaces. Starting on the first whorl, on both adapical and abapical sides, a thick spiral cord (carina) appears and forms nodules at the intersections with the axial lamellae; on the last quarter of whorl a second cord appears, forming 1-2 spiral series of nodules at each side, which delimit the periphery.

The aperture is oval, with continuous peristome. The outer lip is thin with its edge not modified by the spiral cords.

Dimensions: The holotype is 4.73 mm in maximum diameter. The paratype figured is 3.37 mm and 1.40 mm in apertural height. (H/D: 0.41).

Habitat: Bathyal species dredged at 1071-1147 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus intortus* n. sp. is characterized by its short and very bulbous protoconch, sculptured with irregular granules that often interconnect to form a net-like pattern and by its 1-2 nodulous carinae that delimit the periphery.

L. juanchii n. sp. differs by the larger protoconch (746 μm vs 620 μm) and by its more markedly disjunct shell whorls.

L. disjunctionis n. sp. differs because its disjunction is markedly increasing on the last quarter of the spire.

Lyocyclus fijiensis n. sp. (Figure 19)

urn: lsid: zoobank.org: act: 164a22a0-9555-4836-b04c-c522a20501f7

Type material: *Holotype*, FIJI • 1 s (Figs. 19A, B); SE Viti Levu; 18°00'S, 178°54'E; 1058-1091 m; 13 Aug. 1998; MUSORSTOM 10 Stn CP1361; MNHN, IM-2000-35444. *Paratypes*, FIJI • 15 s; same data as for holotype; MNHN, IM-2000-35445.
Material examined (16 s): the type material.

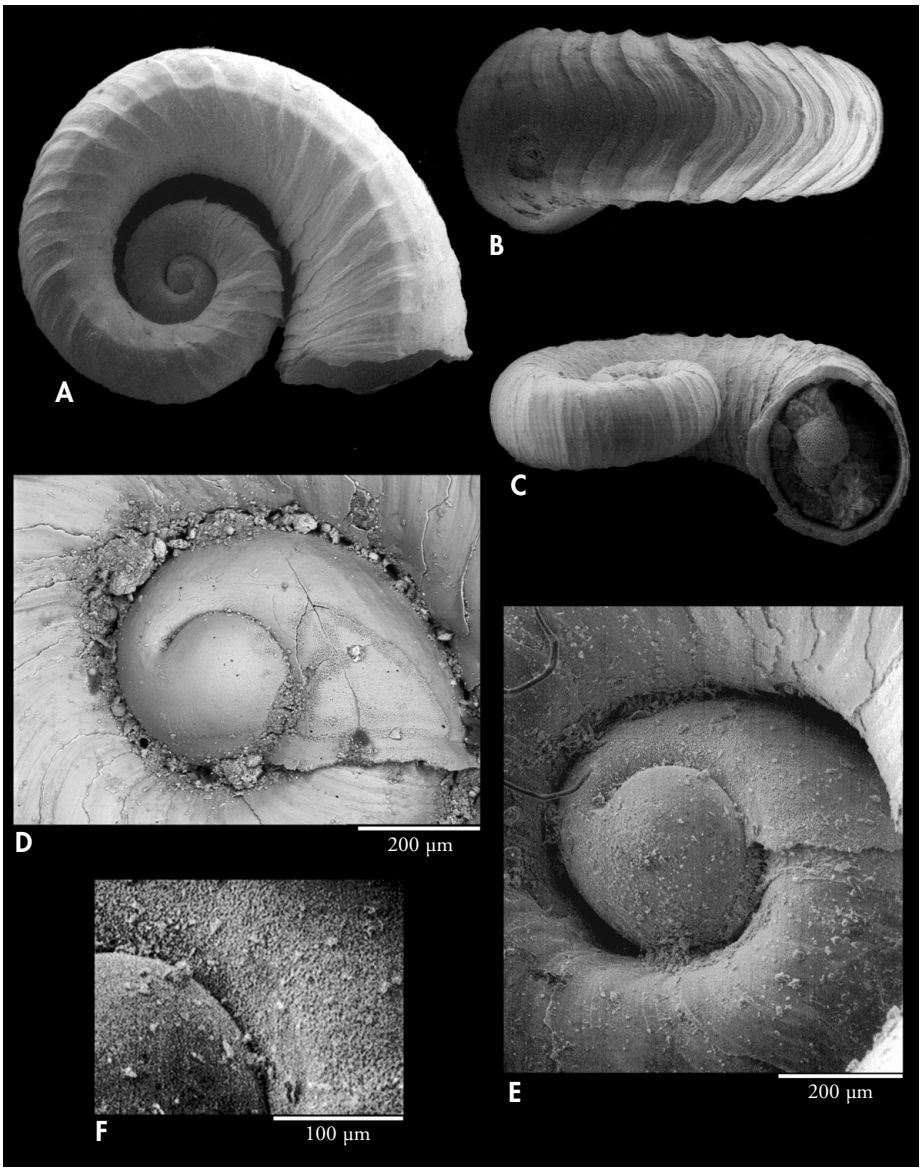

Figure 18. *Lyocyclus intortus* n. sp. Philippines, 14°58'N, 123°3'E, 1071-1147 m. A, B: holotype, diameter 4.73 mm (MNHN); C: paratype, 3.37 mm (MNHN); D: protoconch of the paratype; E, F: protoconch of the holotype and microsculpture.
Figura 18. Lyocyclus intortus *n. sp. Filipinas, 14°58'N, 123°3'E, 1071-1147 m. A, B: holotipo, diámetro 4,73 mm (MNHN); C: paratipo, 3,37 mm (MNHN); D: protoconcha del paratipo; E, F: protoconcha del holotipo y microescultura.*

Type locality: Fiji, SE Viti Levu, 18°00′S, 178°54′E, 1058-1091 m.
Etymology: The specific name is referred to the archipelago where the species was collected.

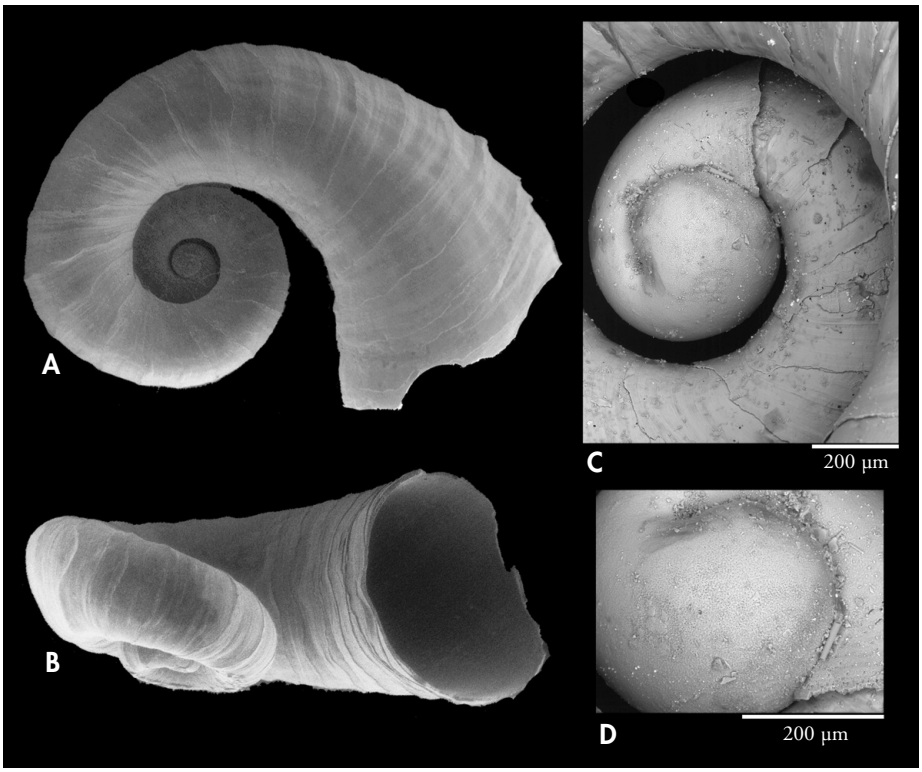

Figure 19. *Lyocyclus fijiensis* n. sp. Fiji, SE of Viti Levu, 18°00.0'S, 178°54'E, 1058-1091 m. A, B: holotype, diameter 7.57 mm (MNHN); C, D: protoconch and microsculpture.
Figura 19. Lyocyclus fijiensis *n. sp. Fiji, SE de Viti Levu, 18°00.0'S, 178°54'E, 1058-1091 m. A, B: holotipo, diámetro 7,57 mm (MNHN); C, D: protoconcha y microescultura.*

Description: Shell small (<8.00 mm), loosely coiled, formed by 2.9 disjunct whorls.

The protoconch has some less than one whorl and a maximum diameter of 685 μm. It begins with a rounded, mammillate nucleus, which is 330 μm in diameter and represents 48 % of the total diameter of the protoconch; then, it is coiled and terminates in a slightly flaring lip. It is sculptured by small, irregular, star-shaped granules that often interconnect to form a net-like pattern and by numerous randomly scattered pores that cover the entire surface.

The teleoconch has two loosely disjunct whorls; the first half whorl is at the same level as the protoconch, then the spire rises adapically. The first teleoconch whorl is wholly disjunct from the protoconch; then the teleoconch is connected by axial lamellae to the next whorl, and finally becomes completely deviating in the last quarter whorl.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords. The lamellae are not equidistant, obliquely circling the whorls and slightly procumbent, mainly in the middle area of the periphery of the last half whorl; their edge is irregular both adapically and abapically; 14 lamellae are observed in the first whorl and 21-23 in the last, with growth lines in the interspaces. There are four spiral cords on the periphery, which bulge on the edge of the lamellae.

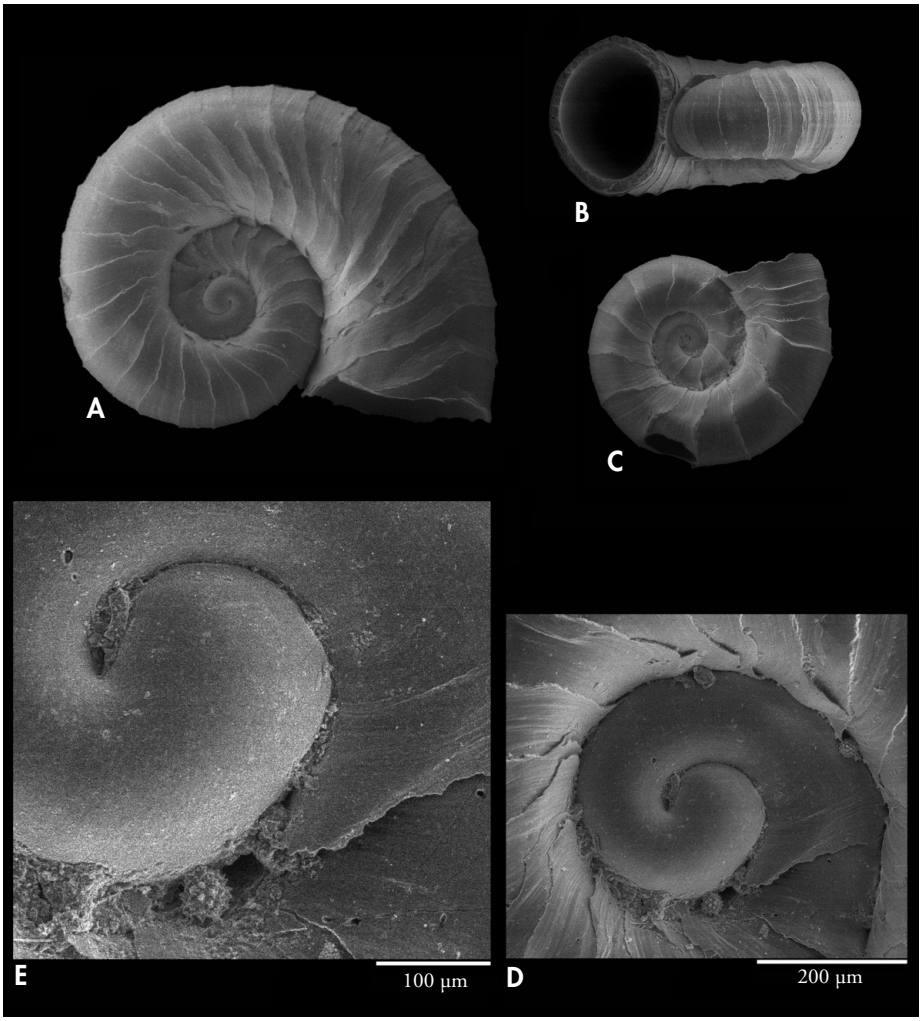

Figure 20. *Lyocyclus circuitus* n. sp. Fiji, E Viti Levu, 17°31'S, 178°53'E, 879-897 m. A: holotype, 3.28 mm (MNHN); B, C: paratypes, diameter 1.66 and 1.6 mm, MNHN; D, E: protoconch of the holotype and detail.

Figura 20. Lyocyclus circuitus *n. sp. Fiji, E de Viti Levu, 17°31'S, 178°53'E, 879-897 m. A: holotipo, 3,28 mm (MNHN); B, C: paratipos, diámetro 1,66 y 1,6 mm, MNHN; D, E: protoconcha del holotipo y detalle.*

The aperture is nearly circular, with a continuous peristome. The outer lip is thin with the edge not modified by the spiral cords.

Dimensions: the holotype is 7.57 mm in maximum diameter.

Habitat: Bathyal species dredged at 1058-1091 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus fijiensis* n. sp. is characterized by its protoconch with a large nucleus, representing 48 % of its diameter; by the cordlets above and below periphery and by its strongly disjunct last half whorl.

Lyocyclus circuitus n. sp. (Figure 20)

urn: lsid: zoobank.org: act: 9cfa15a1-225b-4b03-929a-b5733d28d64e

Type material: *Holotype*, FIJI • 1 s (Fig. 20A); E Viti Levu; 17°31'S, 178°53'E; 879-897 m; 12 Aug. 1998; MUSORSTOM 10 Stn CP1353; MNHN, IM-2000-35446. *Paratypes*, FIJI • 2 s (Figs. 20B-C); same data as for holotype; MNHN, IM-2000-35447.
Material examined (3 s): the type material.
Type locality: Fiji, E Viti Levu, 17°31'S, 178°53'E, 879-897 m.
Etymology: The specific name is from the Latin word *circuitus*, which means "circle" alluding its very round form.

Description: Shell small (<3.50 mm), nearly planispiral, formed by 2.7 hardly disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 410 μm. It begins with a rounded, mammillate nucleus, which is 129 μm in diameter; then it is coiled and terminates with a slightly flaring lip, which covers the initial part of the teleoconch. All surface is sculptured by small, irregular granules that often interconnect to form net-like pattern and covered by numerous randomly scattered pores.

The teleoconch has 1.7 disjunct whorls starting beneath the protoconch lip, and situated at the same level as the protoconch; the whorls are very slightly disjunct, connected mainly along the lamellae, which completely circle the whorls.

Ornamentation is formed by axial lamellae and marked growth lines. There are 37 lamellae, 22 of which on the last whorl, with marked growth lines in the interspaces. The lamellae are equidistant, sigmoidal both adapically and abapically, their edge is irregular and continues all around the whorls; they are more conspicuous on the first half whorl. On the periphery of the whorl, the edges of the lamellae form small nail-like projections.

The aperture has a continuous peristome, nearly oval except for a short flattened inner lip. The outer lip is protruding.

Dimensions: the holotype is 3.28 mm in diameter

The larger paratype is 1.54 mm in diameter and 0.80 mm in height of aperture (H/D: 0.52).

Habitat: Bathyal species dredged at 879-897 m deep.

Distribution: Only known from Fiji, SE Viti Levu, its type locality.

Remarks: *Lyocyclus horroi* n. sp. is characterized by a small protoconch a really planispiral coiling without a disjunct part, and by having about 24 inclined and slightly elevated, squamate axial ribs on the last whorl.

Lyocyclus horroi n. sp. (Figure 21)

urn: lsid: zoobank.org: act: b8304173-e066-4640-bd93-eb78c1aa4dee

Type material: *Holotype*, FIJI • 1 s (Figs. 21A, B); Bligh Water; 16°56'S, 178°08'E; 640-687 m; 08 Aug. 1998; MUSORSTOM 10: Stn CP1332; MNHN, IM-2000-35448. *Paratypes*, FIJI • 33 s (Fig. 21C); same data as for holotype; MNHN, IM-2000-35449.
Material examined (34 s): the type material.
Type locality: Fiji, Bligh Water, 16°56'S, 178°08'E, 640-687 m.
Etymology: The species name is after the malacologist Juan Horro from Vigo, for his important contribution to the study of the Turridae.

Description: Shell small (<3.50 mm), solid, nearly planispiral, formed by 2.5 disjunct whorls.

The protoconch has almost one whorl and its maximum diameter is about 720 μm.

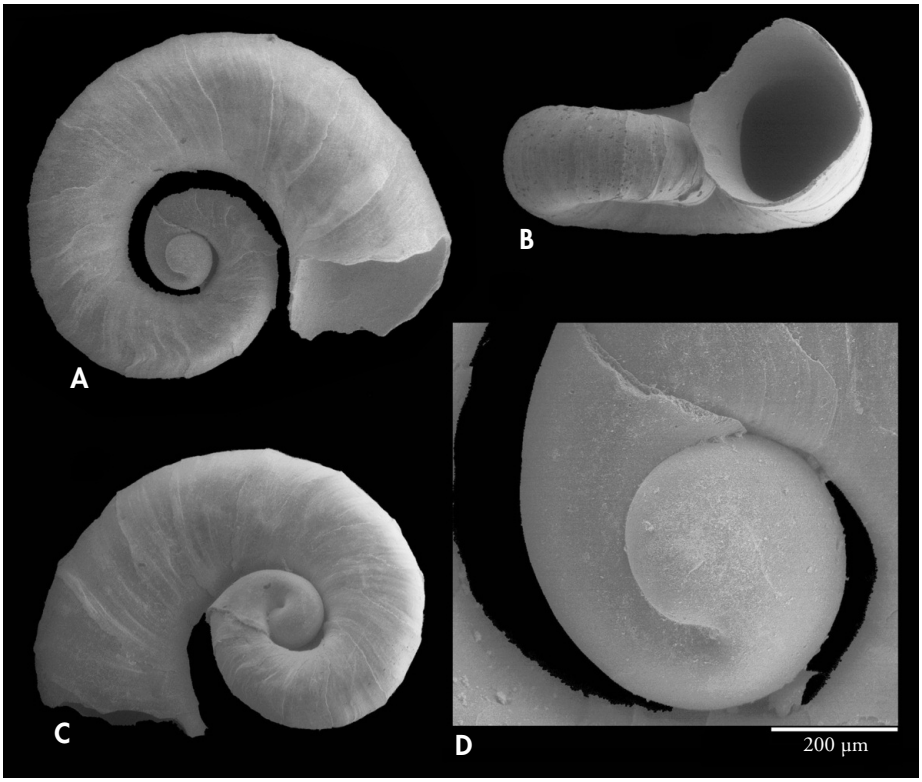

Figure 21. *Lyocyclus horroi* n. sp. Fiji, Bligh Water, 16°56'S, 178°08'E, 640-687 m. A, B: holotype, diameter 3.25 mm (MNHN); C: paratype, diameter 2.81 mm (MNHN); D: protoconch of the holotype.

Figura 21. Lyocyclus horroi *n. sp. Fiji, Bligh Water, 16°56'S, 178°08'E, 640-687 m. A, B: holotipo, diámetro 3,25 mm (MNHN); C: paratipo, diámetro 2,81 mm (MNHN); D: protoconcha del holotipo.*

It begins with a rounded, large mammillate nucleus, which is about 300 µm in diameter. Then, it is coiled and terminates with a slightly flaring lip. The surface is sculptured by very small, irregular granules and numerous randomly scattered pores.

The teleoconch has 1.5 whorls and starts beneath the protoconch lip; the coiling is completely disjunct since the beginning of the protoconch, with teleoconch whorls placed at the same level as the protoconch; there is no point of contact of the lamellae with the preceding whorl.

Ornamentation is formed by axial lamellae and growth lines. The lamellae are slightly sigmoidal, and their edge is irregular; there are 19 lamellae, 15 of which on the last whorl, with faint growth lines in the interspaces. No trace of spiral cords or carinae.

The aperture is rounded, with a continuous peristome. The outer lip has smooth edge, not angulated.

Dimensions: the holotype is 3.25 mm in maximum diameter and 1.2 mm in height of the aperture (H/D: 0.39).

Habitat: Bathyal species dredged at 640-687 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus horroi* n. sp. is characterized by the large mammillate nucleus and by its totally disjunct teleoconch whorls.

Lyocyclus levilicii n. sp. (Figures 22, 23)

urn: lsid: zoobank.org: act: a472616e-3852-4b2f-b646-12bbcae2a674

Type material: *Holotype*, FIJI • 1 s (Fig. 22A); Bligh Water; 17°16'S, 178°15'E; 656-660 m; 05 Aug. 1998; MUSORSTOM 10 Stn DW1314; MNHN, IM-2000-35450. *Paratypes*, FIJI • 5 s; same data as for holotype; MNHN, IM-2000-35451.
Material examined (19 s): the type material and FIJI • 1 s; Bligh Water, 17°10'S, 177°56'E; 567-699 m; 08 Aug. 1998; MUSORSTOM 10 Stn CP1330; MNHN • 2 s; Bligh Water; 17°02'S, 178°02'E; 694-703 m; 08 Aug. 1998; MUSORSTOM 10 Stn CP1331; MNHN • 2 s, Lau Ridge, Yangasa Cluster; 19°03'S, 178°30'W; 700-707 m; 10 Mar. 1999; BORDAU 1 Stn DW1485; MNHN. NEW CALEDONIA • 7 s; Ile des Pins; 23°09'S, 167°27'E; 1004-1009 m; 04 Nov. 2003; NORFOLK 2 Stn DW2144; MNHN • 1 s, Loyalty Basin; 21°31.04'S, 166°24.15'E; 960 m; 12 Apr. 1987; BIOGEOCAL Stn KG228; MNHN.
Type locality: Fiji, Bligh Water, 17°16'S, 178°15'E, 656-660 m.
Etymology: The specific name is formed by the fusion of the two Latin words: *levis, e*, "light" and *licium, ii*, which means "a cordlet" alluding to the very faint spirals in this species.

Description: Shell small (<4.50 mm), nearly planispiral, formed by 2.7 loosely disjunct whorls.

The protoconch has a single whorl and a maximum diameter of 730 μm. It begins with a rounded, mammillate nucleus, which is 240 μm in diameter; then it is coiled and terminates with a strongly flaring, funnel-shaped lip which covers the initial part of the teleoconch. The entire surface is sculptured by small, irregular granules that often interconnect to form net-like pattern and covered by numerous randomly scattered pores.

The teleoconch has 1.7 disjunct whorls starting beneath the protoconch lip; the whorls are hardly disjunct around the protoconch, connected mainly along the lamellae, which completely circle the whorls.

Ornamentation is formed by axial lamellae, spiral cords and marked growth lines. There are 29 lamellae, 19 of which in the last whorl, with marked growth lines in the interspaces. The lamellae are equidistant, develop sigmoidally both adapically and abapically, and their edges are irregular; they are more conspicuous on the first half whorl and less so on the last; on the periphery of the whorl, their edges form small nail-like projections. On the periphery, 3-4 very faint spiral cords are observed.

The aperture is almost circular, with a continuous peristome. The outer lip is protruding.

Dimensions: the holotype size is 4.12 mm in diameter and 1.52 mm in the apertural height (H/D: 0.40).

Habitat: Bathyal species dredged between 657-707 m deep in Fiji and between 960-1009 m in New Caledonia.

Distribution: Only known from Fiji Island and New Caledonia.

Remarks: *Lyocyclus levilicii* n. sp. is very similar to *Lyocyclus circuitus* n. sp., from which it differs by the larger size of its protoconch (730 μm *vs* 410 μm), by the smaller number of lamellae (29 *vs* 37) and because the labial edge of the protoconch is funnel-shaped and strongly flaring.

Lyocyclus valdesquameus n. sp. (Figure 24)

urn: lsid: zoobank.org: act: ca41d4b2-98e9-433e-bb3f-e11ac1e0d500

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 24A, B); off Toupeti; 21°44'S, 166°38'E; 384-385 m; 05 Sep. 2011; EXBODI Stn CP3810; MNHN, IM-2000-35452. *Paratypes*, NEW CALEDONIA • 2 s (Figs. 24C-D); same data as for holotype; MNHN, IM-2000-35453.
Material examined (13 s): the type material and NEW CALEDONIA • 8 s; 21°31'S, 166°19'E; 450 m; 04 Apr. 2011; EXBODI Stn DW3797; MNHN • 1 s; Loyalty Basin; 21°31'S, 166°21'E; 330 m; 16 Apr. 1987; BIOGEOCAL Stn KG252; MNHN • 1 s; East coast; 21°02'S, 165°38'E; 350-400 m; 18 Mar. 1993; BATHUS 1 Stn DE705; MNHN.

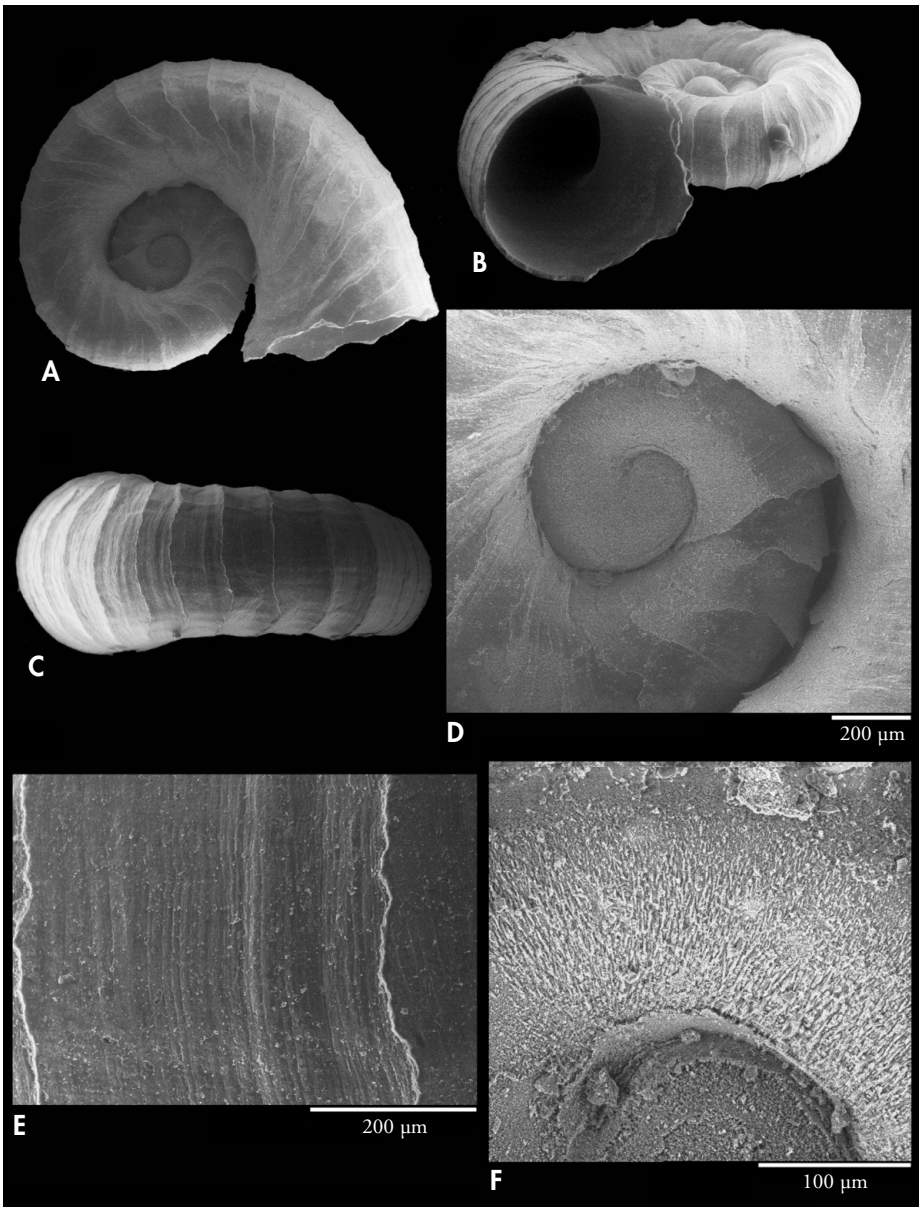

Figure 22. *Lyocyclus levilicii* n. sp. Fiji, Bligh Water, 17°16'S, 178°15'E, 656-660 m. A-C: holotype, diameter 4.12 mm (MNHN); D, E: protoconch and detail; F: detail of the sculpture.
Figura 22. Lyocyclus levilicii *n. sp. Fiji, Bligh Water, 17°16'S, 178°15'E, 656-660 m. A-C: holotipo, diámetro 4,12 mm (MNHN); D, E: protoconcha y detalle; F: detalle de la escultura.*

Type locality: New Caledonia, off Toupeti, 21°44′S, 166°38′E, 384-385 m.
Etymology: The specific name is formed by the fusion of two Latin whorls: *valde* ("very much") and *squameus* ("plenty of scales") alluding its sculpture.

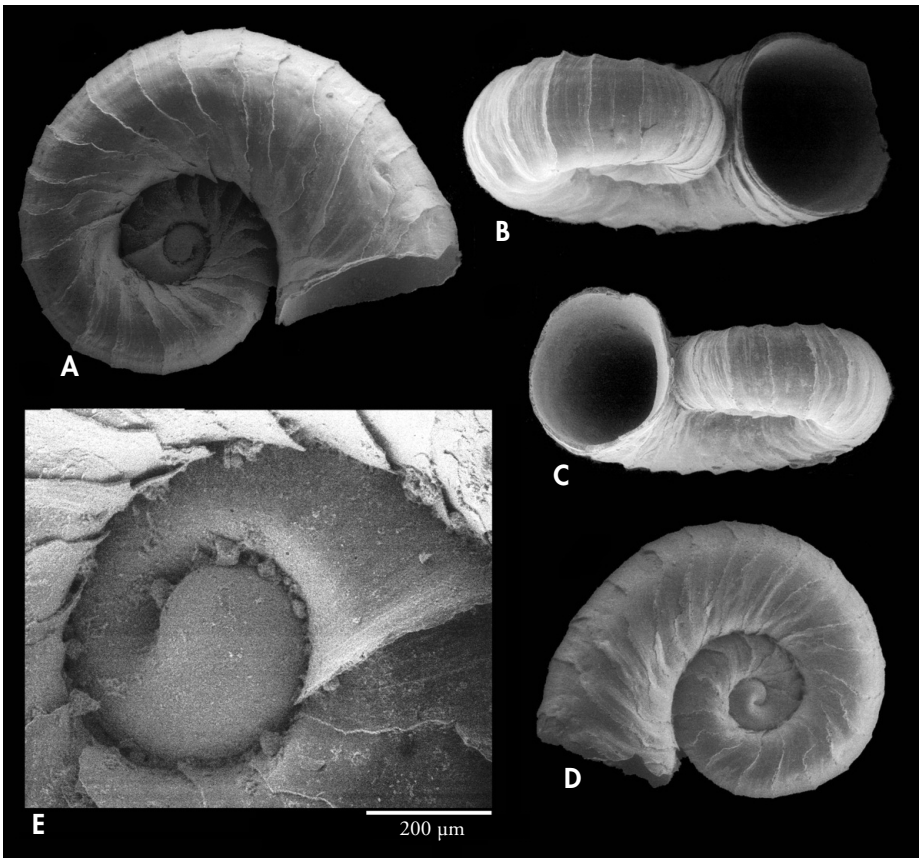

Figure 23. *Lyocyclus levilicii* n. sp. Fiji, Lau Ridge, 19°03'S, 178°30'W, 700-707 m; A, B: shell, diameter 3.75 mm; C, D: shell, 2.85 mm; E: protoconch.
Figura 23. Lyocyclus levilicii *n. sp. Fiji, Cresta de Lau, 19°03'S, 178°30'W, 700-707 m. A, B: concha, diámetro 3,75 mm; C, D: concha, 2,85 mm; E: protoconcha.*

Description: Shell small (<3.25 mm), nearly planispiral, formed by 2.8 disjunct whorls, carinate above and below the periphery.

The protoconch has a single whorl and a maximum diameter of about 567 μm; it begins with a rounded, not mammillate nucleus, which is 167 μm in diameter and whose rough surface is completely covered by randomly scattered pores. Then, it is coiled and develops a central ridge that smoothly angles the protoconch and ends on a distinctly flaring, but not thickened lip; growth lines are seen next to the lip.

The teleoconch has 1.8 disjunct whorls and its periphery is delimited by two thick spiral cords (carinae), one adapical and the other basal.

The whorls are very disjunct, connected mainly along the lamellae, which completely circle the whorls; on the first half whorl the lamellae are the only contact point with the subsequent whorl; the last quarter of whorl is strongly divergent and completely disconnected from the previous one.

Ornamentation is formed by oblique axial lamellae, marked growth lines and the spiral carinae. The lamellae are equidistant, develop obliquely both adapically and abapically; their edge is irregular and they are more conspicuous on the first half whorl and less so on the last one. On the

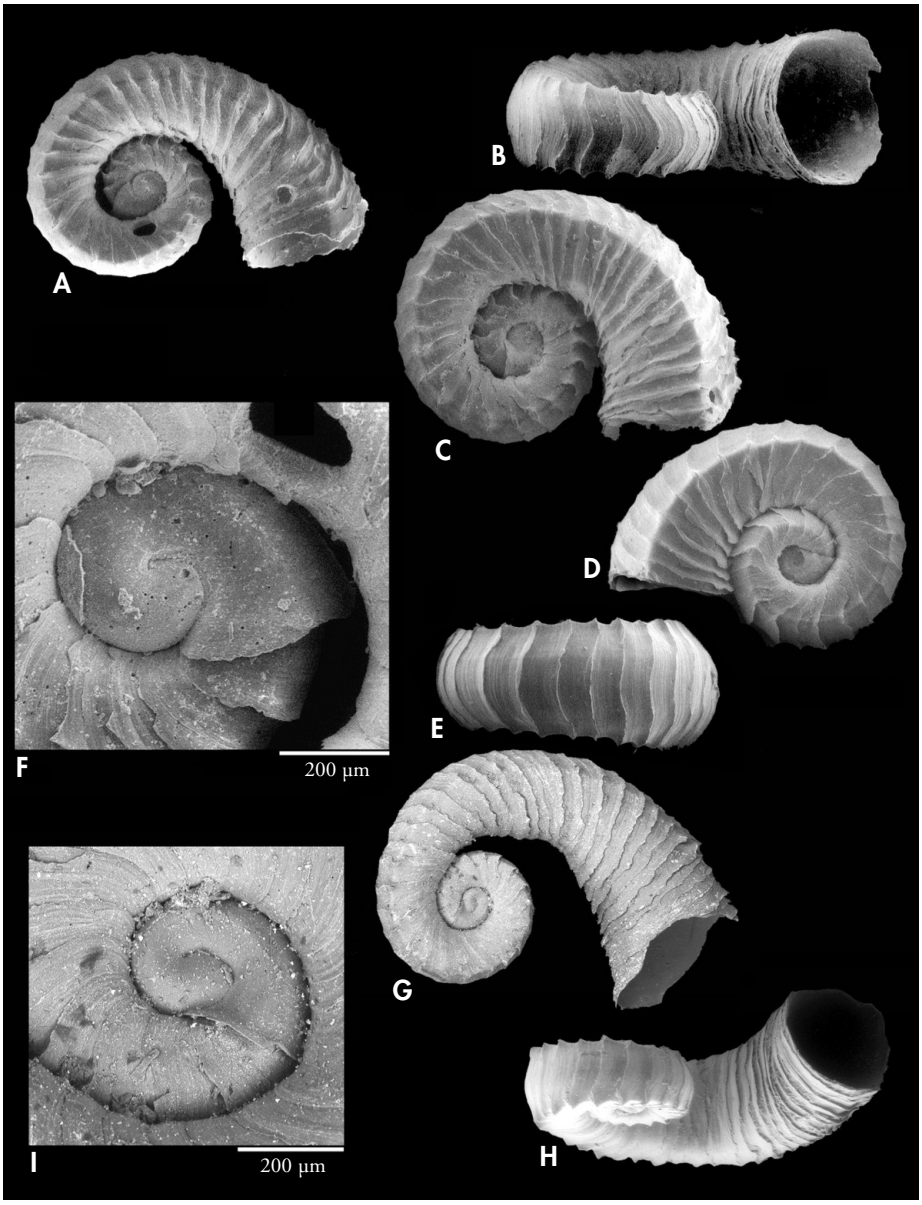

Figure 24. A-F. *Lyocyclus valdesquameus* n. sp. New Caledonia, off Toupeti, 21°44'S, 166°38'E, 384-385 m. A, B: holotype, diameter 3.06 mm (MNHN); C: paratype, diameter 3.18 mm, same locality (MNHN); D, E: paratype, diameter 2.64 mm, same locality (MNHN); F: protoconch of the holotype. G-I. *Lyocyclus* cf. *valdesquameus*, New Caledonia, East coast, 350-400 m. G, H: shell, 3.24 mm (MNHN); I: protoconch.

Figura 24. A-F. Lyocyclus valdesquameus *n. sp. Nueva Caledonia, fuera de Toupeti, 21°44'S, 166°38'E, 384-385 m. A, B: holotipo, diámetro 3,06 mm (MNHN); C: paratipo, diámetro 3,18 mm, misma localidad (MNHN); D, E: paratipo, diámetro 2,64 mm, misma localidad (MNHN); F: protoconcha del holotipo. G-I.* Lyocyclus *cf.* valdesquameus, *Nueva Caledonia, costa Este, 350-400 m. G, H: concha, 3.24 mm (MNHN); I: protoconcha.*

periphery of the first half whorl, their edge forms a strong nail-like projection; 12 lamellae are observed on the first whorl and 30 on the last one, with growth lines in the interspaces.

The aperture is oval, laterally expanded, with a continuous peristome, not angled by the termination of spiral carinae. The outer lip is thin with s smooth edge, not modified by the spiral cords (carinae).

Dimensions: the holotype is 3.06 mm in maximum diameter and 1.19 mm in the height of the aperture (H/D: 0.40).

Habitat: Bathyal species dredged at 330-450 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus valdesquameus* n. sp. differs from other species, as *L. elephantus* n. sp. and *L. microtuber* n. sp., in that the nucleus of the protoconch is flattened, not mammillate.

The specimen from DE705 station has similar morphological features, however its protoconch is smaller (473 μm vs 567 μm), also the nucleus (115 μm vs 157 μm); finally, the carinae delimiting the periphery, are inconspicuous starting on the first whorl of the teleoconch.

Lyocyclus elephantus n. sp. (Figure 25)

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Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 25A, B); 22°18'S, 167°15'E; 425-430 m; 22 May 1978; VAUBAN 1978-1979 Stn DR02; MNHN, IM-2000-35454. *Paratype*, NEW CALEDONIA • 1 s (Fig. 25C); same data as for holotype; MNHN, IM-2000-35455.
Material examined (2 s): the type material.
Type locality: New Caledonia, 22°18'S, 167°15'E, 425-430 m.
Etymology: The specific name (*elephantus*) alludes to the similarity of the shell with a coiled elephant's trunk.

Description: Shell small (<4 mm), nearly planispiral, formed by 2.7 disjunct whorls, peripherally carinate.

The protoconch has a single whorl and a maximum diameter of about 625 μm; it begins with a rounded, mammillate nucleus, which is 170 μm in diameter. Then, it develops a rounded ridge, which is closer to the nucleus than to the outer suture, and terminates with a flaring, funnel-shaped lip which covers the initial part of the teleoconch; growth lines are seen next to the lip. The entire surface is covered by randomly scattered pores and small, apparently aligned, tubercles mainly concentrated in the sutural zone.

The teleoconch, starting beneath the protoconch lip, has 1.7 disjunct whorls and there are two thick spiral cords (carinae), one adapical and another basal, which angle and delimit the periphery. The whorls are disjunct, connected mainly along the lamellae, which completely circle the whorls; on the first whorl, the lamellae are the only contact point with the subsequent whorl; the last quarter of the whorl strongly deviates and is disconnected from the previous whorl.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords (carinae). The lamellae are equidistant, develop obliquely both adapically and basally, their edge is irregular; they are more conspicuous on the first whorl and less so on the last one. On the periphery of the first half whorl, their edge forms a strong nail-like projection, then the edge becomes less prominent; 35 lamellae are observed, 25 of which are on the last whorl, with growth lines in the interspaces. The lamellae form a more or less prominent angle at their intersection with the carinae.

The aperture is oval, taller than wide, laterally expanded, with a continuous peristome. The outer lip is thin with a smooth edge, not modified by the carinae.

Dimensions: the holotype is 3.7 mm in maximum diameter and 1.77 mm in the height of the aperture (H/D: 1.09).

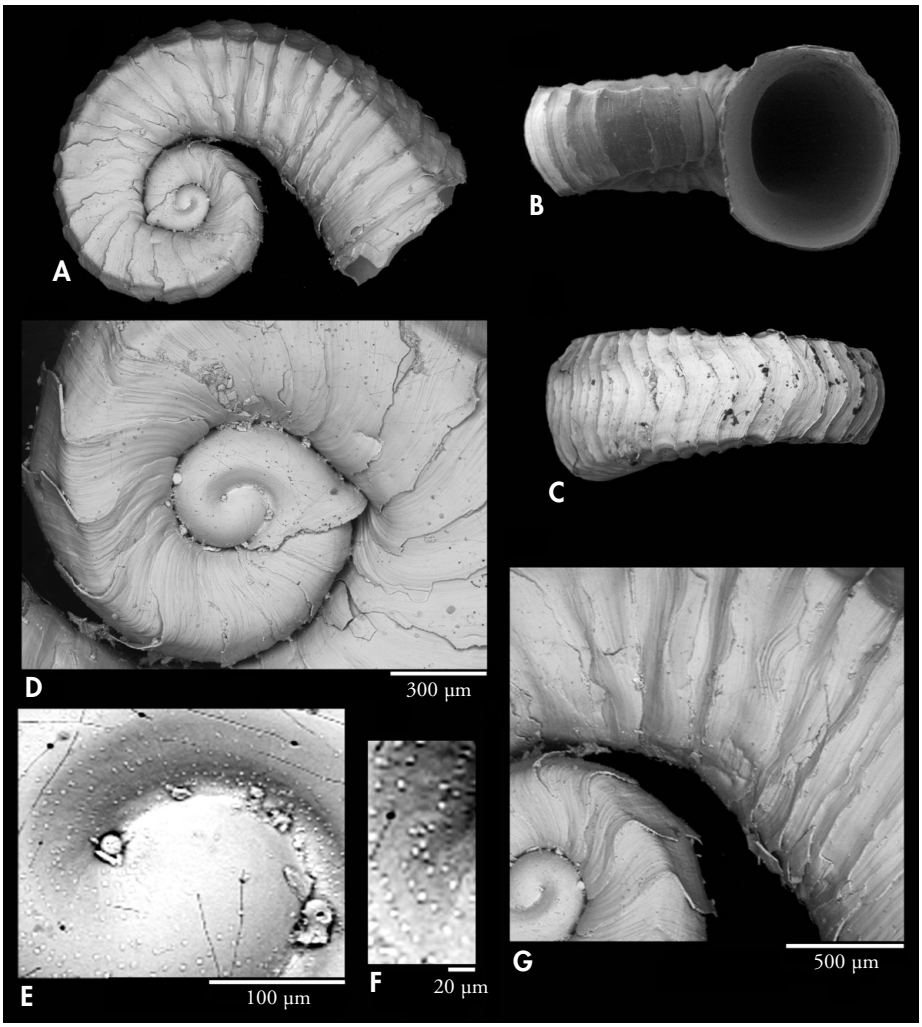

Figure 25. *Lyocyclus elephantus* n. sp. New Caledonia, 22°18'S, 167°15'E, 425-430 m. A, B: holotype, 3.7 mm (MNHN); C: paratype, 2.97 mm (MNHN); D-F: protoconch, detail and microsculpture; G: detail of the sculpture of the teleoconch.

Figura 25. Lyocyclus elephantus *n. sp. Nueva Caledonia, 22°18'S, 167°15'E, 425-430 m, A, B: holotipo, 3,7 mm (MNHN); C: paratipo, 2,97 mm (MNHN); D-F: protoconcha, detalle y microescultura; G: detalle de la escultura de la teleoconcha.*

Habitat: Bathyal species dredged at 425-430 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus elephantus* n. sp. is characterized by the rounded ridge of its protoconch, which is situated close to the suture.

Lyocyclus microtuber n. sp. differs by the completely disjunct shell coiling, the central position of the ridge on the protoconch, and the dense and very fine ornamentation of the protoconch.

Lyocyclus valdesquameus n. sp. differs in that nucleus of the protoconch is flattened, not mammillate.

Lyocyclus microtuber n. sp. (Figure 26)

urn: lsid: zoobank.org: act: d166dc65-fcf3-46eb-8d24-00e9754a4f14

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 26A, B); off Passe d'Ouenou; 22°00'S, 167°01'E; 300-302 m; 08 Sep. 2011; EXBODI Stn CP3828; MNHN, IM-2000-35485. *Paratype*, NEW CALEDONIA • 1 s (Figs. 26C-D); same data as for holotype; MNHN, IM-2000-35486.
Material examined (3 s): the type material and NEW CALEDONIA • 1 s, off Passe d'Ounia; 21°57'S, 166°57'E; 220-232 m; 08 Sep. 2011; EXBODI Stn CP3827; MNHN.
Type locality: New Caledonia, off Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m.
Etymology: The specific name alludes the very small granules and spiral lines of the protoconch.

Description: Shell small (<3.50 mm), nearly planispiral, formed by about 2.9 disjunct whorls, peripherally bicarinate.

The protoconch has a single whorl and a maximum diameter of about 545 μm; it begins with a rounded, mammillate nucleus, which is 146 μm in diameter; then, it develops a central ridge, which slightly angles the protoconch; the protoconch terminates with a flaring, funnel-shaped lip which covers the initial part of the teleoconch. Its surface is sculptured by small, irregular granules, that often interconnect to form net-like pattern and covered by numerous randomly scattered, small and aligned nodules forming spiral threads. That is also observed on the nucleus and on the ridge.

The teleoconch, starting beneath the protoconch lip, has 1.8 disjunct whorls and there are two thick spiral cords (carinae), one adapical and the other one basal, forming angles which delimit the periphery.

The whorls are disjunct, being connected mainly along the lamellae, which continuously circle the whorls; on the first whorl, the lamellae are the only contact point with the subsequent whorl; the last quarter whorl is strongly deviating and disconnected from the previous whorl.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords (carinae). The lamellae are equidistant, develop obliquely both adapically and basally; their edge is irregular and continuous all around the whorls; they are more conspicuous on the first whorl and less so on the last; on the periphery of the first half whorl, their edge protrudes to form like a strong nail-like projection, then the edge becomes less prominent; 43 lamellae are observed, 32 of which on the last whorl, with growth lines in the interspaces. A thick spiral cord on each side delimits the periphery and, at the point of crossing, the lamellae form pointed tubercles.

The aperture is rounded, as high as wide, with a continuous peristome. The outer lip is thin with a smooth edge, not modified by the spiral carinae.

Dimensions: the holotype is 3.32 mm in maximum diameter; the paratype is 2.68 mm in maximum diameter and 1.07 mm in the height of the aperture (H/D: 0.40).

Habitat: Bathyal species dredged at 220-302 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus microtuber* n. sp. is characterized by the completely disjunct shell coiling, the central position of the ridge on the protoconch, and by the dense and very fine ornamentation of the protoconch.

Lyocyclus elephantus n. sp. differs in having the ridge on its protoconch closer to the suture.

Lyocyclus valdesquameus n. sp. differs in that the nucleus of the protoconch is flattened, not mammillate.

Lyocyclus similis n. sp. (Figure 27)

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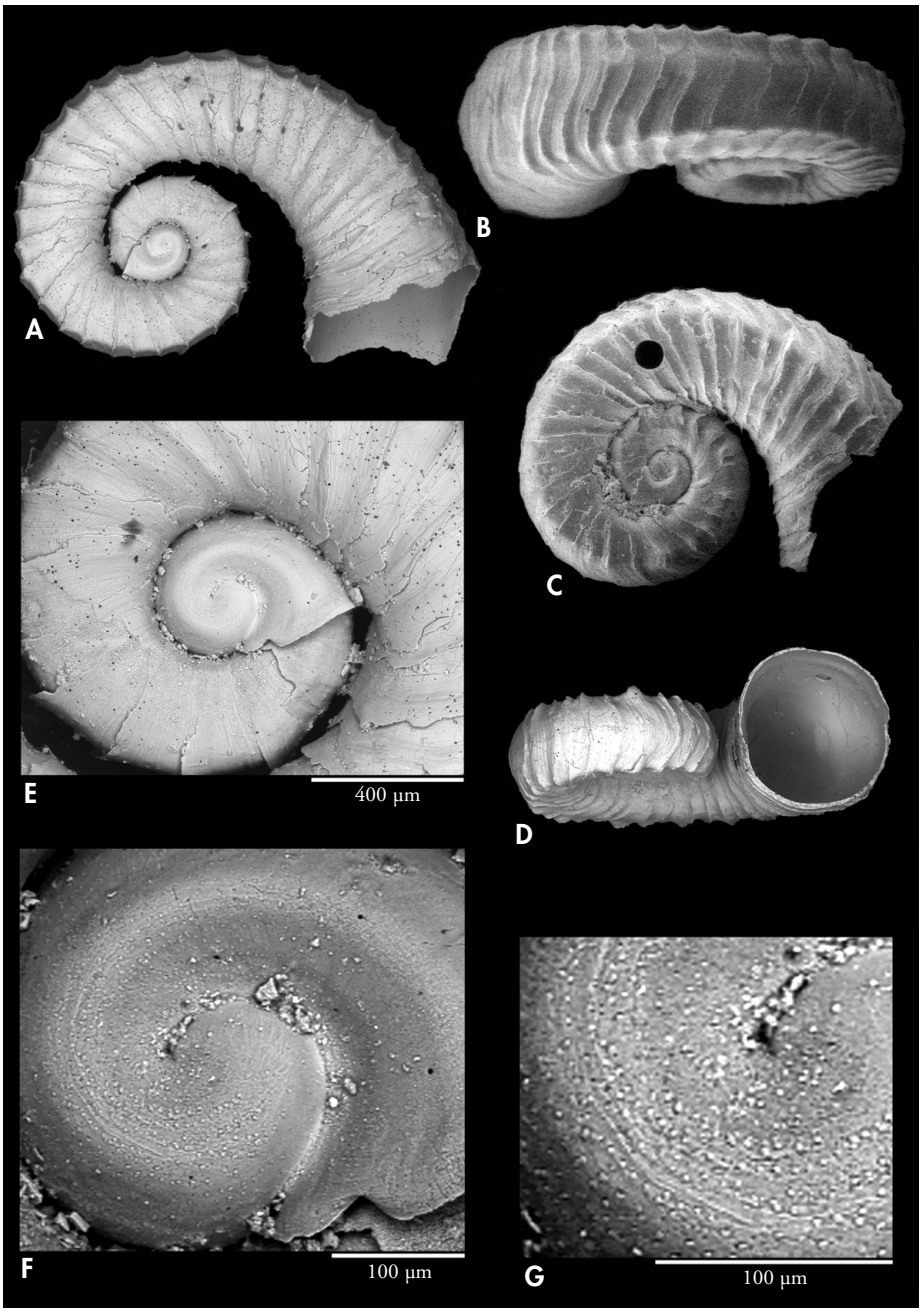

Figure 26. *Lyocyclus microtuber* n. sp. New Caledonia, off Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m. A, B: holotype, diameter 3.32 mm (MNHN); C, D: paratype, 2.68 mm (MNHN); E-G; protoconch of the holotype, detail and microsculpture.

Figura 26. Lyocyclus microtuber *n. sp. Nueva Caledonia, frente a Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m. A, B: holotipo, diámetro 3,32 mm (MNHN); C, D: paratipo, 2,68 mm (MNHN); E-G; protoconcha del holotipo, detalle y microescultura.*

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 27A-C); off Passe d'Ouenou; 22°00'S, 167°01'E; 300-302 m; 08 Sep. 2011; EXBODI Stn CP3828; MNHN, IM-2000-35487. *Paratypes*, NEW CALEDONIA • 8 s (Fig. 27D); same data as for holotype; MNHN, IM-2000-35488.
Material examined (19 spm + 384 s): the type material and NEW CALEDONIA • 4 s; off Thio; 21°31'S, 166°19'E; 450 m; 04 Sep. 2011; EXBODI Stn DW3797; MNHN • 13 s; off Passe de Yate; 22°02'S, 167°05'E; 350-360 m; 08 Sep. 2011; EXBODI Stn CP3829; MNHN • 12 s; off Passe de Yate; 22°02'S, 167°04'E; 325-332 m; 08 Sep. 2011; EXBODI Stn CP3833; MNHN • 56 s; East coast; 21°17'S, 165°57'E; 237-298 m; BATHUS 1 Stn DW654; MNHN • 1 s; East coast; 20°48'S, 165°19'E; 170 m; 14 Mar. 1993; BATHUS 1 Stn DW673; MNHN • 62 s; East coast; 20°35'S, 165°07'E; 380-400 m; 16 Mar. 1993; BATHUS 1 Stn DW683; MNHN • 6 s; East coast; 20°35'S, 164°59'E; 308-324 m; 17 Mar. 1993; BATHUS 1 Stn DE693, MNHN • 8 s; East coast; 20°35'S, 164°58'E; 410-430 m; 17 Mar. 1993; BATHUS 1 Stn CP695; MNHN • 6 spm + 105 s; East coast; 20°57'S, 165°35'E; 160-222 m; 18 Mar. 1993; BATHUS 1 Stn DE700; MNHN • 12 spm + 101 s; East coast; 21°02'S, 165°38'E; 350-400 m; 18 Mar. 1993; BATHUS 1 Stn DE705; MNHN • 1 spm; South New Caledonia; 22°23'S, 166°13'E; 577-780 m; 16 May 1993; BATHUS 2 Stn DW754; MNHN • 7 s; Loyauté Basin; 21°32'S, 166°29'E; 310-315 m; 16 Apr. 1987; BIOGEOCAL Stn DW253; MNHN.
Type locality: New Caledonia, off Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m.
Etymology: The specific name alludes to its similarity with the previous species.

Description: Shell small (<3.00 mm), nearly planispiral, formed by about 2.9 whorls, bicarinate and only a little disjunct in the last quarter whorl.

The protoconch has a single whorl and a maximum diameter of about 520 μm; it begins with a rounded, mammillate nucleus, which is 120 μm in diameter; then, it develops a blunt, wide ridge, close to the internal suture, and terminates with a flaring, funnel-shaped lip, which covers the initial part of the teleoconch. Its whole surface is sculptured by very tiny, interconnected and longitudinal striations and small and aligned micronodules.

The teleoconch starts beneath the protoconch lip, has 1.8 loosely disjunct whorls and there are two thick spiral cords (carinae), one adapical and the other one basal, which forms angles and delimit the periphery.

The whorls are hardly disjunct, being connected mainly along the lamellae which completely circle the whorls; the lamellae are the only contact point with the subsequent whorl; the last quarter whorl is divergent and is disconnected from the previous one.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords (carinae). The lamellae are equidistant, develop obliquely both adapically and basally, their edge is irregular and continued all around the whorls; they are more conspicuous and, on the periphery, their edge protrude to form a nail-like projection; then the edge becomes less prominent; 35 lamellae are observed, 34 of which are on the last whorl, with growth lines in the interspaces. The lamellae form a thick pointed tubercle at their intersection with the carinae. A thick spiral cord on each side delimits the periphery, which is convex.

The aperture is oval, wider than tall, with a continuous peristome. The outer lip is thin with a smooth edge, angled on both sides by the spiral carinae and strongly convex at the periphery.

Dimensions: the holotype is 2.88 mm in maximum diameter and 1.25 mm in apertural height (H/D: 0.43).

Habitat: Bathyal species dredged at 160-780 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus similis* n. sp. is characterized by the strong, prominent and curved axial riblets, which form nodules at their intersections with the two spiral carinae; the protoconch with a ridge bordered by a depressed area near the suture, with numerous microtubercles albeit less than the previous species.

Lyocyclus funiculatus is distinguished by having the ridge of the protoconch more marked and by the presence of fine spiral cords on the periphery, next to the carinae.

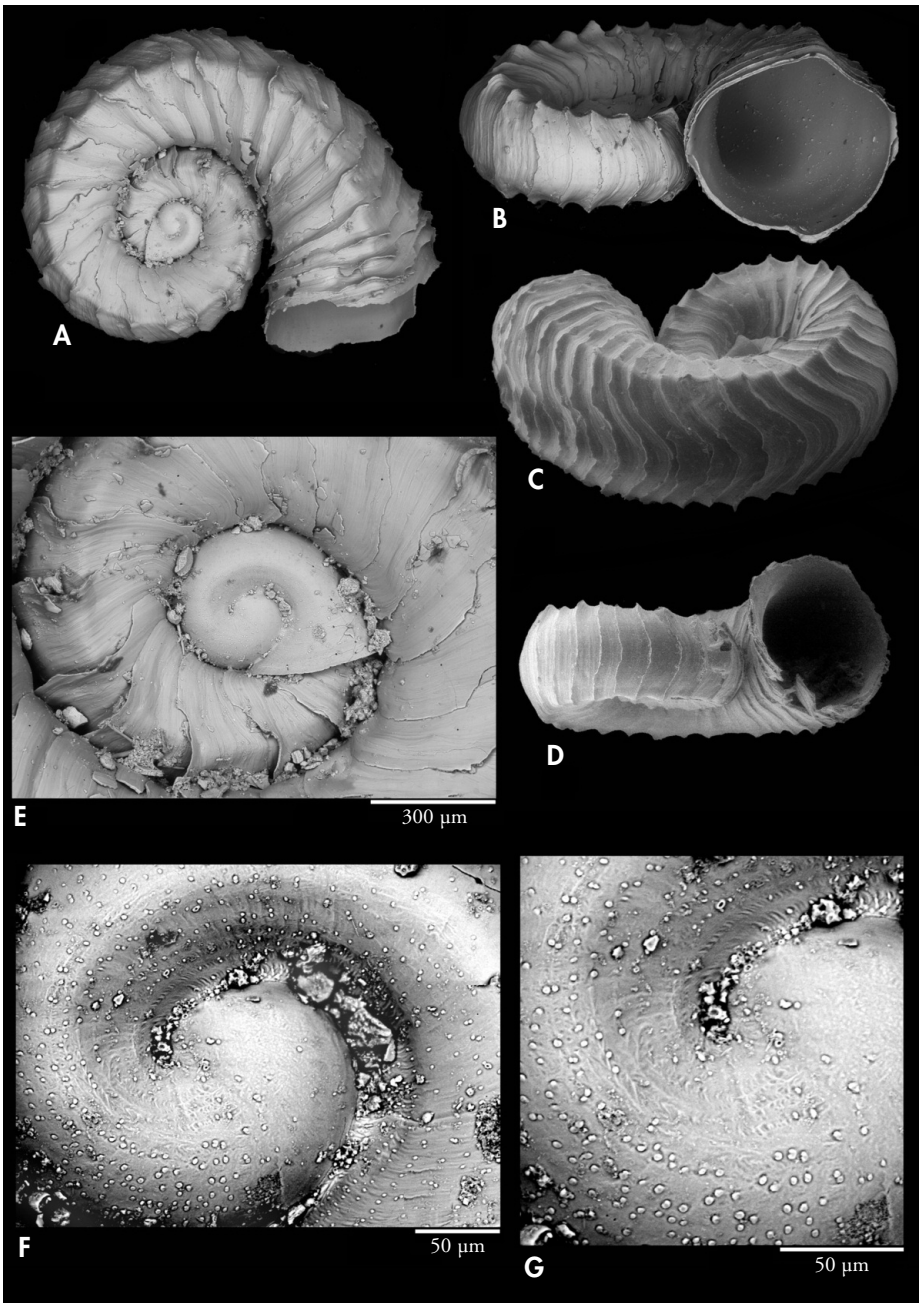

Figure 27. *Lyocyclus similis* n. sp. New Caledonia, off Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m. A, B: holotype, diameter 2.88 mm (MNHN); C, D: paratypes, 2.8 and 2.27 mm (MNHN); E-G: protoconch of the holotype, detail and microsculpture.

Figura 27. Lyocyclus similis *n. sp. Nueva Caledonia, frente a Passe d'Ouenou, 22°00'S, 167°01'E, 300-302 m. A, B: holotipo, diámetro 2,88 mm (MNHN); C, D: paratipos, 2,8 y, 2,27 mm (MNHN); E-G: protoconcha del holotipo, detalle y microescultura.*

Lyocyclus glaber n. sp. (Figure 28)

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Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 28A, B); Loyalty Basin; 22°42'S, 166°33'E; 975 m; 09 Apr. 1987; BIOGEOCAL Stn KG211; MNHN, IM-2000-35456.
Material examined (1 s): the holotype.
Type locality: New Caledonia, Loyalty Basin, 22°42'S, 166°33'E, 975 m.
Etymology: The name derives from the Latin word *glaber*, *bra*, *brum* which means "smooth, flat".

Description: Shell small (<2.75 mm), nearly planispiral, solid, formed by 2.5 disjunct whorls.

The protoconch has almost one whorl and a maximum diameter of 640 μm.

It begins with a rounded, mammillate nucleus, which is about 240 μm in diameter; then it is coiled until ending in an area with numerous growth lines, previous to the slightly flaring protoconch lip. Its surface is smooth.

The teleoconch has 1.4 whorls, starting beneath the protoconch lip; the first whorl is hardly disjunct, being connected mainly along the lamellae, which are equidistant and completely circle the whorl.

Ornamentation is formed by axial lamellae and growth lines. The lamellae are inconspicuous except on the periphery of the first half-whorl, where they have a prominent nail shape, and on the periphery of the remaining whorls, where they are only slightly prominent. No trace of spiral cords nor carinae. The entire surface of the teleoconch is covered by fine growth lines.

The aperture is oval, with a continuous peristome, a little flaring. The outer lip has a smooth edge, not angulated.

Dimensions: the holotype is 2.48 mm in maximum diameter and 1.22 mm in the height of the aperture (H/D: 2.05).

Habitat: Bathyal species dredged at 975 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus glaber* n. sp. is characterized by the weakness of its ornamentation on both sides, and by the lamellae on the peripheral area, stronger than in other species.

Lyocyclus funiculatus n. sp. (Figures 29, 30)

urn: lsid: zoobank.org: act: b8c980c0-880c-4f7d-a031-fa805b0456a1

Type material: *Holotype*, NEW CALEDONIA • 1 s (Fig. 29A); East Coast; 20°35'S, 165°07'E; 408-440 m; 16 Mar. 1993; BATHUS 1 Stn DW687; MNHN, IM-2000-35489. *Paratypes*, NEW CALEDONIA • 58 s (Figs. 30A-H); same data as for holotype; MNHN, IM-2000-35490.
Material examined (59 s): the type material.
Type locality: New Caledonia, East Coast, 20°35'S, 165°07'E, 408-440 m.
Etymology: From the Latin *funiculus*, *i*, which means "cord".

Description: Shell small (<3.00 mm), nearly planispiral, formed by 2.9 partly disjunct whorls, strongly bicarinate.

The protoconch has a single whorl and a maximum diameter of about 530 μm; it begins with a rounded, mammillate nucleus, which is about 100 μm in diameter; starting on the nucleus it develops a blunt central keel in the middle; the coiled part terminates with a flaring, funnel-shaped lip, which covers the initial part of the teleoconch.

The teleoconch, starts beneath the protoconch lip, has about 2.2 whorls (in the largest shells) and there are two thick spiral cords (carinae), one adapical and the other one basal, which angulate and delimit the periphery.

The whorls are not disjunct in the smaller shells, and only in the larger ones, the end of the spire may be separated.

Ornamentation is formed by oblique axial lamellae, marked growth lines,

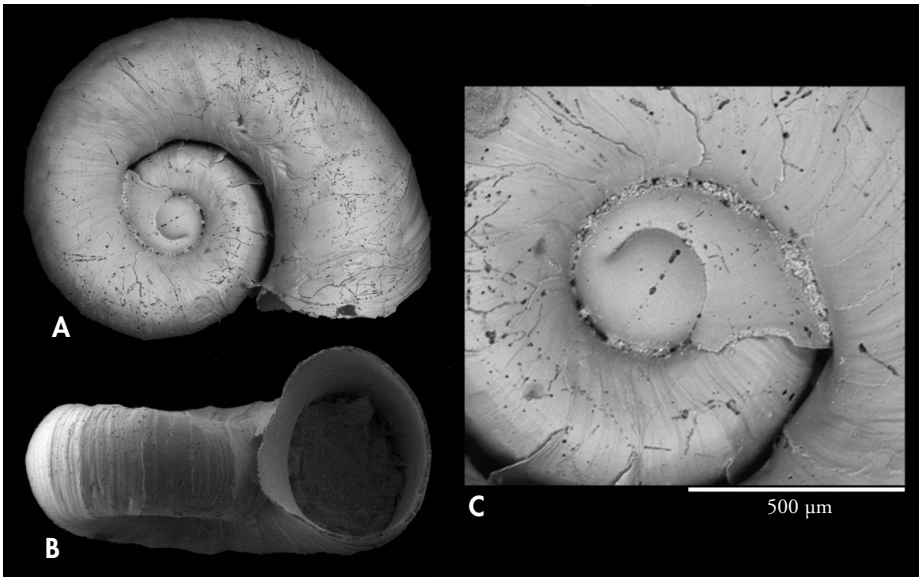

Figure 28. *Lyocyclus glaber* n. sp. New Caledonia, Loyalty Basin, 22°42'S, 166°33'E, 975 m. A, B: holotype, diameter 2.48 mm (MNHN); C: protoconch.
Figura 28. Lyocyclus glaber *n. sp. Nueva Caledonia, Cuenca de Loyauté, 22°42'S, 166°33'E, 975 m. A, B: holotipo, diámetro 2,48 mm (MNHN); C: protoconcha.*

spiral cords (carinae) and cordlets. The lamellae are equidistant, developed obliquely both adapically and basally; their edge is irregular and continued all around the whorls; they are conspicuous, and, on the periphery, their edge forms like a nail-like projection. Then, the edge becomes less prominent; about 25-29 lamellae are observed on the last whorl, with growth lines in the interspaces. The lamellae are forming a thick pointed tubercle; there are fine spiral cords, which can be seen on the periphery.

The aperture is rounded, wider than tall, with a continuous peristome (partly broken in most of our material). The outer lip is thin with a smooth edge, angled by the termination of the spiral carinae.

Dimensions: the holotype is 3.12 mm in maximum diameter.

Habitat: Unknown.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus funiculatus* n. sp. is characterized by the blunt central keel of the protoconch, its bicarinate profile and the thin spiral cords on the periphery.

Lyocyclus dispulsus n. sp. (Figure 31)

urn: lsid: zoobank.org: act: b5583a3c-2706-43e7-89fb-e83f4258f184

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 31A, B); Canal de l'Havannah; 22°18'S, 167°22'E; 850-876 m; 03 Sep. 2011; EXBODI Stn CP3792; MNHN, IM-2000-35457. *Paratypes*, NEW CALEDONIA • 3 s (Figs. 31C-D); same data as for holotype; MNHN, IM-2000-35458.
Material examined (4 s): the type material.
Type locality: New Caledonia, Canal de l'Havannah, 22°18'S, 167°22'E, 850-876 m.
Etymology: The specific name is from the past participle of the Latin verb *dispello*, which means "to push apart" alluding to the markedly disjunct last whorl.

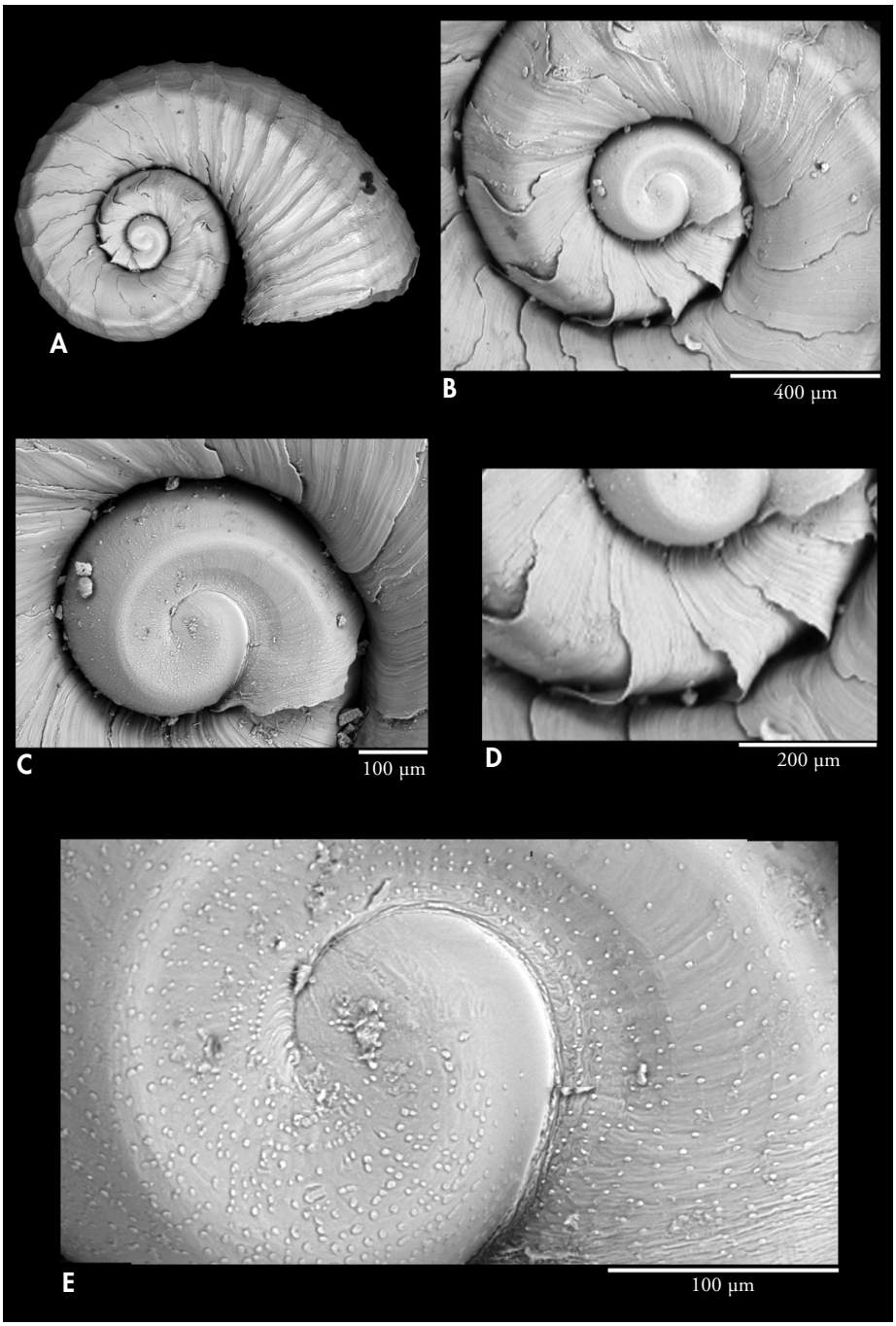

Figure 29. *Lyocyclus funiculatus* n. sp. New Caledonia, East coast, 20°35'S, 165°07'E, 408-440 m. A: holotype, diameter 3.12 mm (MNHN); B-E: protoconch, details and microsculpture.
Figura 29. Lyocyclus funiculatus *n. sp. Nueva Caledonia, costa Este, 20°35'S, 165°07'E, 408-440 m. A: holotipo, diámetro 3,12 mm (MNHN); B-E: protoconcha, detalle y microescultura.*

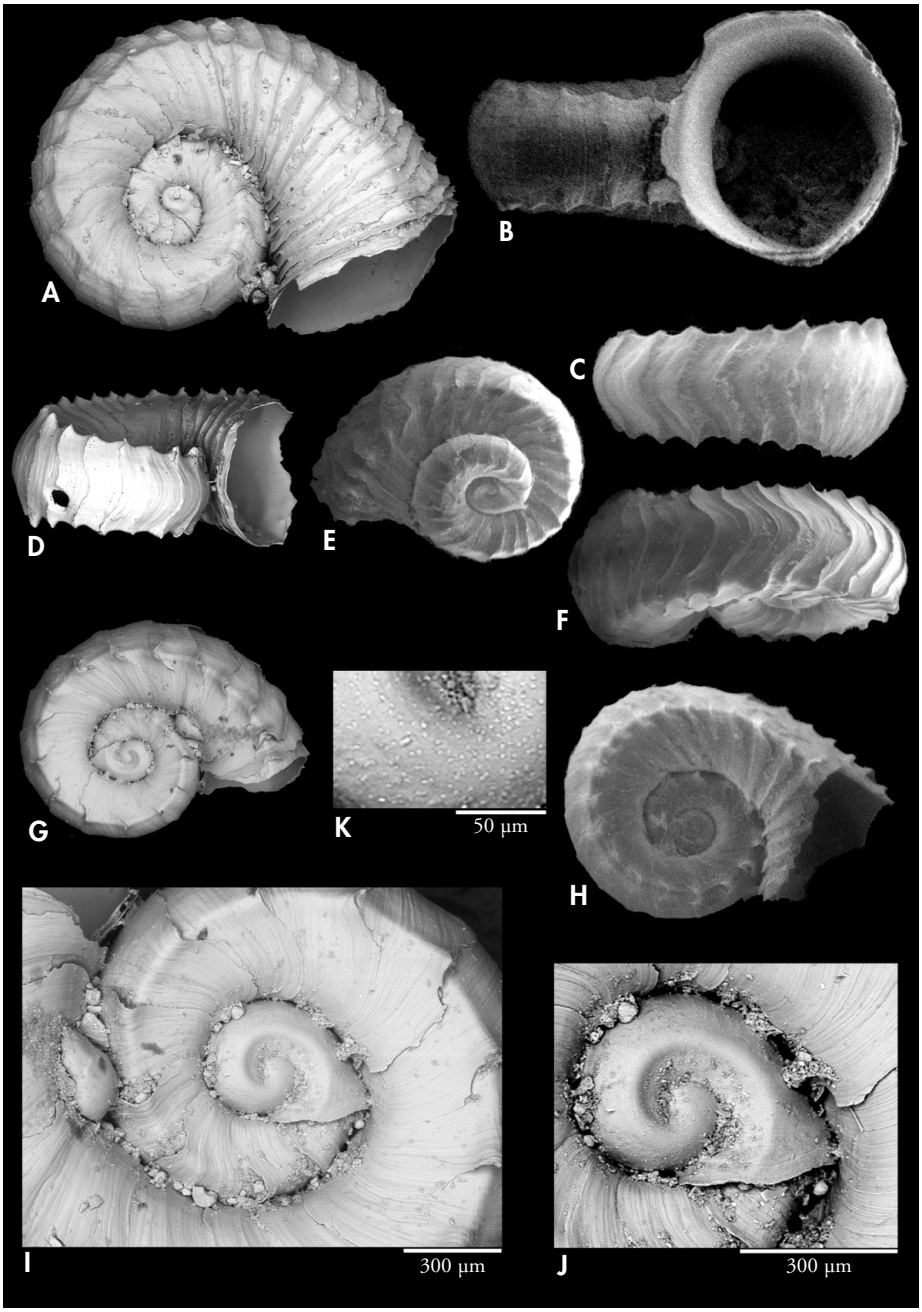

Figure 30. *Lyocyclus funiculatus* n. sp. New Caledonia, East Coast, 20°35'S, 165°07'E, 408-440 m. A, B: paratype, 3.5 mm (MNHN); C-H: paratypes, diameter 2.65, 2.33, 2.17, 2.3, 2.16, 2.7 mm (MNHN); I, J: protoconch and detail; K: microsculpture.

Figura 30. Lyocyclus funiculatus *n. sp. Nueva Caledonia, Costa Este, 20°35'S, 165°07'E, 408-440 m. A, B: paratipo, 3,5 mm (MNHN); C-H: paratipos, diámetro 2,65, 2,33, 2,17, 2,3, 2,16, 2,7 mm (MNHN); I, J: protoconcha y detalle; K: microescultura.*

Description: Shell small (<5.00 mm), solid, formed by 2.8 whorls. Protoconch and first teleoconch whorls nearly planispiral; last whorl strongly disjunct.

The protoconch has somewhat less than one whorl and a maximum diameter of 550 μm. It begins with a rounded, mammillate nucleus, which is 225 μm in diameter and represents 40% of the total diameter of the protoconch; then, it is coiled and terminates with a slightly flaring lip, covering the initial part of the teleoconch. It is sculptured by small, irregular, star-shaped granules that often interconnect to form a net-like pattern and by numerous randomly scattered pores that covered all surface, but they are only visible under high magnification.

The teleoconch starts beneath the protoconch lip and has about 1.8 disjunct whorls, more markedly so in the final part of the last whorl. The protoconch and first half whorl of teleoconch are placed at the same level, then the spire rises adapically.

Ornamentation is formed by faint axial lamellae and marked growth lines. The lamellae are weak and not very protruding, becoming confused with the marked growth lines. Lamellae and growth lines are most prominent in the peripheral area. Only on the first half whorl of the teleoconch, the peripheral edge of the lamellae forms a small nail-like projection.

The aperture is oval, taller than wide, with a continuous peristome and a smooth edge.

Dimensions: Holotype 4.90 mm in diameter, with a height (aperture) of 2.00 mm.

Habitat: Bathyal species dredged at 850-876 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus dispulsus* n. sp. is characterized by the large and rounded mammillate nucleus of the protoconch; teleoconch ornamentation of faint axial lamellae and strongly disjunct last whorl.

Lyocyclus wareni n. sp. (Figure 32)

urn: lsid: zoobank.org: act: b5bc1e94-78fe-4361-a62f-725bc0ffd199

Type material: *Holotype*, NEW CALEDONIA • 1 s (Fig. 32A); Passe de Boulari; 22°30'S, 166°24'E; 250-350 m; 07 Jun. 1979; VAUBAN 1978-1979 Stn DR40; MNHN, IM-2000-35459. *Paratypes*, NEW CALEDONIA • 1 spm (studied by Warén, 1989) + 105 s (Figs. 32B-D); same data as for holotype; MNHN, IM-2000-35460.
Material examined (107 s): the type material.
Type locality: New Caledonia, 22°30'S, 166°24'E, 250-350 m.
Etymology: The species is named after the well-known malacologist Anders Warén, who studied it for the first time, without naming it.

Description: Shell small (<3.50 mm), nearly planispiral, formed by 2.8 hardly disjunct whorls, bicarinate.

The protoconch has a single whorl and a maximum diameter of about 650 μm; it begins with a rounded, mammillate nucleus, which is 170 μm in diameter. Then it is coiled, with a smoothly convex surface and a sharply delimited sutural channel; the protoconch terminates in a zone with dense growth lines, prior to a distinctly flaring, funnel-shaped lip, which covers the initial part of the teleoconch. All the surface of the larval shell is sculptured by small, aligned nodules, in greater number inside the channel of the sutural zone.

The teleoconch starts beneath the protoconch lip, has 1.8 hardly disjunct whorls and its periphery is convex and strongly bicarinate; there are two thick spiral cords (carinae), one adapical and the other one basal, which angulate and delimit the periphery. Protoconch and teleoconch whorls are placed on a similar plane (nearly planispiral). The whorls are

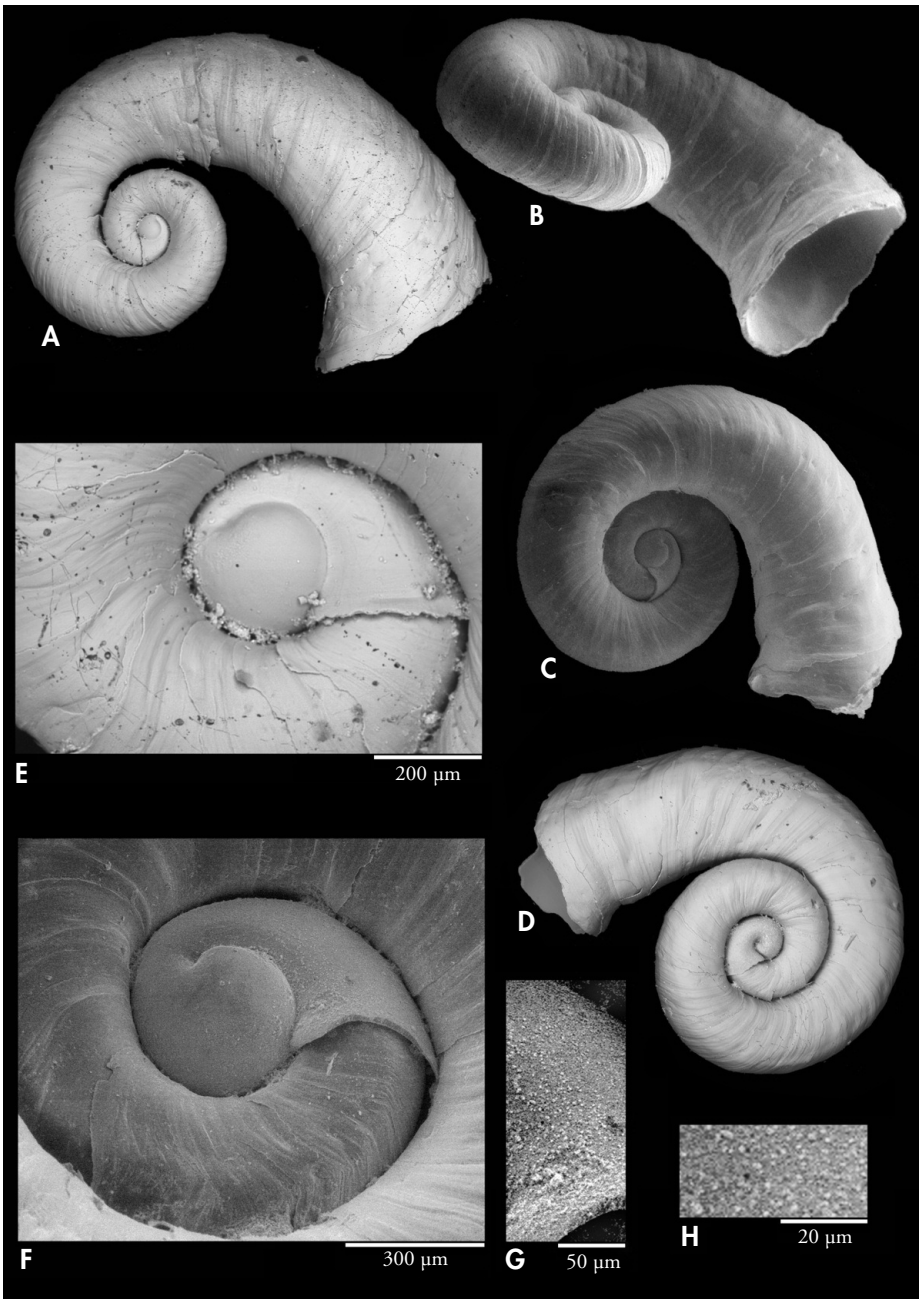

Figure 31. *Lyocyclus dispulsus* n. sp. New Caledonia, Havannah Channel, 22°18'S, 167°22'E, 850-876 m. A, B: holotype, diameter 4.9 mm; C, D: paratype, 3.7 mm; E, F: protoconchs of holotype and paratype; G, H: microsculpture.

Figura 31. Lyocyclus dispulsus *n. sp. Nueva Caledonia, Havannah Channel, 22°18'S, 167°22'E, 850-876 m. A, B: holotipo, diámetro 4,9 mm; C, D: paratipo, 3,7 mm; E, F: protoconchas del holotipo y un paratipo; G, H: microescultura.*

connected only along the lamellae which completely circle the whorls.

Ornamentation is formed by oblique axial lamellae, growth lines and spiral cords (carinae). The lamellae are equidistant, developed obliquely both adapically and basally, their edge is irregular and continues all around the whorls; 49 lamellae are observed, 33 of which are on the last whorl, with growth lines in the interspaces. The lamellae form a thick pointed tubercle at their intersection with the carinae.

The aperture is rounded, taller than wide, with a continuous peristome. The outer lip is thin with a smooth edge, angled by the termination of the carinae.

Dimensions: the holotype is 3.21 mm in maximum diameter.

The radula (examined by Warén, 1989) (Fig. 4C) is typically vanikorid with oar-shaped marginal teeth with fine, comb-like denticles on the inside of the outer, and outside of the inner marginal teeth and numerous comb-like denticles on the lateral and central teeth.

The animal had large and conspicuous epipodial folds (Warén, 1989).

Habitat: Bathyal species dredged at 250-350 m deep.

Distribution: Only known from the type locality.

Remarks: Warén (1989) was able to examine the soft parts and radula of the species now described, concluding that both the external morphology of body and radula are typically vanikorid. He considered *Lyocyclus* as a deviating vanikorid and proposed a new generic placement in Vanikoriidae because the similarities in the soft parts and the radula.

Lyocyclus wareni n. sp. is characterized by the sutural channel of the protoconch, carinate periphery and for the high number of axial lamellae.

Lyocyclus josemanuelrubioi n. sp. (Figure 33)

urn: lsid: zoobank.org: act: f73a3692-b2ef-4a83-814b-210f5dece05a

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 33A, B); Loyalty Basin, off Thio; 21°32′S, 166°29′E; 310–315 m; 16 Apr. 1987; BIOGEOCAL Stn DW253; MNHN, IM-2000-35491. *Paratype*, NEW CALEDONIA • 1 s (Fig. 33C); same data as for holotype; MNHN, IM-2000-35492.
Material examined (2 s): the type material.
Type locality: New Caledonia, Loyalty Basin, off Thio, 21°31.36′S, 166°29.3′E, 310–315 m.
Etymology: This species is named after Jose Manuel Rubio Salazar, brother of the first author.

Description: Shell small (<2.90 mm), nearly planispiral, formed by 2.7 disjunct whorls, peripherally carinate.

The protoconch has more than one whorl and a maximum diameter of about 562 μm; it begins with a rounded, mammillate nucleus, which is about 120 μm in diameter; starting on the nucleus it develops a blunt central keel, and terminates with a distinctly flaring, funnel-shaped lip, which covers the initial part of the teleoconch. The entire surface of the protoconch is sculptured by conspicuously aligned micropustules, most evident in the sutural zone.

The teleoconch has about 2.6 whorls, starting beneath the protoconch lip, and its periphery is wide and very convex; there are two thick spiral cords (carinae) that angulate and delimit the periphery. In the holotype, the whorls are disjunct since the beginning of the teleoconch; in the paratype, they are disjunct along the protoconch, at the beginning of the teleoconch and in the last quarter whorl.

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords (carinae). The lamellae are radial and equidistant, develop obliquely both adapically and basally, their edge is irregular and continued around the entire whorl; they are more conspicuous on the periphery, where their edge forms a nail-like projection; 30 lamellae are observed, 22 of which are on the last whorl, with growth lines

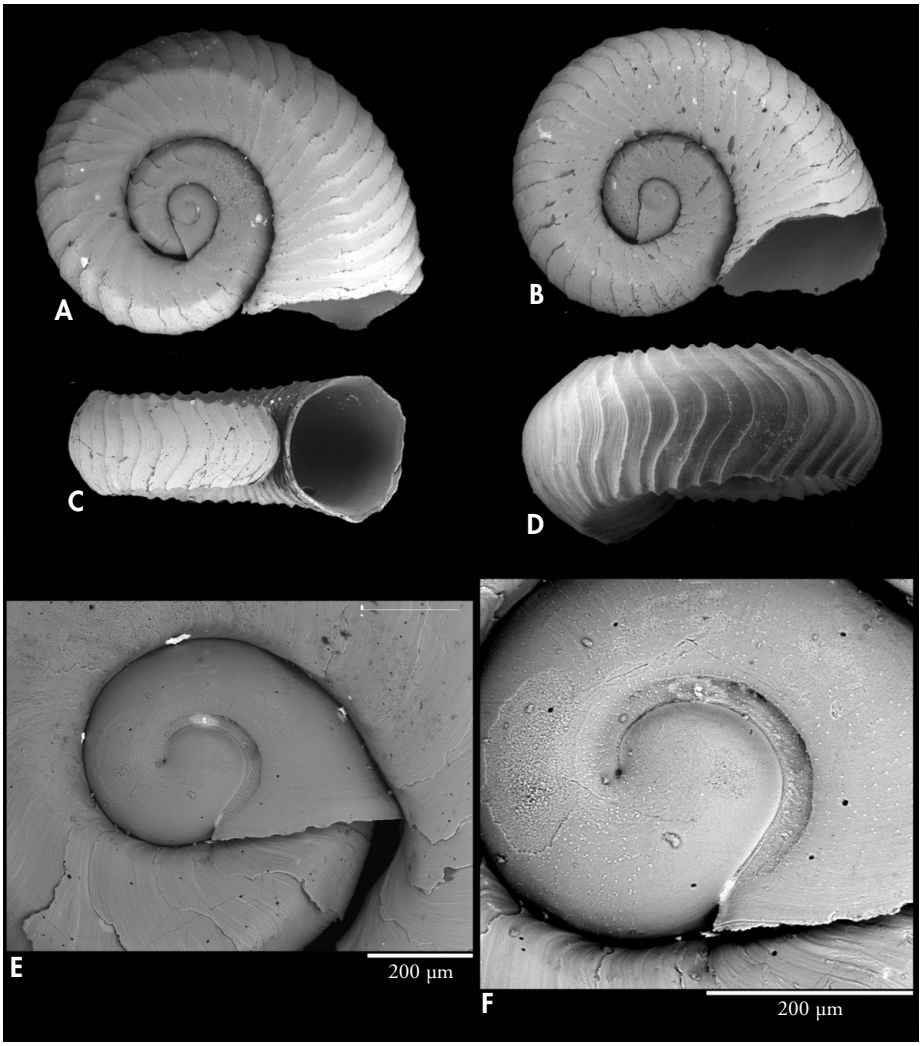

Figure 32. *Lyocyclus wareni* n. sp. New Caledonia, 22°30'S, 166°24'E, 250-350 m. A: holotype, diameter 3.21 mm (MNHN); B-D: paratypes, diameter 3.0, 2.87 and 3.05 mm (MNHN); E, F: protoconch and detail.

Figura 32. Lyocyclus wareni *n. sp. Nueva Caledonia, 22°30'S, 166°24'E, 250-350 m. A: holotipo, diámetro 3.21 mm (MNHN); B-D: paratipos, diámetro 3,0, 2,87 y 3,05 mm (MNHN); E, F: protoconcha y detalle.*

in the interspaces. The lamellae form a thick and pointed, thorn-like fold, at their intersection with the carinae.

The aperture is oval, taller than wide, with a continuous peristome. The outer lip is thin with a smooth edge, angled by the termination of the carinae.

Dimensions: the holotype is 2.80 mm in maximum diameter and 1.02 mm in height of the aperture (H/D: 0.36).

Habitat: Bathyal species dredged at 310-315 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus josemanuelrubioi* n. sp. is characterized by its disjunct whorls; and by its wide and convex periphery delimited by thick carinae, which form strong and raised, spine-like folds at their intersections with the carinae.

L. funiculatus differs by its carinate protoconch and by the presence of fine spiral cords in the periphery.

L. similis differs by its periphery, strongly convex in the last quarter whorl.

Lyocyclus lamellaris n. sp. (Figure 34)

urn: lsid: zoobank.org: act: 9a188a3e-2292-4e84-85b2-3ecf82183663

Type material: *Holotype*, NEW CALEDONIA • 1 s (Figs. 34A, B); off Toupeti; 21°44'S, 166°38'E; 384-385 m; 05 Sep. 2011; EXBODI Stn CP3810; MNHN, IM-2000-35493.
Material examined (1 s): the holotype.
Type locality: New Caledonia, off Toupeti, 21°44'S, 166°38'E, 384-385 m.
Etymology: The specific name refers to the numerous lamellae of the surface of the teleoconch.

Description: Shell very small (<2.10 mm), nearly planispiral, formed by about 2.6 whorls, peripherally carinate and hardly disjunct.

The protoconch has a single whorl and a maximum diameter of about 527 μm; it begins with a rounded, mammillate nucleus, which is 127 μm in diameter; then, it is coiled and develops a blunt, wide central ridge, terminating with a flaring, funnel-shaped lip, which covers the initial part of the teleoconch. Its whole surface is sculptured by aligned micropustules.

The teleoconch starts beneath the protoconch lip, has 1.5 loosely disjunct whorls and its periphery is very wide and convex; there are two thick spiral cords (carinae) which angle and delimit the periphery. The whorls are hardly disjunct, being connected mainly along the lamellae which completely circle the whorls. Protoconch and teleoconch whorls are placed on a similar plane (nearly planispiral).

Ornamentation is formed by oblique axial lamellae, marked growth lines and spiral cords (carinae). The lamellae are oblique, their edge is often irregular because they are chipped; they are very developed laterally and very conspicuous peripherally, mainly on the first half whorl, where they are shaped like a nail; 27 lamellae are observed, 22 of which are on the last whorl, with growth lines in the interspaces. The lamellae, form a u-shaped fold at their intersection with the carinae.

The aperture is trapezoidal, with a continuous peristome. The outer lip, with a smooth edge, is angled by the termination of the carinae.

Dimensions: the holotype is 2.08 mm in maximum diameter and 0.85 mm in height of the aperture (H/D: 0.41).

Habitat: Bathyal species dredged at 384-385 m deep.

Distribution: Only known from the type locality.

Remarks: *Lyocyclus lamellaris* n. sp. is characterized by its protoconch with a mammillate nucleus and with an ornamentation of spirally aligned pustules; by its wide and strongly bicarinate periphery with strong folds at their intersections with the lamellae; also by the strongly developed lateral lamellae and by the trapezoidal shape of the aperture.

Lyocyclus lamellaris n. sp. is very similar to *L. similis, L. funiculatus* and *L. wareni.*

Lyocyclus wareni n. sp. has more lamellae and is uniquely diagnosed by the wide channel of its protoconch; *L. funiculatus* n. sp. has a strong ridge on the protoconch and fine spiral cords on the periphery, next to the carinae and, finally, *L. similis* n. sp. by the strongly convex peripheral zone in the last quarter whorl.

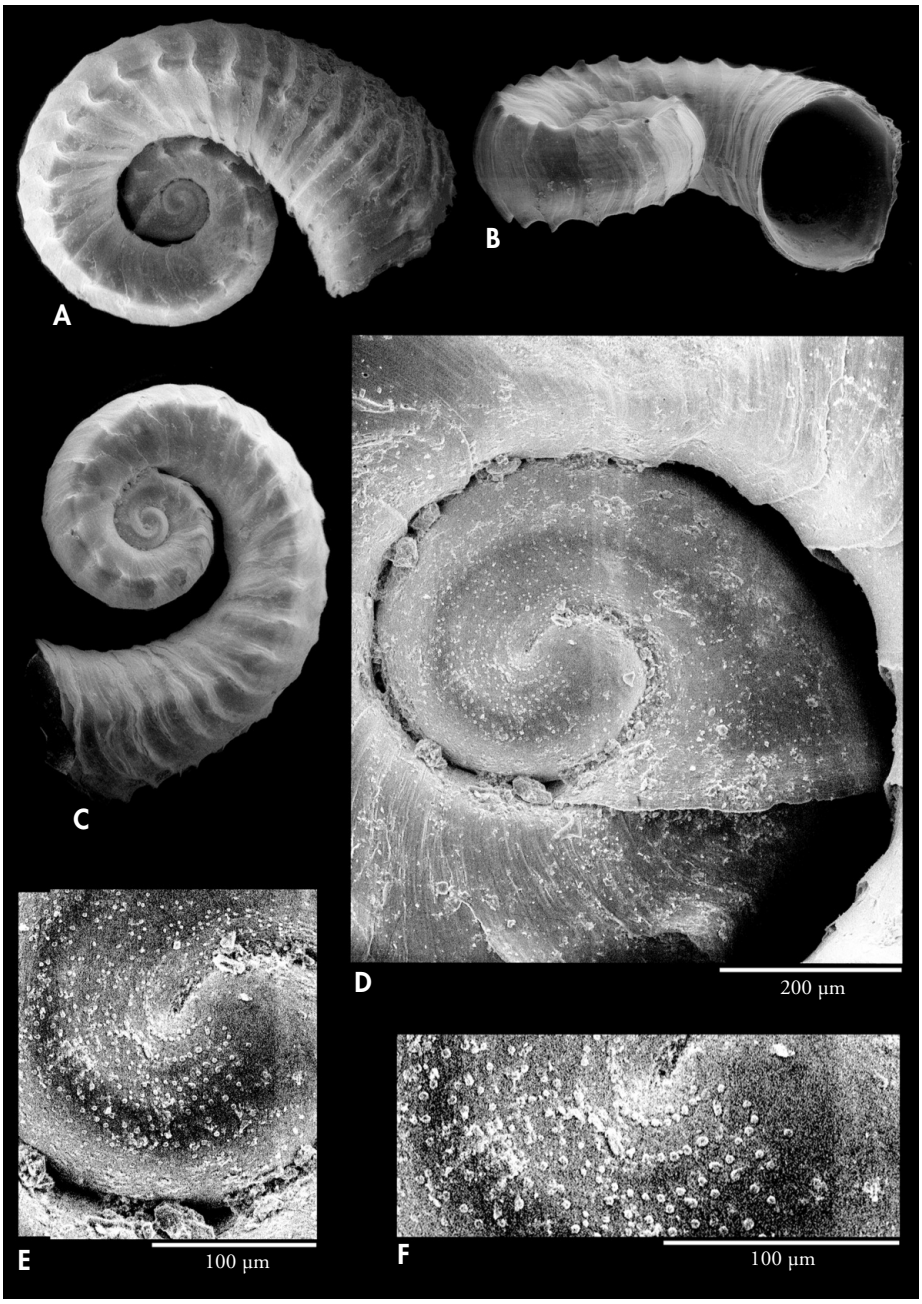

Figure 33. *Lyocyclus josemanuelrubioi* n. sp. New Caledonia, Loyalty Basin, off Thio, 21°31.36'S, 166°29.3'E, 310–315 m. A, B: holotype, diameter 2.8 mm,; C: paratype, 2.96 mm; D-F: protoconch, microsculpture and detail.

Figura 33. Lyocyclus josemanuelrubioi *n. sp. Nueva Caledonia, Cuenca de Loyauté, frente a Thio, 21°31,36'S, 166°29,3'E, 310–315 m. A, B: holotipo, diámetro 2,8 mm,; C: paratipo, 2,96 mm; D-F: protoconcha, microescultura y detalle.*

Nescitus n. gen.

urn:lsid:zoobank.org:act:B656B05E-4847-4BB5-9309-15A4C8479E16

Type species: *Nescitus laminarum* n. sp.

Etymology: The generic name is derived from the Latin word *nescitus, a, um* which means "unknown" in reference to our initial ignorance about which genus the new species should be placed in.

Diagnosis: Shell minute, solid, nearly planispiral adapically, strongly lamellate and deeply umbilicate.

Protoconch of strongly convex whorls, 220-245 μm in diameter and a slightly granular sculpture; aperture of larval shell not expanded.

Teleoconch whorls loosely connected only very loosely and mainly along the axial ribs (lamellae) that encircle the complete whorl.

Periphery, adapically defined by a thick spiral cord with keel.

The aperture is oval with the peristome sharply expanded outward.

Umbilicus narrow and deep.

Remarks: The shape and ornamentation of the protoconch, the disjunct coiling of the teleoconch and the presence of oblique axial ribs that encircle the complete whorl supported its placement in Lyocyclidae. However, some characters present (such as the relatively wide and deep umbilicus; progressive increase in the size of the axial ribs until they become strong and wide lamellae; the oval aperture with sharply expanded peristome, and the periphery keeled adapically, delimited by a thick cord) differentiated the species from others in the genus *Lyocyclus*. For all of that, we decided to describe a new genus to place this new species.

Nescitus laminarum n. sp. (Figure 35)

urn:lsid:zoobank.org:act:C1405FF0-8248-41EB-976D-B615D3BCC27C

Type material: *Holotype*, NEW CALEDONIA • 1 s (Fig. 35A); Norfolk Ridge, Banc Éponge (mont B); 24°55'S, 168°22'E; 508-532 m; 27 Jan. 1993, SMIB2: Stn DW146-147; MNHN, IM-2000-35461. *Paratypes*, NEW CALEDONIA • 3 s (Figs. 35B-D); same data as for holotype; MNHN, IM-2000-35462.
Material examined (8 s): the type material and NEW CALEDONIA • 4 s (lost or broken in an accident); same data as for holotype.
Type locality: New Caledonia, Norfolk Ridge, Banc Eponge (mont B), 24°55'S, 168°22'E, 508-532 m.
Etymology: The specific name alludes the presence of axial sculpture as very important lamellae in a so small shell: from the Latin word *"lamina, ae"* in reference to the prominent lamellae.

Description: Shell minute (<1.00 mm in diameter), solid, nearly planispiral adapically, low spired, formed by 2.5 whorls loosely disjunct, strongly lamellate and deeply umbilicate.

The protoconch has about one strongly convex whorl, maximum diameter between 220-245 μm and is apparently smooth, although, at high magnification, a fine granulated sculpture can be observed. The aperture of the larval shell is not expanded.

The teleoconch whorls are loosely disjunct, being connected with the subsequent whorl only through the peripheral edge of the lamellae. There are 1.5 whorls sculptured by axial lamellae, spiral cords and incremental lines.

The axial lamellae are oblique and slightly procumbent on the first half whorl, subsequently thicker and higher, and expand outward, protruding above the periphery, with teleoconch growth resuming from under each lamella.

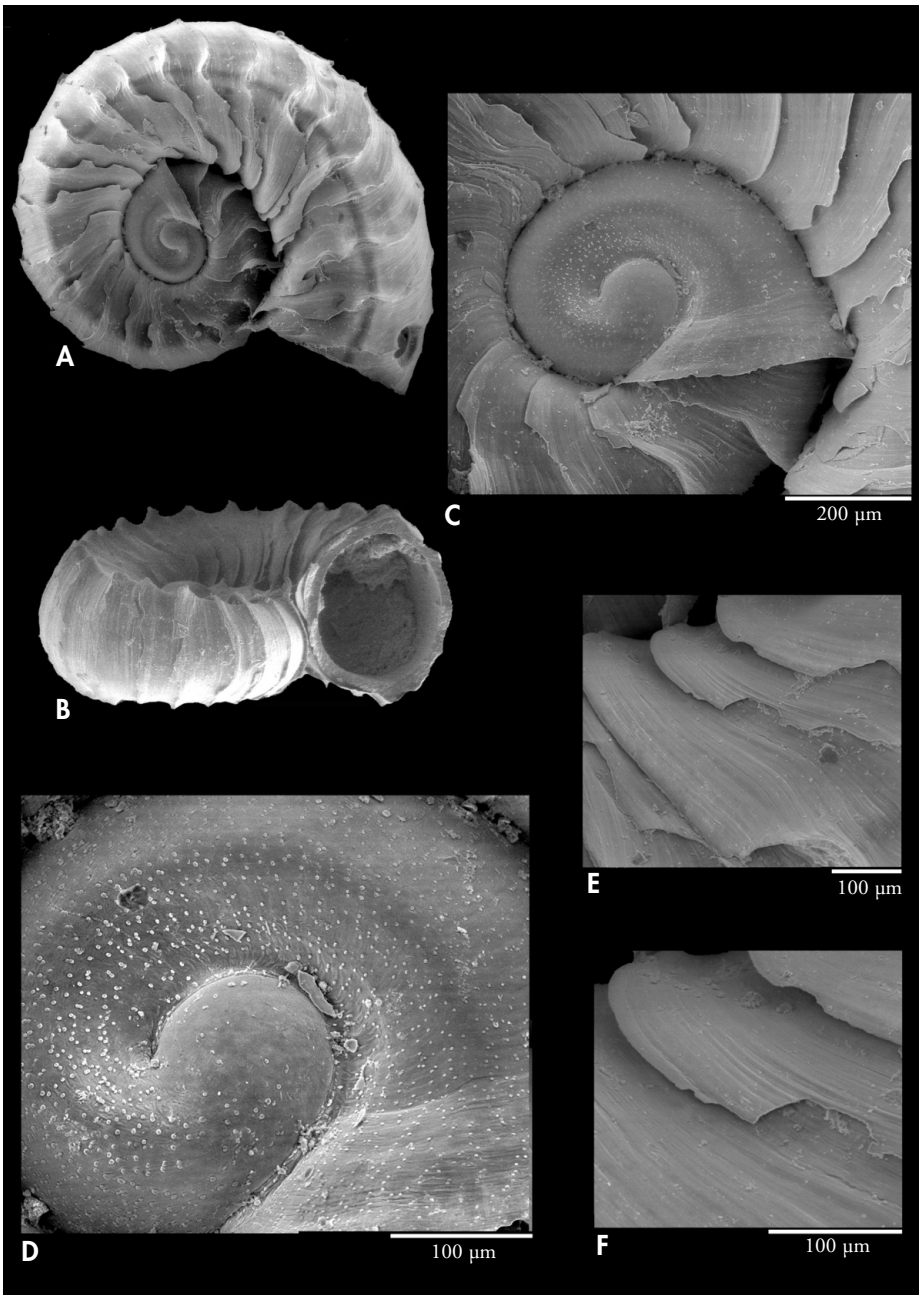

Figure 34. *Lyocyclus lamellaris* n. sp. New Caledonia, off Toupeti, 21°44'S, 166°38'E, 384-385 m. A, B: holotype, diameter 2.08 mm (MNHN); C, D: protoconch and microsculpture; E, F: detail of the lamellae.

Figura 34. Lyocyclus lamellaris *n. sp. Nueva Caledonia, frente a Toupeti, 21°44'S, 166°38'E, 384-385 m. A, B: holotipo, diámetro 2,08 mm (MNHN); C, D: protoconcha y microescultura; E, F: detalle de las laminillas.*

The periphery is slightly convex, demarcated adapically by a thick spiral cord forming a keel.

The growth lines are distributed on the entire teleoconch.

Umbilicus relatively wide and deep. The aperture is oval, with a continuous peristome, widely flaring.

Dimensions: the holotype is 1.01 mm in diameter.

Habitat: Bathyal species dredged at 508-532 m deep.

Distribution: Only known from Banc Eponge, Norfolk Ridge, New Caledonia.

Remarks: *Nescitus laminarum* n. sp. is characterized by its small size, its relatively wide umbilicus and very deep; the progressive increase in the size of the axial ribs until they become strong and wide lamellae; the oval aperture with a sharp and expanded peristome, and the periphery delimited and angled adapically by a thick cord.

Species previously placed in *Lyocyclus* and transferred to other families

Family Eudaroniidae Gründel, 2004

Genus *Eudaronia* Cotton, 1945

Eudaronia Cotton, 1945: 158 [Type species by original designation: *Cyclostrema* (*Daronia*) *jaffaensis* Verco, 1909. Recent, deep waters off South Australia].

Diagnosis: Shell minute, almost perfectly planispiral, with a deeply concave apex and base; teleoconch whorls uniformly smooth and keeled both apically and basally and aperture orthocline with typical trapezoidal outline.

Remarks: Cotton (1945) included this genus in the family Liotiidae. Warén (1991) reexamined the type species and the radula of *"Lyocyclus" biconcavus* (Thiele, 1925) and wrote "I therefore refrain from attempts to classify the three genera *Adeuomphalus*, *Eudaronia*, and *Palazzia* in a family".

Stratigraphic range: Mid Bathonian (Mid Jurassic) to Recent (Kaim, 2004).

Eudaronia biconcava (Thiele, 1925) (Figure 36A-C)

Lyocyclus (?) *biconcavus* Thiele, 1925: 117, pl. 9, figs. 18-19.
Eudaronia biconcava (Thiele, 1925): Warén (1991: 77, fig. 8A; misspelled *biconcavus* p. 77). - Kano, Chikyu & Warén (2009).

Type material: *Syntype*, SOMALIA • 1 s (Fig. 36 A-C); off Mogadiscio; 1°49'N, 45°29'5"W; 1134 m; Deutsche Tiefsee-Expedition Stn 256; Museum für Naturkunde, Berlin (ZMB/Moll-109251). Examined from photographs.
Type locality: Somalia, off Mogadiscio; 1°49'N, 45°29'5"W; 1134 m.

Description: in Thiele (1925: 117).

Syntype diameter 1 mm, height of the aperture 0.7 mm.

Habitat: Bathyal species dredged at 1134 m depth in blue mud bottom with *Globigerina* mud.

Distribution: Only known from the type locality.

Remarks: Thiele (1925: 116) had doubts about the generic location of this species in *Lyocyclus*, as it lacked the typical ornamentation of the species, which was evidenced by placing the question mark (?) between the generic name and the species name and, as he himself commented, leaving open his systematic position.

Warén (1991) examined the radula of a specimen of *L. biconcavus* from off Réunion Island, Indian Ocean (from

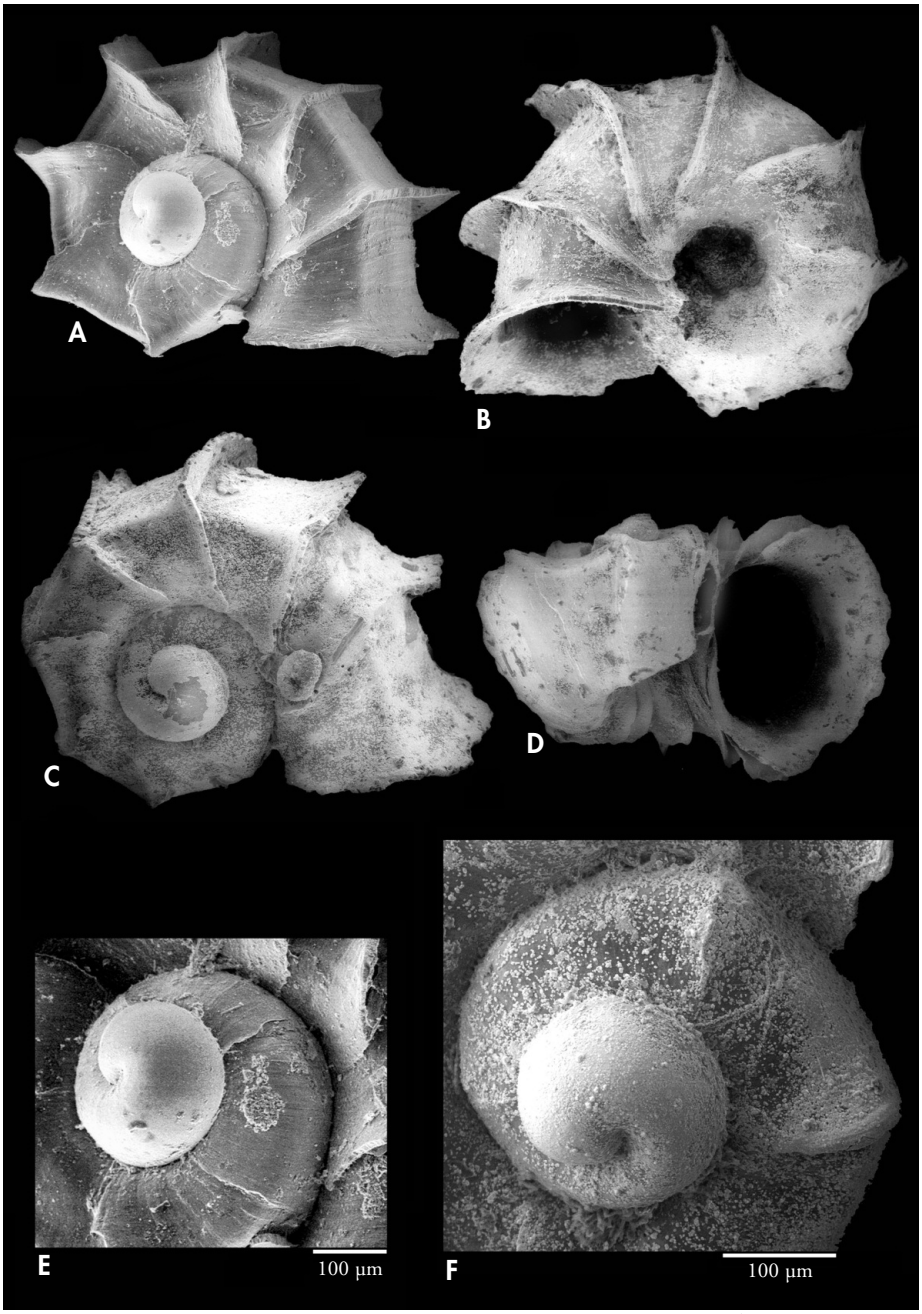

Figure 35. *Nescitus laminarum* n. sp. New Caledonia, Norfolk Ridge, Banc Éponge (mount B), 24°55'S, 168°22'E, 508-532 m. A: holotype, diameter 1.01 mm (MNHN); B-D: paratypes, 0.86, 0.92 and 1.19 mm (MNHN); E, F: protoconchs of holotype and paratype.

Figure 35. Nescitus laminarum *n. sp. Nueva Caledonia, Norfolk Ridge, Banco Éponge (cumbre B), 24°55'S, 168°22'E, 508-532 m. A: holotipo, diámetro 1,01 mm (MNHN); B-D: paratipos, 0,86, 0,92 y 1,19 mm (MNHN); E, F: protoconchas del holotipo y de un paratipo.*

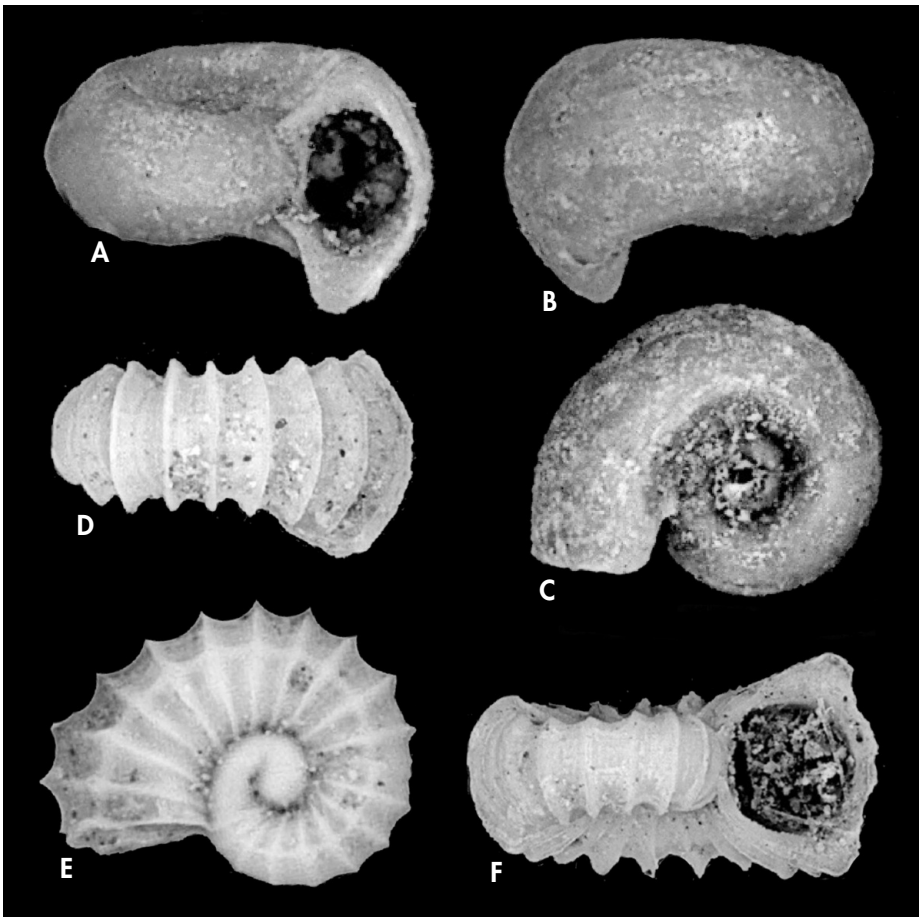

Figure 36. A-C. *Eudaronia biconcava* (Thiele, 1925), off East Africa, "Valdivia" Stn 256, 1°49'N, 45°29.5'E, 1134 m. Syntype (ZMB/Moll-109251). D-F. *Adeuomphalus orientalis* (Thiele, 1925). Zanzibar channel, Tanzania, "Valdivia" Stn 256, 1°49'N, 45°29.5'E, 1134 m. Syntype (ZMB/Moll-109249).

Figura 36. A-C. Eudaronia biconcava *(Thiele, 1925), frente a Africa Oriental, "Valdivia" Stn 256, 1°49'N, 45°29.5'E, 1134 m. Sintipo (ZMB/Moll-109251). D-F.* Adeuomphalus orientalis *(Thiele, 1925). Canal de Zanzibar, Tanzania, "Valdivia" Stn 256, 1°49'N, 45°29,5'E, 1134 m. Sintipo (ZMB/Moll-109249).*

MNHN cruise MD32) and verified that it has an atypical but unquestionably rhipidoglossate radula. There are not any archaeogastropods known to have a similar radula, although some species of Seguenziidae, which approach *Eudaronia* in radular morphology.

The shell of *Eudaronia* species is rather uniformly smooth, without axial ribs; the whorls are species keeled both apically and basally; nevertheless the aperture has a typical trapezoidal outline as in of *Adeuomphalus* (Warén, 1991: fig. 14A–E; Kaim, 2004: fig. 2A–C).

After examination of the Syntypes in ZMB (Moll-109251), we agree with Warén (1991) and Kano, Chikyu & Warén (2009) in placing *L. biconcavus* in the genus *Eudaronia*.

Family unassigned (in superfamily SEGUENZIOIDEA)
Genus *Adeuomphalus* Seguenza, 1876

Adeuomphalus orientalis (Thiele, 1925) n. comb. (Figure 36D-F)

Lyocyclus orientalis Thiele, 1925: 117, pl. 9, figs. 16-17

Type material: *Syntype*, TANZANIA • 1 s; 1°49'N, 45°29.5'E; 1134 m; Deutsche Tiefsee-Expedition Stn 256; Museum für Naturkunde, Berlin (ZMB/Moll 109249). Examined from photographs.
Type locality: Tanzania, Zanzibar channel, 1°49'N, 45°29.5'E, 1134 m.

Description: See THIELE (1925). The syntype photographed is 1.5 mm in diameter and 0.75 mm in height in the aperture.

Habitat: Bathyal species dredged on a blue clay bottom with *Globigerina* mud at 463 m deep (Stn 245) and at 1134 m deep (Stn 256).

Distribution: Only known from the type locality.

Remarks: After the examination of the syntypes in ZMB (Moll-109250, 109249), we place *L. orientalis* in the genus *Adeuomphalus* Seguenza, 1876, as it agrees with the main morphological characters of this genus.

The syntypes examined present the main morphological characters described by KANO, CHIKYU & WARÉN (2009) for *Adeuomphalus* genus, such as:

- whorls keeled both apically and basally
- aperture orthocline with typical trapezoidal outline as in the type species of *Adeuomphalus* (WARÉN, 1991)
- axial ribs straight or slightly flexuous.

It has not been possible to examine the protoconch, but even so, the characters presented in *L. orientalis* correspond more with species of *Adeuomphalus* than with species of *Lyocyclus*.

DISCUSSION AND CONCLUDING REMARKS

The Lyocyclidae family is currently composed of two genera, one of which is new to science (*Lyocyclus* Thiele, 1925 and *Nescitus* n. gen.).

After WARÉN (1989, 1991) provided all knowledge on the soft parts of Lyocyclidae species. As for radula, we have verified, consistently to WARÉN (1989), that it is typically vanikoroid, but with a differentiating element: the central cusp bird beak shape of the central tooth (Fig. 4C).

The operculum (Fig. 4E) is oval with an eccentric nucleus and a rudimentary peg, being similar in shape to some species *Schwartziella* and *Zebina*.

The main morphological character shared by both genera is the disjunct coiling shell, while both the shape and ornamentation of the protoconch, and the type of axial ornamentation (lamellae; axial ribs) are the most important differential morphological characters.

The protoconch in Lyocyclidae is paucispiral, its diameter ranges between 500-750 μm, not exceeding 1 ½ whorls. The large mammillate nucleus present in some species of *Lyocyclus* is about 40% of the maximum diameter of the protoconch.

The protoconch in the genus *Nescitus* is strongly convex, with labial edge not expanded, while in *Lyocyclus*, the protoconch has a mammillate nucleus and a more or less developed larval shell, with a funnel-shaped labial edge, open outwards.

The 27 species of the genus *Lyocyclus* collected and studied in the present work typically show a limited geographic distribution; 25 species are found in the western Pacific.

New Caledonia seems to be the area with more species of this group: 10 species were collected only in this archi-

pelago and one more was shared with Fiji, which had three additional species more in its waters; two species were collected in Mozambique; two off Papua New Guinea; five off Solomon Islands, three off the Philippines and one off Vanuatu. The two remaining species were collected off Mozambique in the SW Indian Ocean.

The depth ranges of the new species in the two genera seem upper bathyal:

-No shelf species from less than 200 m depth; 10 species between 200 and 600 m; 9 species between 600 and 1000 metres; and 8 species were found deeper than 1000 metres; these being: *Lyocyclus micro* n. sp., *L. distortus* n. sp., *L. protampla* n. sp., L. *juanchii* n. sp., *L. disjunctionis* n. sp., *L. intortus* n. sp., *L. fijiensis* n. sp., *L. levilicii* n. sp.

In some species, the limits in the depth ranges may depend of density of sampling. For example, *Lyocyclus similis* n. sp. was collected in 13 locations off New Caledonia with about 420 specimens and shells, all of them in 300-430 m and we assume that the depth range is well documented. In contrast, 106 shells of *L. wareni* n. sp. were collected only from the type locality off New Caledonia, in a depth range of 250-350 m.

-the number of the shells or live-collected specimens was small for most of the species studied:

-6 species were collected only by the holotype: *L. simplex* n. sp.; *L. tubae* n. sp.; *L. micro* n. sp.; *L. squamosus* n. sp.; *L. glaber* n. sp.; L. *lamellaris* n. sp.

-in 9 species, the holotype was accompanied with a short number of paratypes (1-3) in the collected material: *L. magnioris* n. sp.; *L. distortus* n. sp.; *L. separates* n. sp.; *L. circuitus* n. sp.; *L. valdesquameus* n. sp.; *L. elephantus* n. sp.; *L. microtuber* n. sp.; *L. dispulsus* n. sp.; *L. josemariarubioi* n. sp.

-in 9 additional species, the holotype was accompanied with a larger number of paratypes (4-15) in the collected material: *L. angularis* n. sp. (10 p); *L. protangulata* n. sp. (9 p); *L. protampla* n. sp. (4 p); *L. juanchii* n. sp. (7 p); *L. disjunctionis* n. sp. (12 p); *L. intortus* n. sp. (14 p); *L. fijiensis* n. sp. (15 p); *L. levilicii* n. sp. (5 p); *L. similis* n. sp. (8 p).

-in only three species the number of the paratypes collected was higher: *L. horroi* n. sp. (33 p); *L. funiculatus* n. sp. (58); *L. wareni* n. sp. (105 p).

The protoconch in the Lyocyclidae is paucispiral, its diameter ranges between 500-750 μm, not exceeding 1 ½ whorls. The large mammillate nucleus present in some species of *Lyocyclus* come to represent up to 48% of the maximum diameter of the protoconch.

The size (diameter) of the protoconch was variable. Those with a larger diameter (more than 730-740 μm) were: *Lyocyclus. distortus* n. sp., *L. protampla* n. sp., *L. juanchii* n. sp., *L. levilicii* n. sp. and *L. horroi* n. sp. These are followed by others with a slightly smaller diameter (between 600 and 700 μm): *L. tubae* n. sp., *L. micro* n. sp., *L. squamosus* n. sp., *L. separatus* n. sp., *L. disjunctionis* n. sp., *L. intortus* n. sp., *L. fijiensis* n. sp., *L. elephantus* n. sp., *L. glaber*, n. sp. and *L. wareni* n. sp. The smallest protoconch has a diameter of 410 μm, in *Lyocyclus circuitus.*

The nucleus of this protoconch was usually rather variable, the larger ones being: *L. juanchi* n. sp., with 400 μm in diameter, and *L. fijiensis* n. sp. with 330 μm. In contrast, the species with the smallest protoconch of the nucleus diameters are: *L. funiculatus* n. sp, with 100 μm; *L. similis* n. sp. with 120 μm and *L. circuitus* n. sp. with 129 μm. Species with intermediate diameters are: *L. simplex* n. sp., *L. angularis* n. sp., *L. magnoris* n. sp., *L. protangulata* n. sp., *L. valdesquameus* n. sp., *L. elephantus* n. sp., *L. microtuber* n. sp., *L. wareni* n. sp., *L. josemariaerubioi* n. sp. and *L. lamellaris* n. sp.

The shells of the genus *Lyocyclus* were variable in relation to the disjunct coiling of the spire that increases in size. This character (disjunct spire) is very variable: Some species totally lack disjunct coiling like *L. squamosus* n. sp., *L. protampla* n. sp., *L. circuitus* n. sp., *L. levilicii* n. sp., *L. wareni* n. sp., and *L. lamellaris* n. sp. Other species have minor or hardly important disjunct coiling: *L. simplex* n. sp., *L. angularis* n. sp., *L. protangulata* n. sp., *L. juanchii* n. sp., *L.*

horroi n. sp., *L. valdesquameus* n. sp., *L. similis* n. sp., *L. glaber* n. sp., *L. funiculatus* n. sp. and *L. josemariarubioi* n. sp. Some have moderate disjunct coiling: *L. magnioris* n. sp., *L. separatus* n. sp., *L. intortus* n. sp., *L. elephantus* n. sp. and *L. funiculatus* n. sp., while in several species the disjunct coiling is major: *L. tubae* n. sp., *L. disjunctionis* n. sp., *L. fijiensis* n. sp., *L. microtuber* n. sp. and L. *dispulsus* n. sp.

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