



## A new genus of the family Tornidae (Gastropoda, Truncatelloidea) with the description of eight new species

## Un nuevo género de la familia Tornidae (Gastropoda, Truncatelloidea) con la descripción de ocho nuevas especies

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### RESUMEN

Se describen un nuevo género y 8 nuevas especies pertenecientes a la familia Tornidae (=Vitrinellidae) (Caenogastropoda: Truncatelloidea). Las especies estudiadas proceden del sudeste del Pacífico tropical en Nueva Caledonia, las Islas Marquesas y Filipinas, y fueron recolectadas en gran parte durante las expediciones Tropical Deep-Sea Benthos, dirigidas por IRD y MNHN. El nuevo género *Monodosus* se ha basado en caracteres morfológicos únicos presentes en las ocho nuevas especies descritas; se discute su posición sistemática y se compara con otros géneros de caracteres morfológicos similares. Cada una de las especies se ilustra mediante fotografías al microscopio electrónico de barrido, discutiendo su variabilidad específica y aportando datos sobre el hábitat, distribución geográfica y rango batimétrico.

### ABSTRACT

A new genus and 8 new species belonging to the family Tornidae (=Vitrinellidae) (Caenogastropoda: Truncatelloidea) are described. The species studied are from the southeastern tropical Pacific and were collected in New Caledonia, the Marquesas Islands and the Philippines, mainly during the Tropical Deep-Sea Benthos expeditions conducted by IRD and MNHN. The new genus *Monodosus* is based on unique morphological features that are present in the eight new species described; their systematic position is discussed and the new genus is compared with others genera presenting similar morphological characters. Each species is illustrated by scanning electron microscope photographs; their specific variability is discussed and information about their habitat, geographical distribution and bathymetric range is provided.

### INTRODUCTION

At the occasion of an ongoing study of the "vitrinelliform" gastropods from the tropical southeastern Pacific, collected during the Tropical Deep-Sea Benthos expeditions conducted by IRD and MNHN in New Caledonia, the Marquesas Islands and the Philippines,

our attention was caught by a small group of discoidal, very flattened and strongly keeled (among other characters) species, which, judging by their general appearance, could belong to the genus *Vitrinorbis* (see PILSBRY & OLSSON, 1952). However, further examination

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and comparison with the original description of this genus suggested that they did not actually fit in it, and so we decided to define a new genus based on the unique shared characters of these species, as presented hereafter.

## MATERIALS AND METHODS

In the present work, we studied material from several oceanographic campaigns carried out by the Muséum National d'Histoire Naturelle (hereafter MNHN) in the Tropical South Pacific (detailed in BOUCHET, HEROS, LOZOUET & MAESTRATI 2008). The most relevant for the present study were MON-TROUZIER (1993), a land-based expedition carried out on the sites of Touho (East coast of New Caledonia) and Koumac (West coast), named in honour of R.P. Montrouzier, a pioneer in the description of the New Caledonian

micro molluscs, and MUSORSTOM 9 (1997) on board R/V *Alis*, in the Marquesas Archipelago.

Illustrations for all the studied species were prepared using a Scanning Electron Microscope (SEM) Quanta 200 and EVO LS15. Measurements of the teleoconch, the maximum height (H) and maximum diameter (D) are based on the scale bar of the SEM micrographs. The protoconch was measured by the VERDUIN (1976) method in which a nucleus is considered at the beginning of the spire.

### Abbreviations:

MNHN Muséum National d'Histoire Naturelle, Paris

D maximum diameter of the shell, measured perpendicular to the axis of coiling

H total height of the shell

Stn station

s clearly empty shells

## SYSTEMATIC PART

Superfamily TRUNCATELLOIDEA Gray, 1840

Family TORNIDAE Sacco, 1896

Subfamily VITRINELLINAE Bush, 1897

### *Monodosus* gen. nov.

*Description:* Shell discoidal, nearly planispiral; protoconch usually slightly elevated in relation to the plane of the teleoconch, ornamented with thick, flexuous oblique riblets; teleoconch with a prominent peripheral keel and with a row of spirally aligned nodules on the adapical side; umbilicus widely open, allowing to see the protoconch in a basal view. Surface of teleoconch macro or microscopically striated.

*Type species:* *Monodosus planus* spec. nov. from New Caledonia.

*Etymology:* *Monodosus*: the generic name is formed by the fusion of two words: *mono*, from the greek *mónos*, which means "one"; and *nodosus*, "with nodes or nodules", alluding to the single spiral line with isolate nodules on its adapical part.

*Discussion:* Among the previously known genera, *Vitrinorbis* Pilsbry & Olsson, 1952 (type species: *Vitrinorbis callistus* Pilsbry & Olsson, 1952, by original designation) is most similar, mainly because of the discoidal form of its shells with a flat or concave spire, broadly open umbilicus and a keeled periphery; but the species in this genus have a smooth protoconch lacking any flexuose oblique riblets; they also have no adapical nodes on the teleoconch whorls nor have an umbilicus so widely open that it allows to see the protoconch.

The genus *Ovini* described by SIMONE (2013) is also somewhat similar due the high degree of shell compression, but it can be distinguished by its planispiral protoconch (in the type

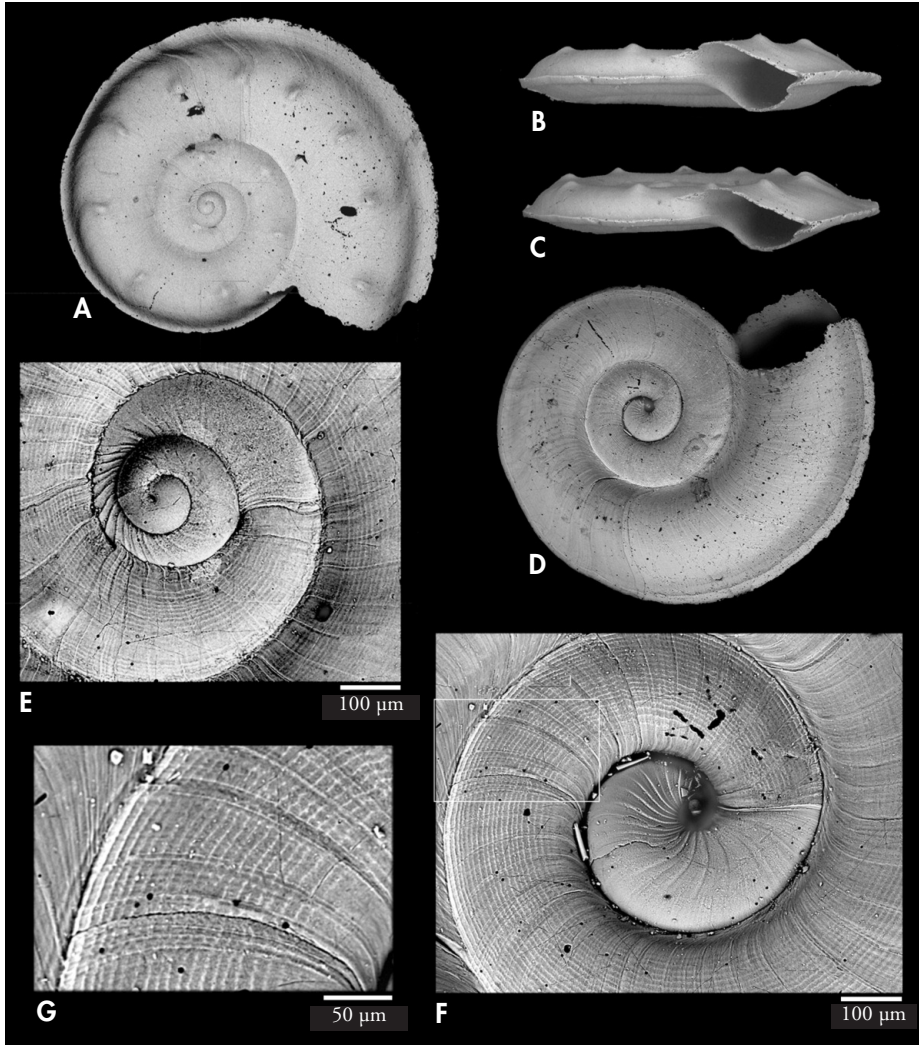


Figure 1. *Monodosus planus* spec. nov., holotype, 2.4 mm diameter, New Caledonia, Touho area, Lagoon of Grand Récif Mangalia, "Montrouzier" Stn 1264, 8 m. A: apical view; B, C: apertural views; D: basal view; E: protoconch; F: protoconch in basal view; G: microsculpture.

Figura 1. *Monodosus planus* spec. nov., holotipo, diámetro 2,4 mm, Nueva Caledonia, sector de Touho, Laguna de Grand Récif Mangalia, "Montrouzier" est. 1264, 8 m. A: vista apical; B, C: vistas aperturales; D: Vista basal; E: protoconcha; F: protoconcha en vista basal; G: microescultura.

species with only 1.25 whorls) which is smooth and also lacks any oblique riblets. It also lacks the spiral line of nodules on the teleoconch.

Other recent genera with discoidal shapes include *Cochliolepis* Stimpson, 1858 and *Sigareturnus* Iredale, 1936

(which lack a keeled periphery, oblique riblets in the protoconch and the line of nodules), and also *Discopsis* de Folin, 1870 and *Laciniorbis* Martens, 1897 (which have a keeled periphery but a different protoconch and also lack the adapical line of nodules).

*Monodosus planus* spec. nov. (Figure 1A-G)

**Type material:** Holotype in MNHN (IM-2000-32482) and 2 paratypes in MNHN (IM-2000-32483) from the type locality.

**Type locality:** New Caledonia, Touho area, Lagoon of Grand Récif Mangalia, 20°44.5'S-165°15.9'E, 8 m, sandy bottom, [MONTROUZIER expedition, 1993: Stn 1264].

**Etymology:** The specific name derives from the Latin word, *planus*, *a*, *um* which means "flat" alluding the very small height of the shell, which has a lenticular form.

*Description:* Shell very small (<2.5 mm), discoidal, nearly planispiral; spire formed by 4 ¼ whorls separated by a thin suture, keeled and widely umbilicate.

The protoconch has 2.1 whorls, measuring 380 µm in diameter and with a nucleus of 100 µm, is developed in two phases, the first one completely smooth and the second presenting more than 30 thick flexuous, oblique riblets most developed at the beginning of the second whorl, and also apparent in umbilical view.

The teleoconch has nearly 2 whorls, slightly convex, with a well-developed peripheral keel; adapically it is more convex than abapically. The ornamentation is formed by growth lines, spiral cordlets and nodules; the growth lines are slightly undulating and well marked on the adapical side, distinctly curved on the umbilical side; the cordlets, very fine and numerous, cover the entire surface of the teleoconch, including the keel; the nodules are spirally aligned, slightly elongated towards the outer

edge, and are located adapically closer to the periphery than to the suture; there are 4 nodules on the first teleoconch whorl and 10 on the last whorl.

Umbilicus very broad and shallow, exposing the protoconch also from the base.

Aperture somewhat rhomboidal, prosocline; parietal area and columella very thin and narrow; outer lip angled internally by the peripheral keel.

Dimensions: the holotype measures 2.4 mm in diameter and 0.4 mm in height (H/D: 0.16).

*Habitat:* Infralittoral species dredged from 8 m on sandy bottom with bioclasts.

*Distribution:* Only known from the type locality.

*Remarks:* *Monodosus planus* spec. nov. is characterized by the numerous oblique and flexuous riblets of the protoconch; by the elongate form and radial direction of the spirally aligned nodules (which start almost immediately after the first ½ whorl of the teleoconch), and by the prominent peripheral keel.

*Monodosus paucistriatus* spec. nov. (Figure 2A-G)

**Type material:** Holotype in MNHN (IM-2000-32492) and 6 paratypes in MNHN (IM-2000-32493), all from the type locality.

**Type locality:** New Caledonia, Koumac area, Passe de Koumac, Tombant Est, 20°40.4'S-164°14.9'E, 10-60 m, on hard bottoms [MONTROUZIER: Stn 1311].

**Etymology:** The specific name alludes to the small surface covered with fine spiral striation.

*Description:* Shell very small (≤2.5 mm), discoidal, nearly planispiral, spire formed by 4 whorls separated by a thin suture, keeled and widely umbilicate.

The protoconch is slightly raised above the first teleoconch whorl, has a little more than 2 whorls, measuring 320 µm in diameter with a nucleus of about

50 µm; it is developed in two phases, the first one completely smooth and the second presenting about 30 oblique, flexuous riblets which extend almost from suture to suture, many of them not reaching the lower one.

The teleoconch has between 1 ¾ and 2 whorls, with a large peripheral keel



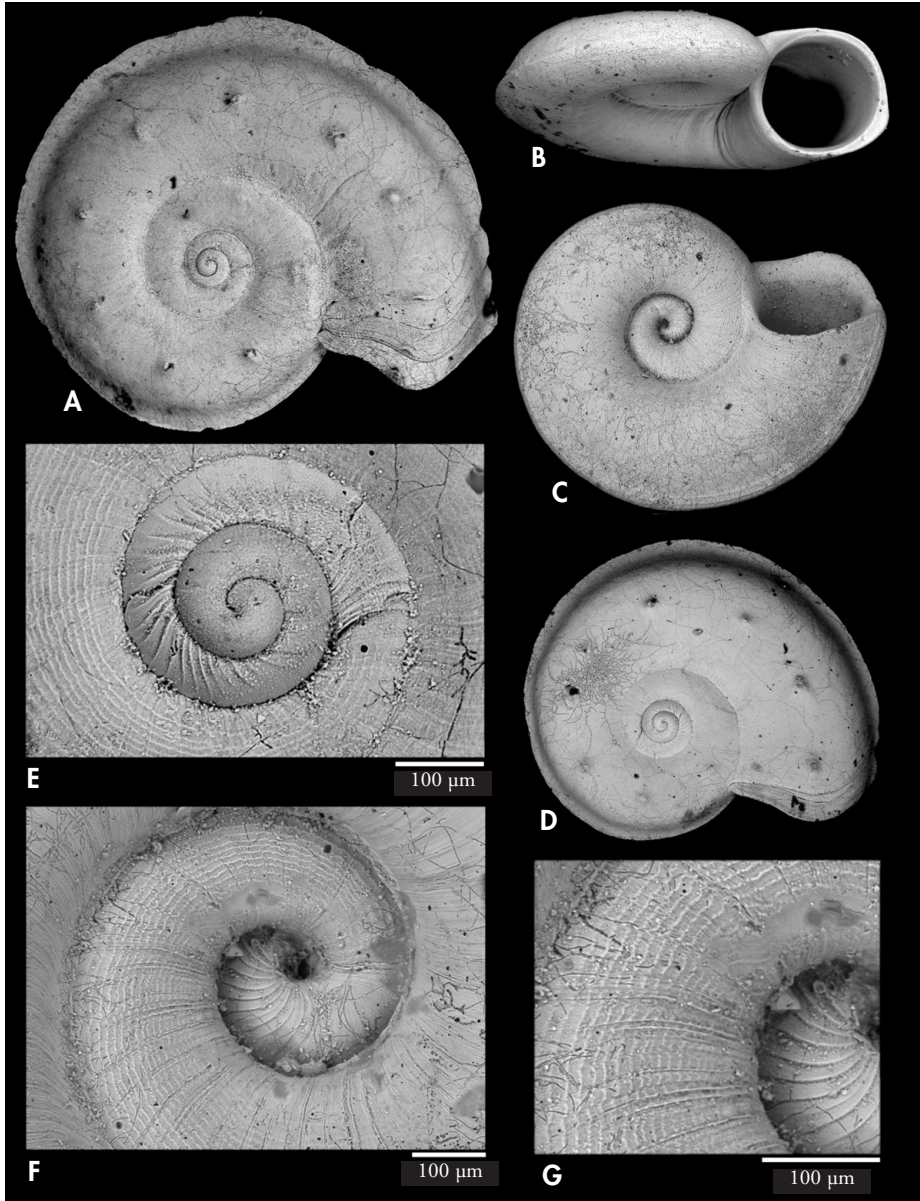


Figure 2. *Monodosus paucistriatus* spec. nov., New Caledonia, Koumac area, Passe de Koumac, Tombant Est, “Montrouzier” Stn 1311, 20°40.4’S-164°14.9’E, 10-60 m. A: holotype, 2.5 mm diameter, apical view; B: paratype, 1.9 mm, same locality, apertural view; C, D: paratype, 1.9 mm, same locality, apical and basal views; E: protoconch, same specimen as C-D; F, G: basal view of the protoconch and detail, same specimen.

Figura 2. *Monodosus paucistriatus* spec. nov., Nueva Caledonia, sector de Koumac, Passe de Koumac, Tombant Est, “Montrouzier” est 1311, 20°40.4’S-164°14.9’E, 10-60 m. A: holotipo, diámetro 2,5 mm, vista apical; B: paratipo, 1,9 mm, misma localidad, vista apertural; C, D: paratipo, 1,9 mm, misma localidad, vistas apical y basal; E: protoconcha, mismo ejemplar que C-D; F, G: vista basal de la protoconcha y detalle, mismo ejemplar.

near the base, more irregular in older specimens; convex both adapically and abapically. Ornamentation consists of growth lines, spiral cordlets and nodules; the growth lines are very thin and flexuous over the entire teleoconch, except in the vicinity of the labial margin, where they become very thick, modifying the contour of the keel; the cordlets, thin and numerous, cover the surface of the teleoconch up to  $\frac{3}{4}$  of a whorl, then disappear, leaving only a small band with cordlets next to the suture. Nodules are rounded, spirally aligned and located adapically, equidistant between the keel and the suture; they start from  $\frac{3}{4}$  of a whorl and 8-9 can be seen on the last whorl. Abapically, there are 3 spiral cordlets next to the keel. Umbilicus very broad and shallow, exposing the protoconch from the base, ornamented with spiral cordlets on the teleoconch whorl.

Aperture rounded, prosocline; parietal area with a thin callous layer; columella arched, thin and slightly reflected towards the umbilicus; outer lip angled internally by the peripheral keel and forming also a small internal angle close to the parietal area.

Dimensions: the holotype size 2.50 mm in diameter and 0.7 mm in height (H/D: 0.28).

*Habitat*: Infralittoral to circalittoral species dredged at 10-60 m on hard bottoms.

*Distribution*: Only known from the type locality.

*Remarks*: The most similar species is *Monodosus planus* spec. nov. but the present species has a rounded aperture, not flattened-rhomboidal; *M. planus* also has a more depressed spire, the protoconch almost at the same level and with H/D of 0.16 versus 0.28 in *M. paucistriatus* spec. nov.

### *Monodosus externus* spec. nov. (Figure 3A-E)

**Type material**: Holotype in MNHN (IM-2000-32494), one paratype in MNHN (IM-2000-32495) from West Pamilacan Island, Cervera shoal, PANGLAO 2004 Stn T39, 9°30'N-123°50'E, 100-138 m, muddy sand.

**Type locality**: Philippines, between Panglao and Pamilacan islands, 09°33.4'N-123°51.0'E, 106-137 m, fine sand and mud with echinoderms.

**Etymology**: The specific name derives from the Latin word, *externus*, *a, um*, which means "outside", alluding to the fact that the dorsal nodules are closer to the external border than in other congeneric species.

*Description*: Shell very small ( $\leq 2.0$  mm), discoidal, nearly planispiral, spire formed by more than 3  $\frac{3}{4}$  whorls separated by a thin suture, keeled and widely umbilicate.

The protoconch is slightly eroded in the holotype, but the sculpture can still be seen. It is slightly raised above the first teleoconch whorl, has about 2 whorls, measuring 350  $\mu$ m in diameter and is developed in two phases, the first one completely smooth and the second presenting about 9 oblique sigmoidal ribs that extend between sutures.

The teleoconch has 1  $\frac{3}{4}$  whorls, with a large peripheral keel near the base, convex both adapically and abapically.

Ornamentation consists of growth lines and nodules; the growth lines are very thin and flexuous on all the teleoconch except in the vicinity of the labial margin, where they become thicker, but do not modify the contour of the keel; spiral cordlets on the surface of the teleoconch are not observed. Nodules are elongated, spirally aligned and adapically located closer to the keel, forming a line being developed from the first  $\frac{1}{4}$  of whorl; 12 can be seen on the last whorl. Abapically, 3 spiral cordlets can be seen near the keel.

Umbilicus very broad and shallow, exposing the protoconch from the base, ornamented inside with spiral cords on the teleoconch whorl.



Figure 3. *Monodosus externus* spec. nov., holotype, 2.0 mm diameter, Philippines, between Panglao and Pamilacan islands, 09°33.4'N-123°51.0'E, 106-137 m, fine sand and mud with echinoderms. A: apical view; B: apertural view; C: oblique basal view; D: protoconch; E: detail of the last whorl in abapical view.

*Figura 3. Monodosus externus spec. nov., holotipo, diámetro 2.0 mm, Filipinas, entre Panglao y las islas Pamilacan, 09°33.4'N-123°51.0'E, 106-137 m, arena fina y fango con equinodermos. A: vista apical; B: vista apertural. C: vista basal oblicua. D: protoconcha. E: detalle de la última vuelta en vista abapical.*

Aperture ovoid, prosocline; parietal area callous with a thin layer; columella arched, thin and slightly reflected towards the umbilicus; outer lip angled internally by the peripheral keel and forming also a small internal angle close to the parietal area.

Dimensions: the holotype is 2.0 mm in diameter and 0.38 mm in height (H/D: 0.19).

*Habitat:* Circalittoral species dredged at 100-138 m in muddy sand bottom and at 106-137 m in fine sand and mud with echinoderms bottom.

*Distribution:* Between Panglao and Pamilacan islands, the type locality, and West Pamilacan island.

*Remarks:* The most important characters of this species are the very flat shell, with scarce presence of microsculpture.

The most similar species is *M. planus* spec. nov., which can be distinguished by a slightly larger protoconch, with many more flexuous riblets (about 30 in opposition to only 9 in *M. externus*); the positions of the nodules is slightly closer to the periphery in *M. externus* spec. nov.

*Monodosus proximus* spec. nov. (Figure 4A-F)

**Type material:** Holotype in MNHN (IM-2000-32490) and 2 paratypes in MNHN (IM-2000-32491), from the type locality.

**Type locality:** Philippines, West of Pamilacan island, Cervera shoal, 09°29'N-123°52'E, 95-128 m, sandy bottom with echinoderms.

**Etymology:** The specific name is from the Latin word *proximus*, *a, um*, alluding to the aligned nodules that are closer to the axis than in other congeneric species.

*Description:* Shell very small (<2.5 mm), discoidal, nearly planispiral, spire formed by about 4 ¼ whorls separated by a thin suture, keeled and widely umbilicate.

The protoconch is slightly raised above the first teleoconch whorl, and has more than 2¼ whorls; it measures about 400 µm in diameter and is developed in two phases, the first one completely smooth and the second presenting about 20 oblique, flexuous, short riblets close to the upper suture.

The teleoconch has nearly 2 whorls, with a large peripheral keel near the base; it is convex both adapically and abapically. Ornamentation consists of thin growth lines, spiral cordlets and nodules; the cordlets, very thin and numerous, cover the space between the suture and the keel until the end of the first whorl, then they only persist between the suture and the line of nodules. These are elongated, spirally aligned and are situated adapically, closer to the suture than to the peripheral keel, united by a very blunt keel; they start from the beginning of the teleoconch and 6 can be seen on the last whorl. Umbilicus very broad and shallow, exposing the protoconch from the base; ornamented inside by the spiral cords on the first whorl of the teleoconch.

Aperture rounded, prosocline; callous in the parietal area with a thin layer; columella arched, thin and slightly reflected towards the umbilicus; outer lip angled internally by the peripheral keel and forming also to small internal angle close to the parietal area.

**Dimensions:** the holotype size is 2.0 mm in diameter. A paratype is 2.4 mm in diameter.

**Habitat:** Circalittoral species dredged at 95-128 m on a sandy bottom with echinoderms.

**Distribution:** Only known from the type locality.

**Remarks:** The main characteristics of the present species are: the very short oblique ribs in the protoconch, the low number of the adapical nodules and their position closer to the upper suture.

The most similar species is *M. paucistriatus* spec. nov., which differs in having the riblets on the protoconch extending much further away from the suture, and in the shape of the nodules which are rounded rather than spirally elongate.

*Monodosus planus* spec. nov. and *M. brevispiralis* spec. nov. have more nodules and these are not elongate spirally, but are placed closer to the periphery; besides, *M. planus* has a protoconch with more riblets, which are more elongate.

*Monodosus multinodosus* spec. nov. also has more nodules, placed closer to the periphery, and the shell is completely striated.

*Monodosus simulans* spec. nov. has a much coarser sculpture which persists over the whole shell, and nodules that are more elongate spirally and placed on an evident carina.

*Monodosus prolatus* spec. nov. has hardly defined nodules, has a spiral striation only at the beginning of the teleoconch, and also has grooves with a network of minute, irregular incisions.

*Monodosus simulans* spec. nov. (Figure 5A-F)

**Type material:** Holotype in MNHN (IM-2000-32488).

**Type locality:** Philippines, Panglao Island, Bolod, 09°32'N-123°48'E, 152 m, in coarse sand.

**Etymology:** The specific name derives from the Latin word, *simulans*, *antis*, which means "imitator", alluding to the fact that the usual sculpture of the nodules is not very apparent.



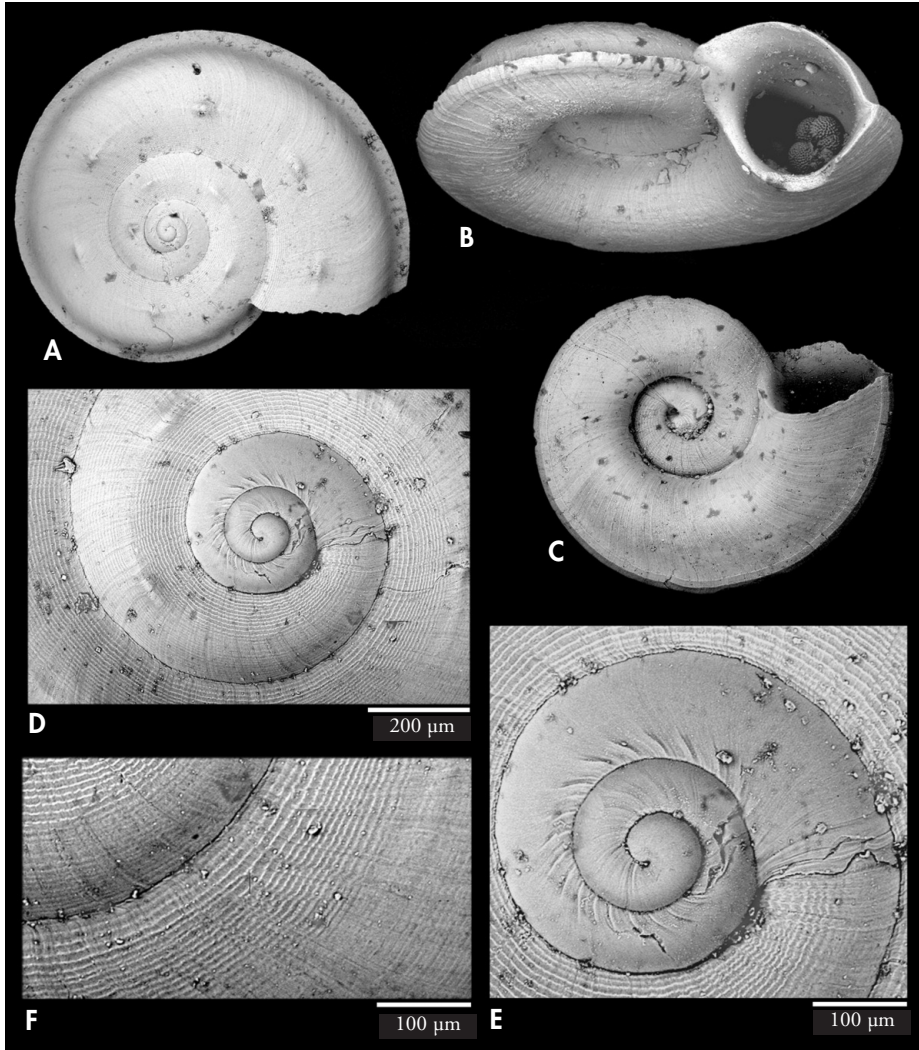


Figure 4. *Monodosus proximus* spec. nov., Philippines, West of Pamilacan island, Cervera shoal, 09°29'N-123°52'E, 95-128 m, sandy bottom with echinoderms. A: holotype, 2.0 mm diameter, apical view; B: paratype, 2.8 mm, same locality, oblique apertural view; C: paratype, 1.8 mm, same locality, basal view; D, E: protoconch of the holotype; F: microsculpture of the last whorl of the holotype, in apical view.  
 Figura 4. *Monodosus proximus* spec. nov., Filipinas, oeste de la isla de Pamilacan, Cervera shoal, 09°29'N-123°52'E, 95-128 m, fondo arenoso con equinodermos. A: holotipo, diámetro 2,0 mm, vista apical; B: paratipo, 2,8 mm, misma localidad, vista apertural oblicua; C: paratipo, 1,8 mm, misma localidad, vista basal; D, E: protoconcha del holotipo; F: microescultura de la última vuelta del holotipo, en vista apical.

**Description:** Shell very small (<2.5 mm), discoidal, nearly planispiral; spire with slightly over 4 whorls, separated by a wide and deep suture, keeled and widely umbilicate, exposing the protoconch .

The protoconch is slightly raised over the first teleoconch whorl, has a little more than 2 whorls, measuring 450 µm in diameter, and has a nucleus of about 70 µm; it is developed in two phases, the

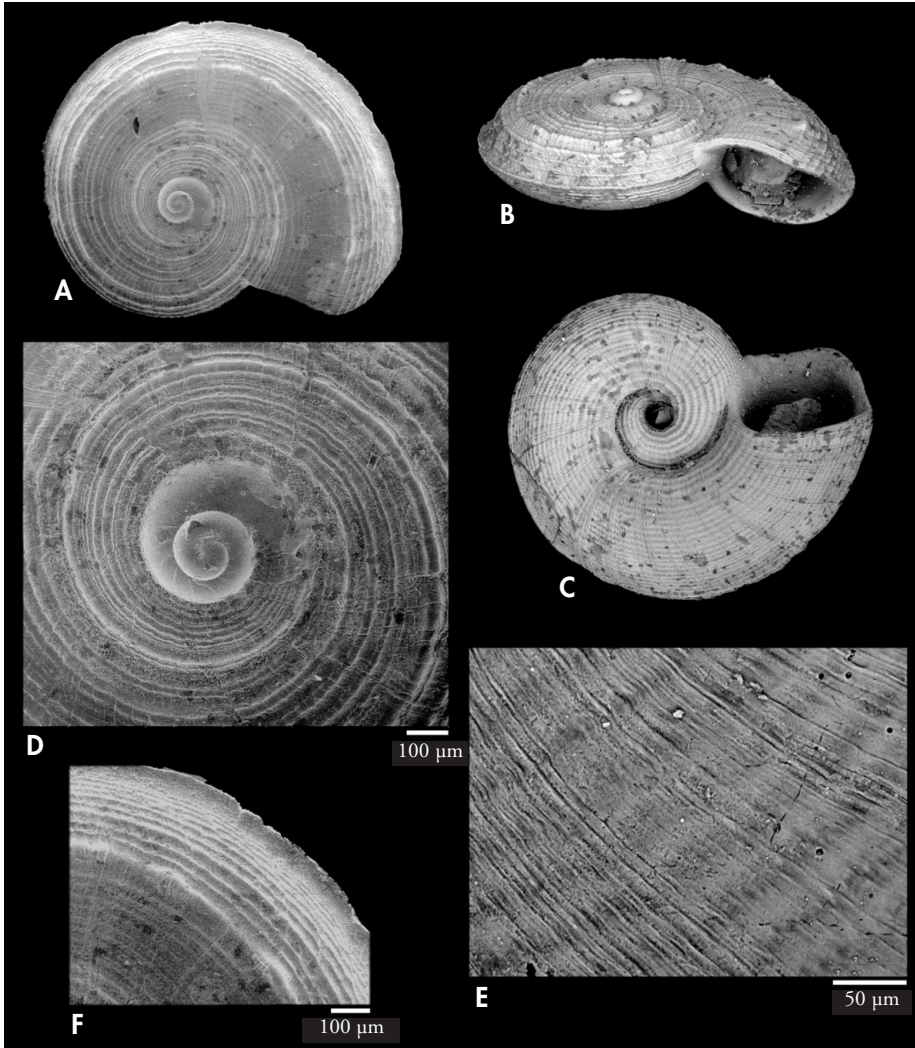


Figure 5. *Monodosus simulans* spec. nov., holotype, 2.5 mm diameter, Philippines, Panglao Island, Bolod, 09°32'N-123°48'E, 152 m. A: apical view; B: oblique apertural view; C: basal view; D: protoconch; E, F: microsculpture and detail.

Figura 5. *Monodosus simulans* spec. nov., holotipo, diámetro 2,5 mm, Filipinas, isla de Panglao, Bolod, 09°32'N-123°48'E, 152 m. A: vista apical; B: vista apertural oblicua; C: vista basal; D: protoconcha; E, F: microescultura y detalle.

first one completely smooth and the second presenting 5-6 thin oblique sigmoidal riblets that are limited to the adapical part of the spire.

The teleoconch has 2 whorls with a peripheral keel and has a thick and elevated spiral row of elongate nodules,

forming a blunt keel adapically; in this part, the whorls are flat on either side of this blunt keel, and are convex abapically. The ornamentation consists of growth lines, spiral cords and nodules; the growth lines are strongly marked, very closely set, their interaction with

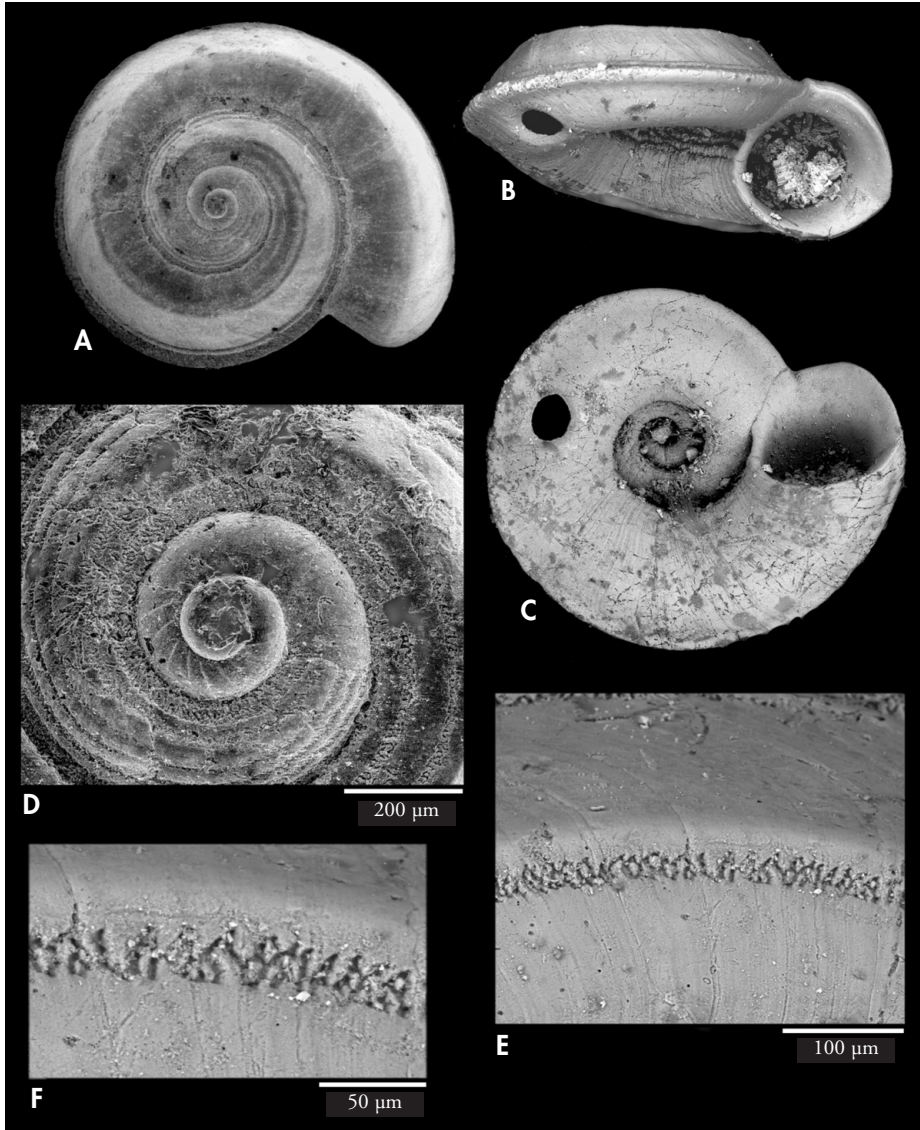


Figure 6. *Monodosus prolatus* spec. nov., holotype, 2.4 mm diameter, Philippines, Panglao Island, SE of Dauis, 09°37.2'N-123°52.2'E, 2 m. A: apical view; B: apertural view; C: basal view; D: protoconch; E, F: adapical keel and groove, and detail.

Figura 6. *Monodosus prolatus* spec. nov., holotipo, diámetro 2,4 mm, Filipinas, isla de Panglao, SE de Dauis, 09°37,2'N-123°52,2'E, 2 m. A: vista apical; B: vista apertural; C: vista basal; D: protoconcha; E, F: quilla adapical y ranura, y detalle.

spiral threads producing numerous and irregular small nodules, which on the base look more like incised lines; spiral cordlets covering the entire surface of

the teleoconch, unequal between the suture and the peripheral keel, more uniform and thicker between the keel and the inner part of the umbilicus. The



nodules are elongated and placed along a thick spiral cord that forms an angle, and develop from the beginning of the teleoconch; about 9 can be seen on the last whorl.

Umbilicus very broad and shallow, exposing the protoconch from the base.

Aperture quadrangular, prosocline; parietal area with a rather thin callous layer; columella arched, not very thick and slightly reflected towards the umbilicus; outer lip angled internally by the peripheral keel and the line of nodules, forming also a small internal angle close to the parietal area.

### *Monodosus prolatus* spec. nov. (Figure 6A-F)

**Type material:** Holotype in MNHN (IM-2000-32489).

**Type locality:** Philippines, Panglao Island, SE of Dauis, 09°37.2'N-123°52.2'E, 2 m, muddy coarse sand with rubble.

**Etymology:** The specific name derives from the Latin word, *prolatus*, a, um, which means "extended", alluding to the fact that the dorsal nodules are slightly elongated.

*Description:* Shell very small (<2.5 mm), discoidal, nearly planispiral, spire formed by nearly 4 ½ whorls separated by a wide suture, keeled and widely umbilicated.

The protoconch is slightly raised above the first teleoconch whorl, has about 2 whorls, measuring 420 µm, about 50 µm in the nucleus; it is developed in two phases, the first one completely smooth and the second presenting 8-10 flexuous, oblique riblets that extend between sutures.

The teleoconch has nearly 2 ¼ whorls, with a thick peripheral keel close to the base and a narrow band located between the keel and the suture, forming a blunt angle on the last whorl; adapically, the whorls are flat on either side of this blunt keel, and are convex abapically. Ornamentation consists of thin growth lines, spiral cordlets and nodules; the growth lines are very thin adapically and more marked abapically; five thick spiral cords are seen at the beginning of the teleoconch and disappear progressively from the first whorl; the spaces between the cords are covered by a network of minute threads; the nodules are elongated and very subtle

Dimensions: the holotype is 2.5 mm in diameter and about 0.5 mm in height (H/D: 0.2).

*Habitat:* Circalittoral species dredged at 152 m on a coarse sand bottom.

*Distribution:* Only known from the type locality.

*Remarks:* *Monodosus simulans* spec. nov. is characterized by the rather large size of its protoconch, and differs from all other species described herein by its coarse, unequal spiral cordlets and the shape of the nodules which are spirally elongate along a cord, not transversely elongate as in e.g. *M. planus*.

and are located along the adapical angle. The groove bordering adapically the peripheral keel shows an irregular mesh of minute incisions, only seen under high magnification (Figs. 6E-F).

Umbilicus very wide and rather deep, exposing the protoconch from the base, ornamented inside by the growth lines and two thick spiral cords.

Aperture rounded, prosocline; parietal area callous with a thick layer; columella arched and reflected towards the umbilicus; outer lip angled internally by the peripheral keel and forming also a small internal angle close to the parietal area.

Dimensions: the holotype is 2.4 mm in diameter and 1.05 mm in height (H/D: 0.437).

*Habitat:* Infralittoral species dredged at 2 m in muddy coarse sand with rubble bottom.

*Distribution:* Only known from the type locality.

*Remarks:* *Monodosus prolatus* spec. nov. is characterized by spiral cords which develop on the first whorl of the teleoconch and later disappear, leaving only the peripheral and adapical keels. The nodules are tenuous but the overall



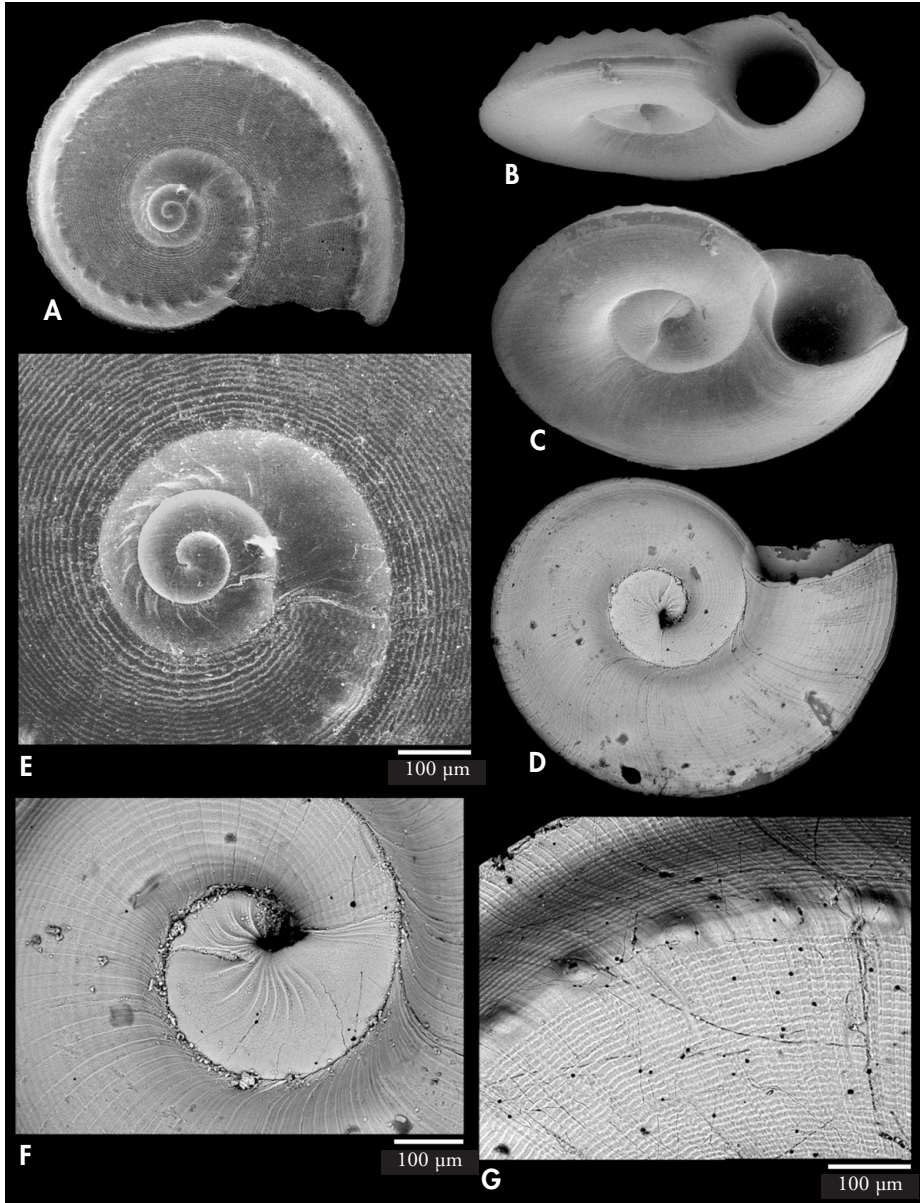


Figure 7. *Monodosus multinodosus* spec. nov., Marquesas Archipelago, Fatu Hiva, Musorstom 9 Stn DR1247, 1150-1250 m. A: holotype, 1.45 mm diameter, apical view; B, C: paratype, 1.5 mm, same locality, apertural view and oblique basal view; D: paratype, 1.5 mm, same locality, basal view; E: protoconch of the holotype; F: basal view of the protoconch, same paratype as D; G: microsculpture of the holotype.

Figura 7A-G. *Monodosus multinodosus* spec. nov., Archipiélago de las Marquesas, Fatu Hiva, Musorstom 9 Stn DR1247, 1150-1250 m. A: holotipo, diámetro 1,45 mm, vista apical; B, C: paratipo, 1,5 mm, misma localidad, vista apertural y vista basal oblicua; D: paratipo, 1,5 mm, misma localidad, vista basal; E: protoconcha del holotipo; F: vista basal de la protoconcha, mismo paratipo que D; G: microscultura del holotipo.

similarity with *M. proximus* and the presence of the axial riblets on the protoconch support the generic placement.

Among the new species previously described, *Monodosus planus* spec. nov., *M. brevispira* spec. nov. and *M. multinodosus* spec. nov. can be distinguish by

having only a very thin spiral sculpture and the nodules being well defined. *M. simulans* spec. nov. has spiral cords in all the adapical part that are continuous up to the end of the spire. Abapically, the striae are wider and less numerous, and it does not have an irregularly excavate groove.

***Monodosus multinodosus* spec. nov.** (Figures 7A-G, 8A-F)

**Type material:** Holotype in MNHN (IM-2000-32486) and 14 paratypes in MNHN (IM-2000-32487) from the type locality.

**Type locality:** Ile Fatu Hiva, Marquesas Archipelago, 10°34'S-138°42'E, 1150-1250 m [MUSORS-TOM 9: Stn DR1247].

**Etymology:** The specific name derives from the Latin words, *multi*, which means "a lot", and *nodosus*, *a, um*, with nodules, alluding the more numerous nodules of the shell.

*Description:* Shell very small (<1.5 mm), discoidal, nearly planispiral; spire formed by 3 ½ whorls separated by a thin suture, keeled and widely umbilicated.

The protoconch is slightly raised above the first teleoconch whorl, has 2 ¼ whorls, measuring 410 µm in diameter with a nucleus of about 80 µm; it is developed in two phases, the first one completely smooth and the second presenting about 13 very oblique folds that extend only over a small subsutural zone, without reaching the sutures nor the median part of the whorl, and also abapically in the vicinity of the umbilicus.

The teleoconch has 1 ¼ whorls, with a peripheral keel; adapically it is flat, and abapically somewhat convex with a central depression.

Ornamentation consists of thin growth lines, spiral cordlets and nodules; the cordlets are very thin and numerous, and cover the entire surface of the teleoconch, including the keel and inside the umbilicus; they are more dense and tighter adapically, more spaced and less numerous on the base; the nodules are rounded, spirally aligned and located adapically closer to the keel, forming a narrow band that forms an angle on the shell and starts at the beginning of the teleoconch; there

are between 31 and 37 on the last whorl.

Umbilicus very broad but rather shallow, exposing the protoconch from the base. In this part the spiral cordlets of the teleoconch are attenuated and the the protoconch shows flexuous axial riblets.

Aperture rounded and prosocline; parietal area with a very thin callus; columella nearly straight, thin and slightly reflected towards the umbilicus; outer lip angled internally by the peripheral keel and the row of nodules.

Dimensions: the holotype size 1.45 mm in diameter and about 0.48 mm in height (H/D: 0.33).

*Habitat:* Dredged at 1150-1250 m depth, but this occurrence could result from downslope transport in this very steep area.

*Distribution:* Only known from the type locality.

*Remarks:* *Monodosus multinodosus* spec. nov. is similar in some respects to *M. brevispiralis*, but differs in the number of nodules and in the profile of the adapical whorl (see in Remarks of *M. brevispiralis*).

*Monodosus planus* n. sp has nodules set much more widely apart, and not so close to the periphery and the spiral striae are continued over the row of nodules.

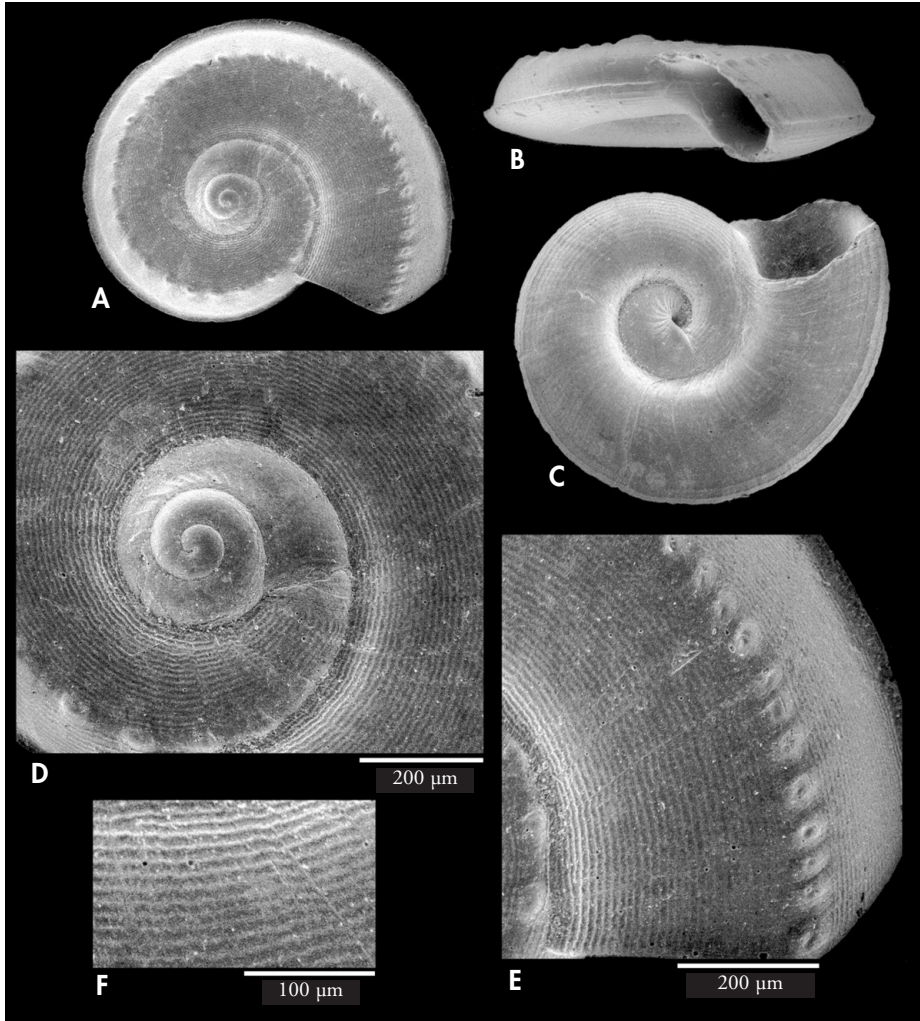


Figure 8. *Monodosus multinodosus* spec. nov., Marquesas Archipelago, Fatu Hiva, Musorstom 9, Stn DR1247, 1150-1250 m. A: paratype, 1.45 mm diameter, apical view; B: paratype, 1.5 mm diameter, apertural view; C: paratype, 1.4 mm diameter, basal view; D: protoconch, same paratype as A; E, F: microsculpture and detail.

Figura 8. *Monodosus multinodosus*. spec. nov., Archipiélago de las Marquesas, Fatu Hiva, Musorstom 9, Stn DR1247, 1150-1250 m. A: paratipo, diámetro 1,45 mm, vista apical; B: paratipo, diámetro 1,5 mm, vista apertural; C: paratipo, diámetro 1,4 mm, vista basal; D: protoconcha, mismo paratipo que A; E, F: microescultura y detalle.

*Monodosus brevispiralis* spec. nov. (Figure 9A-D)

**Type material:** Holotype in MNHN (IM-2000-32484) and one paratype in MNHN (IM-2000-32485) from the type locality.

**Type locality:** Tahuata Island, Marquesas Archipelago, 09°54'S-139°07'E, 48 m [R/V "Marara" Stn D47, col. J. Poupin 1990].

**Etymology:** The specific name derives from the Latin words, *brevis*, *e*, which means “short”, and *spiralis*, the “spire” of the shell, due to the teleoconch being very short, smaller than one whorl.

**Description:** Shell very small (<1.5 mm), discoidal, nearly planispiral; spire with a little more than 3 whorls separated by a thin suture, keeled and widely umbilicate.

The protoconch has 2 ¼ whorls, measuring about 400 µm in diameter and is developed in two phases, the first one completely smooth and the second one with about 18 very oblique folds that extend only over a small subsutural zone, without reaching the sutures nor the median part of the whorl.

The teleoconch has slightly less than one whorl, with a peripheral keel that starts from the first ¼ whorl; similarly convex adapically and abapically. The ornamentation consists of growth lines, spiral cordlets and nodules; the growth lines are sigmoidal and not very marked; the very fine numerous cordlets cover the entire surface of the teleoconch, except for a narrow spiral band (along which is situated the line of nodules), the keel and the interior of the umbilicus; the nodules are rounded, spirally aligned, and located adapically close to the keel; they are developed before the first quarter of whorl, and are 13 on the last whorl.

Umbilicus very broad and rather shallow; exposing the protoconch also from the base.

Aperture rounded, prosocline; parietal area with a very thin callous layer; columella arched, thin and slightly reflected from the columellar lip to the umbilicus; outer lip angled internally by the peripheral keel and less so by the row of nodules.

## CONCLUSIONS AND COMMENTS

In the present work a new genus is described in the family Tornidae, including 8 species, all of them also new to science.

Some morphological characters are quite straightforward: all have a depressed spire, a peripheral keel and

Dimensions: the holotype is 1.05 mm in diameter and 0.23 mm in height (H/D: 0.22).

**Habitat:** Circalittoral species, dredged at a depth of 48 m.

**Distribution:** Only known from the type locality,

**Remarks:** *Monodosus brevispiralis* spec. nov. is characterized by the smaller extension and very oblique setting of the riblets on its protoconch and by the smooth band, without spiral cordlets, along the row of nodules; also by the fact that the spiral cordlets do not cover the peripheral keel, and by the shape of the aperture, modified by the keel and the row of nodules. In these respects, it most resembles *M. multinodosus* spec. nov. and could be taken as a juvenile of the latter, but differs in the onset of the nodules which appear earlier and more closely set in *M. multinodosus* (being about 13 in the first whorl of *M. brevispiralis* versus 25-27 in *M. multinodosus*), and also the adapical surface of the teleoconch of *M. brevispiralis* spec. nov. is regularly curved while in *M. multinodosus* spec. nov. the line of nodules marks an angle along which an almost flat surface is in contact with another slightly curved surface. Furthermore, the band along the row of nodules is smooth in *M. brevispiralis* whereas in *M. multinodosus*, it has a median cordlet and shows some striation.

*Monodosus planus* spec. nov. has less nodules, whereas the protoconch has more numerous and more elongate oblique riblets.

more or less noticeable nodules, disposed in a spiral row on the adapical side. Due to their small size and to the fact that they were collected from sediments, no soft parts were studied and we present here no data on the external anatomy or the radula.



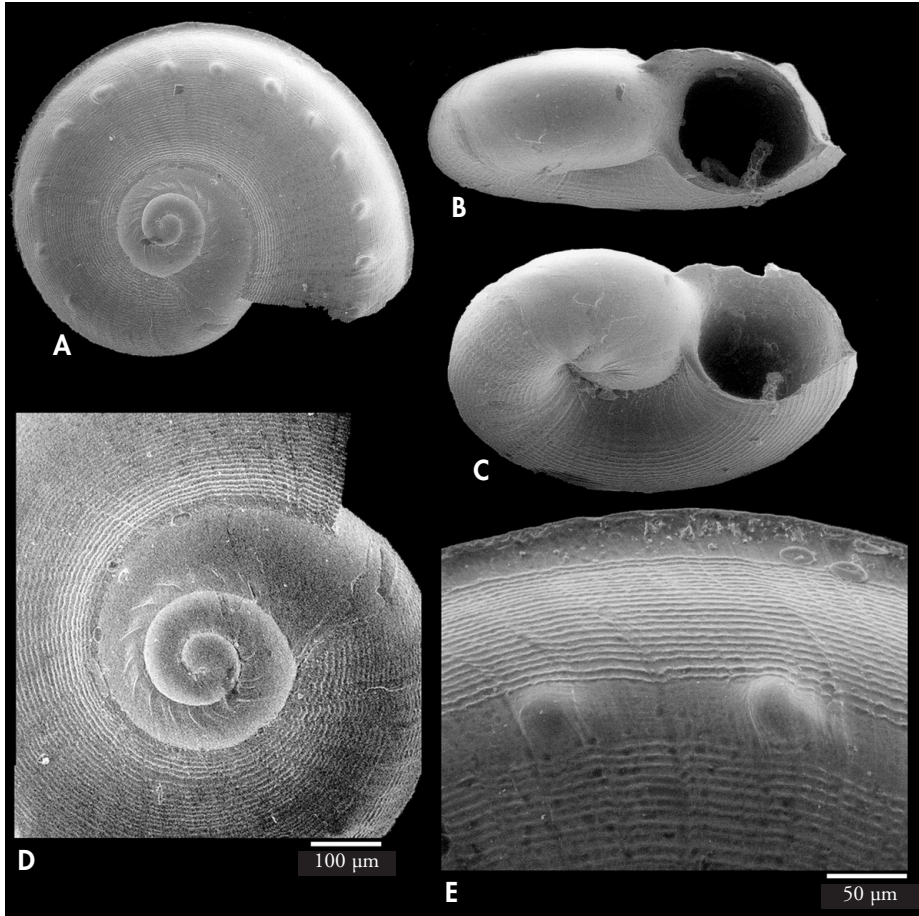


Figure 9. *Monodosus brevispiralis* spec. nov., holotype, 1.05 mm diameter, Marquesas Archipelago, Tahuata, R/V "Marara" Stn D47, 48 m. A: apical view; B: apertural view; C: oblique basal view; D: protoconch; E: microsculpture.

Figura 9. *Monodosus brevispiralis* spec. nov., holotipo, diámetro 1,05 mm, Archipiélago de las Marquesas, Tahuata, R/V "Marara" Stn D47, 48 m. A: vista apical; B: vista apertural; C: vista basal oblicua; D: protoconcha; E: microescultura.

The protoconch is rather similar in all the species: slightly raised above the first teleoconch whorl, having between 2 and  $2\frac{1}{4}$  whorls. Its size is rather large, between 320 and 450  $\mu\text{m}$ . Oblique sigmoidal lamellae are always present, sometimes occupying all the width between sutures (*M. planus*, *M. prolatus*, *M. paucistriatus*, *M. externus*), while in other cases they are very short and do not reach the sutures or at least do not

reach one of them (*M. brevispiralis*, *M. multinodosus*, *M. simulans*, *M. proximus*).

Of the 8 new species, 4 were collected in the Philippines, 2 in Marquesas Islands and 2 in New Caledonia, in a bathymetric range: 2 - 1250 m. The species from New Caledonia were collected at a depth of 8 m (*M. planus*) or between 10 and 30 m (*M. paucistriatus*). For the species from Marquesas Islands: *M. brevispiralis*, at 48 m; *M. multinodosus*,

between 1150-1250 m. Finally, the four species collected in the Philippines had the following bathymetric range: *M. prolatus*, 2 m; *M. proximus*, between 95 and 128 m; *M. externus*, between 100 and 138 m; *M. simulans*, at 152 m. However, much caution must be taken with the deepest occurrence, since the extremely steep slopes of the Marquesas are very prone to downslope transport from the nearby foreereef.

The habitat is not exactly known, since the species were collected empty from sediments in New Caledonia (sand bottom; hard bottom); Marquesas (no information); Philippines (muddy coarse sand with rubble; sand or fine sand and mud with echinoderms; muddy sand; coarse sand). The Philippines is the geographical area where more species were found, thus presenting the greatest known diversification for this genus.

## BIBLIOGRAPHY

- BOUCHET P., HEROS V., LOZOUET P. & MAESTRATI P. 2008. A quarter-century of deep-sea malacological exploration in the South and West Pacific: Where do we stand? How far to go?, in: Héros V. et al. (Ed.) *Tropical Deep-Sea Benthos, Volume 25. Mémoires du Muséum national d'Histoire naturelle (1993)*, 196: 9-40.
- PILSBRY H.A. & OLSSON A.A. 1952. Vitrinellidae of the Panamic Province: II. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 104: 35-88, pl. 2-13.
- SIMONE L. R. L. 2013. A new Brazilian Tornid is possibly the flattest coiled snail. *Journal of Molluscan Studies*, 79: 187-189.
- VERDUIN, A. 1976. On the systematic of Recent *Rissoa* of the subgenus *Turboella* Gray, 1847, from the Mediterranean and European Atlantic coasts. *Basteria*, 40: 21-73.

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