

**New species of Conradiidae Golikov & Starobogatov, 1987  
(= Crosseolidae Hickman, 2013) (Gastropoda: Trochoidea)  
from the Tropical Indo-Pacific**

**II. The genus *Crosseola* and the description of *Crossolida* n. gen.**

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**KEYWORDS.** Gastropoda, Trochoidea, Conradiidae, Crosseolidae, *Crosseola*, Indo-Pacific, new species.

**ABSTRACT.** New species of crosseolid vetigastropods, obtained during several expeditions in the Indo-West Pacific, organized by MNHN and IRD, are studied. In this second part we describe 23 species of the genus *Crosseola* Iredale, 1924, of which 19 are new. All these species are compared with the previously known species in this genus. A new genus is described and includes three new species and one which was previously included in the genus *Crosseola*.

**RESUMEN.** Se han estudiado nuevas especies de vetigastropodos crosseólidos obtenidos en varias expediciones en el Índico y en el Pacífico Occidental organizadas por el MNHN y IRD. En el presente trabajo (parte II) se estudian 23 especies del género *Crosseola* Iredale, 1924, de las cuales 19 son nuevas, siendo descritas y representadas aquí. Todas estas especies son comparadas con las previamente conocidas en este género. Un nuevo género es descrito en el cual se incluyen tres nuevas especies, además de otra descrita anteriormente en otro género diferente.

## INTRODUCTION

The aspects of the Family Conradiidae Golikov & Starobogatov, 1987, and the genera included in this family were already introduced in the first part of the present study (Rubio & Rolán, 2019). In that introduction the genus *Crosseola* was thoroughly described.

## Material and methods

The material used for the present work was obtained during several expeditions in the Indo-Pacific organized by MNHN and IRD from 1977 to 2014 and from the collection of Sandro Gori (Italy):

BENTHEDI (1977) on board of *Le Suroît* Mozambique Channel (doi.org/10.17600/77003111)  
MUSORSTOM 3 (1985) on board of R/V *Coriolis*, Philippines (doi.org/10.17600/85005911)  
SMCB (1991) on board R/V *Marara*, French Polynesia)

BATHUS 1 (1993) on board of R/V *Alis*, New Caledonia (doi.org/10.17600/93000350)

BATHUS 2 (1993) on board R/V *Alis*, New Caledonia. (doi.org/10.17600/93000360)

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

MUSORSTOM 10 (1998) on board R/V *Alis* explored the Fijian Archipelago. (doi.org/10.17600/98100080)

TAIWAN 2001 (2001) on board of *Chung Tung Long No.26*

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

PANGLAO 2005 (2005) on board of R/V *DA-BFAR*, Philippines

PAPUA NIUGINI (2012) on board of R/V *Alis*, Papua New Guinea (doi.org/10.17600/18000841)

MADEEP (2014) on board of R/V *Alis*, Bismarck and Solomon seas (doi.org/10.17600/14004000)

All the material studied in the present work is constituted by empty shells, obtained in the sediments. 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

AMS: Australian Museum, Sydney, Australia.

MNH: Muséum national d'Histoire naturelle, Paris, France.

IRD: Institut de Recherche pour le Développement, Paris, France.

SAMC: South African Museum, Cape Town, South Africa.

CSG: collection of Sandro Gori.

#### SYSTEMATICS

**VETIGASTROPODA** Salvini-Plawen, 1980

Superfamily **TROCHOIDEA** Rafinesque, 1815

Family **CONRADIIDAE** Golikov & Starobogatov, 1987

Genus *Crosseola* Iredale, 1924

*Crosseola* Iredale, 1924: 183, 251. Type species by original designation: *Crossea concinna* Angas, 1867. Recent, NSW, Australia.

**Diagnosis.** (From Hickman, 2013). Shell small: Maximum adult shell size of approximately 5 mm (larger than most conradiids. Umbilical keel strongly developed and punctate, separated from the columella by a deep narrow groove (pseudo-umbilicus).

The columellar lip presents a prominent basal pit in the type species. A shallow anterior notch, prominently developed projects from the base of the columella. Sculpture finely cancellate to punctate, resulting from incomplete fusion of axial and spiral elements. A decrease in size and spacing of punctae can be seen on later whorls, and it is also present on a thickened labial varix which only appears as a terminal growth feature in adults.

**Habitat.** It is not well known. They have been found to inhabit from intertidal ecosystems to 200 m deep. There is only one mentioned case (see *C. indigaxial* n. sp. below) of it being found in a rocky bottom with caves. The shells were always collected in sand grit. *Crosseola concinna*, type species of the genus, occurs intertidally at Long Reef, New South Wales, Australia (Hickman, 2013).

**Remarks.** Hickman (2013) noted: "The robust, globose to turbanate shells are easily recognized by the characteristic sculpture, the unique umbilical keel, the narrow pseudo-umbilicus, and the distinctive

channeled notch in the basal lip. The prosocline outer lip is shallowly sinuate in some species."

Until now, no living animal could be observed and consequently there is no information on its external anatomy.

Bathymetrically, species of this genus are present from the intertidal zone to bathyal depths.

Species of *Crosseola* have been found in Tertiary substrata.

In Australia the first appearance of the genus is an undescribed Eocene species (Buonaiuto, 1979). In New Zealand the genus ranges in time from the Miocene (Otaian) to Recent.

The type species is distributed from New South Wales to Tasmania, Victoria, and South Australia. But the genus extends from Japan to Australasia, the Indian Ocean, South Africa and the Atlantic Ocean (Rubio & Rolán, 2019).

Rubio & Rolán (2014) described *Crosseola gorii*, the first record of the genus from the West coast of Africa. Later, Rolán, Gori & Rubio (2016) and Rubio & Rolán (2017a, 2017b) described new Atlantic and Indo-Pacific species.

Currently there are 30 extant and fossil species described:

#### Extant species

*Crosseola bellula* (A. Adams, 1865)

*Crosseola concinna* (Angas, 1867)

*Crosseola cancellata* (Tenison-Woods, 1878)

*Crosseola striata* (Watson, 1883) [(in Hickman (2013: 9, fig. 3 A-G)].

*Crosseola consobrina* (May, 1916) [(in May (1916: 97, pl. 7, fig. 37)].

*Crosseola cuvieriana* (Mestayer, 1919)

*Crosseola errata* Finlay, 1926

*Crosseola favosa* Powell, 1937

*Crosseola intertexta* Powell, 1937

*Crosseola bollonsi* Dell, 1956

*Crosseola pseudocollonia* Powell, 1957

*Crosseola foveolata* (Barnard, 1963)

*Crosseola gorii* Rubio & Rolán, 2014

*Crosseola brasiliensis* Rubio & Rolán, 2017

*Crosseola caribbeae* Rubio & Rolán, 2017

*Crosseola madagascariensis* Rubio & Rolán, 2017

*Crosseola marquesensis* Rubio, Rolán & Letourneux, 2017

*Crosseola ordinata* Rubio & Rolán, 2017

*Crosseola similiter* Rubio & Rolán, 2017

*Crosseola solomonensis* Rubio & Rolán, 2017

#### Fossil species

*Crosseola princeps* (Tate, 1890)

*Crosseola semiornata* (Tate, 1893) [(in Darragh (1970: 194)]

*Crosseola sultan* Finlay, 1930

*Crosseola proerrata* Finlay, 1930

*Crosseola tenuisculpta* Laws, 1936

*Crosseola munditia* Laws, 1936

*Crosseola sinemacula* Laws, 1939  
*Crosseola waitotara* Laws, 1940  
*Crosseola emilyae* Laws, 1950  
*Crosseola henryi* Laws, 1950

The genus *Crosseola* is very heterogeneous; in general the species described are identified with different morphotypes such as *C. bellula*, *C. concinna*, *C. cuvieriana*, *C. consobrina* or *C. foveolata*. Each and every one of them possesses the fundamental morphological characters described for the genus (Hickman, 2013); however, they are so different from each other that they could be grouped into a new genus for each morphotype.

***Crosseola bellula*** (A. Adams, 1865)  
 Fig. 1A-E

*Crosseola bellula* A. Adams, 1865: 323 (Type locality: Gotto Islands, Japan, 64 fms).  
*Crosseola bellula* (A. Adams, 1865) — Rubio & Rolán, 2017a: 18.  
*Dolicrosseola bellula* (A. Adams, 1865) — Hasegawa & Fukuda, 2017: 813, pl. 83, fig. 1 (misidentified species).

**Type material.** 2 syntypes MNHN-IM-2000-31037. Collection A. Adams et Crosse. Coll. of Journal de Conchyliologie. Examined by photographs.

**Description.** The following is based on syntypes from the MNHN. Shell of very small size (<2.5 mm in diameter), robust, turbiniform, formed by about 4 whorls separated by an evident suture, not carinated. The protoconch is smooth formed by  $\frac{3}{4}$  of a whorl. The teleoconch has almost  $3\frac{1}{4}$  whorls and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The entire surface of the teleoconch is covered by microgranules. In the first two whorls, cords and ribs form a regular reticle of rectangular/quadrangular spaces; there are no nodules at the intersection points; abapically, at the last whorl, the spaces become narrower and oval. There is no predominance of axial or spiral ornamentation; however, the spiral cords project slightly over the axial ribs, but without angulating the rounded periphery of the teleoconch. In apertural view, there can be seen 4 spiral cords (1 subsutural and 3 peripheral) at the first whorl, 3 at the second and 10-12 in the last one. After the first whorl, the subsutural cord disappears gradually and a larger space, crossed by longer axial ribs, is formed. At the base, around the periumbilical cord, there is another wide area, without cords, crossed only by sinuous axial ribs and in some cases anastomosed. There are no variciform axial thickenings. A prominent periumbilical cord, formed by successive thick oblique ribs, borders and delimits the umbilicus. Umbilicus totally covered by an extension of the columellar lip.

Aperture rounded, prosocline; columella arched, very wide at its base and reflected towards the umbilicus, coming to cover it completely, with an anterior channel at the base. Outer lip with smooth margin, not thickened or variciform.

**Dimensions:** The syntypes measure 2.00 mm in diameter (Fischer-Piette, 1950: 70).

**Habitat.** Collected at 64 fms (A. Adams, 1865).

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

**Remarks.** *Crosseola bellula* was described by A. Adams (1865) from Gotto Islands, Japan, but was not accompanied by any illustration. It was three years later that A. Adams (1868: Pl IV, fig. 10) provided the first illustration of the species.

Rubio & Rolán (2017a), after examining the syntypes considered that this species was assigned to *Crosseola*, since they had the morphological characters described by Hickman (2013) for the genus, and because of its similarity to other species as *C. similiter* n. sp. and *C. favosa* Powell, 1937.

Hasegawa & Fukuda (2017) misidentified the species and placed it in the family Elachisnidae Ponder, 1985, genus *Dolicrosseola* Iredale, 1924. However, the figured species was a different one, probably undescribed.

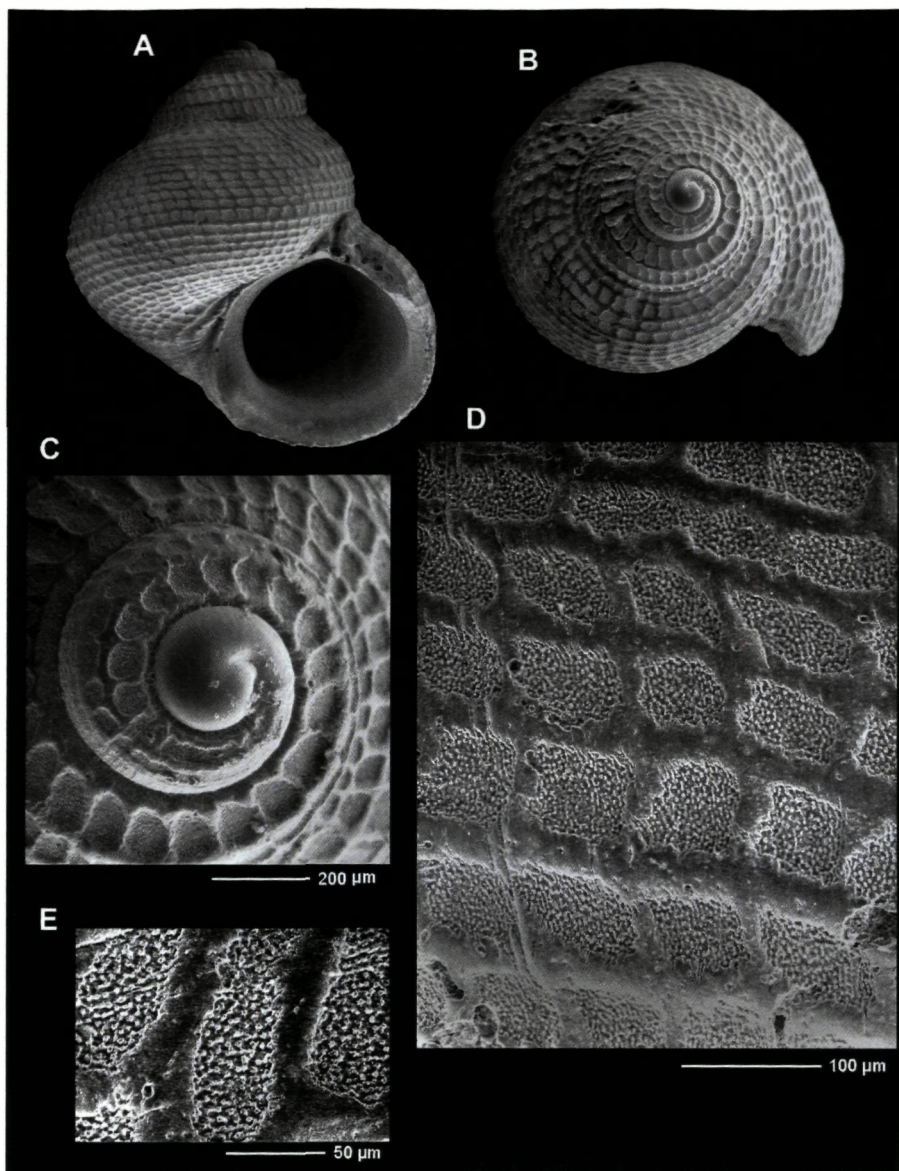
In our opinion, *Crosseola bellula* represents one of the 4-5 morphotypes of the genus *Crosseola*, which can probably be constituted in new genera after a detailed anatomical and molecular study.



**Figure 1A-E**  
*Crosseola bellula* (A. Adams, 1865). Syntypes MNHN-IM-2000-31037. Collection A. Adams et Crosse.

***Crosseola foveolata*** (Barnard, 1963)  
 Fig. 2A-E

*Turbo foveolatus* Barnard, 1963: 216, fig. 6 (Type locality: 34°5'S-25°42'E, off Cape Recife, 95 m).  
*Crosseola foveolata* (Barnard, 1963) — Herbert, 2015: 82, figs 6M-N, 9I.

**Figure 2A-E**

*Crosseola foveolata* (Barnard, 1963). A-B. Shell, 2.62 mm, South Africa, 35°40'S-21°59'E, 165 m (MNHN); C. Protoconch; D-E. Sculpture and detail.

**Type material.** *Turbo foveolatus* Barnard 1963. Syntypes in SAMC (A9284).

**Material examined.** VEMA, stn 28, 1 s, South Africa, 35°40'S-21°59'E, 165 m (MNHN).

**Description.** See the original description in Barnard (1963).

Shell of very small size (<3.00 mm), robust, turritiform, almost as wide as high, formed by 4.1 whorls, rounded periphery and narrowly umbilicated. The protoconch is rough, formed by 0.8 whorls, with a spiral cordlet and has a size of 300 µm in diameter.

The teleoconch has 3.1 whorls separated by a shallow suture. Ornamentation formed by spiral cords, axial ribs and microgranules.

Cords and ribs form a regular reticulate of rectangular/quadrangular spaces; at the last whorl, the spaces become narrower and elongated; their great number provides the surface of the teleoconch with a foveolate aspect, like covered by multiple holes. There is no predominance of axial or spiral ornamentation. In apertural view, there can be seen 3 spiral cords (1 subsutural and 2 peripheral) at the first whorl, 3 at the second and 20-22 in the last one. There are no variciform axial thickenings.

The microgranules cover only the reticular space.

A periumbilical cord, formed by successive oblique riblets, borders and delimits the umbilicus, which is reduced to a narrow fissure.

Aperture rounded, prosocline; columella arched, reflected towards the umbilicus, wide and with an anterior and barely visible channel at its base. Outer lip with a smooth margin that is not thickened nor variciform.

Dimensions: The figured shell is 2.56 mm in diameter and 2.33 mm in height (H/D: 0.91).

**Habitat.** Circalittoral-bathyal species dredged at 91-285 m in Agulhas Bank and at 165 m in Vema Bank.

**Distribution.** Agulhas Bank, from off Algoa Bay area to off Cape Infanta (no data for living specimens) (Herbert, 2015). Vema Bank, from off Cape Town.

**Remarks.** Herbert (2015) considered the reticulated-foveolar sculpture of *Turbo foveolatus*, as a reminiscent of the early whorls of *Crosseola concinna*, so he placed it, although with some reservation, in the genus *Crosseola*, because he suspected that it might belong to an undescribed crosseolid genus (foveolar means a surface with a sculpture of small fovea or holes).

*Crosseola inverta* (Hedley, 1907)

Fig. 3A-F

*Crosseola inverta* Hedley, 1907: 501-502, pl. 17, fig. 15  
*Crosseola inverta* (Hedley, 1907): Cotton, 1959: 204.

**Type material.** Holotype AMS C.21793.

**Type locality.** Great Barrier Reef, Capricorn Group, Masthead Island, Queensland, Australia. 31-37 m depth, 23°31'58.8"S, 151°45'0"E.

**Material examined.** BATHUS 2, stn DW717, 1 s, S New Caledonia, S Ile des Pins, 22°44'S-167°17'E, 350-393 m (MNHN).

**Description.** Original description in Hedley (1907). Shell of small size (<4.00 mm), with a biconical appearance, robust, turbiniform, formed by 4.8 whorls, carinate and narrowly umbilicate.

The protoconch protrudes, has 0.8 whorls, a smooth surface and a size of 160 µm in diameter.

The teleoconch has 4 whorls and is peripherally carinate in the last and fourth whorl. Ornamentation formed by spiral carinae, spiral cords, axial ribs and microgranules.

In the first two and a half whorls, cords and ribs form a regular reticle of rectangular/quadrangular spaces and low nodules at the points of intersection. In the last whorl and a half, there is a raised peripheral carina, with a sharp margin and with thin and short oblique ribs on each side; at the same time in the interspaces, new intermediate cords appear, doubling

their number in the last whorl, also increasing the number of axial ribs, and giving the effect of small perforations over the entire surface.

A prominent periumbilical cord (funicle), formed by successive axial riblets, borders and delimits the umbilicus; it appears in the parietal zone and separates from the base abapically, forming two umbilical orifices, one in the parietal zone and the other in the columellar one.

Aperture rounded, prosocline; columella thick and arched, very wide at its base and reflected towards the umbilicus, with a prominent anterior channel at the base. Outer lip thick, with smooth margin, not thickened or variciform.

Dimensions: the shell photographed measures 3.61 mm in height and 3.29 mm in diameter (H/D: 1.10).

**Habitat.** Infralittoral to bathyal species. Collected at 31-37 m in Queensland, Australia (Hedley, 1907). Dredged in New Caledonia at 350-393 m depth.

**Distribution.** Queensland, Australia and New Caledonia.

**Remarks.** Hedley (1907) considered *Crossea inverta* close to *Crosseola biconica* (Hedley, 1902), from which it differs by being larger, proportionally broader, with a lower spire and a heavier funicle.

The morphological features of *C. inverta* make it an unmistakable species, totally different from the other species studied up to now.

*Crosseola delicata* n. sp.

Fig. 4A-E

**Type material.** Holotype MNHN-IM-2000-34417 (Fig. 4A) and one paratype MNHN-IM-2000-34418 (Fig. 4B).

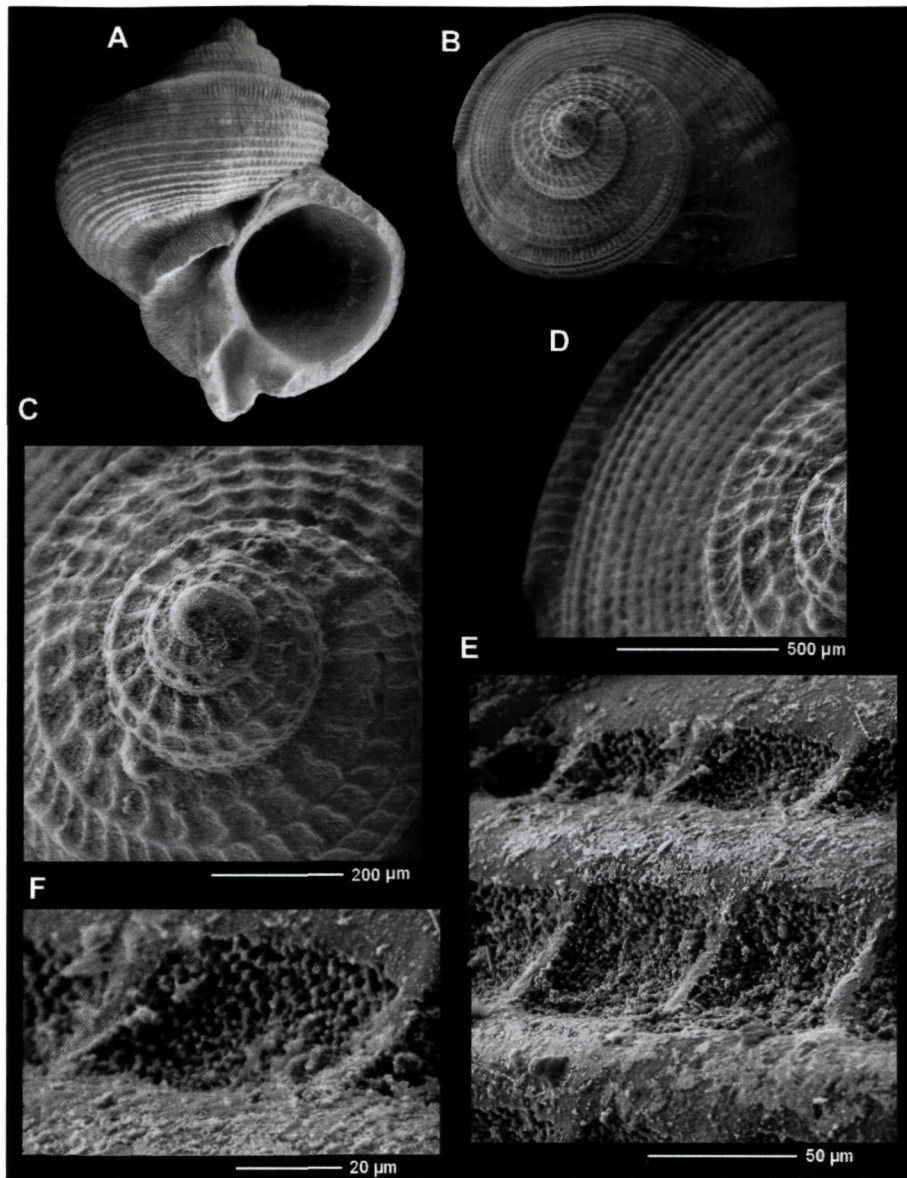
**Type locality.** NE coasts Taiwan, off Tashi, 24°48'N-122°07'E, 248-257 m (TAIWAN 2001: stn CP101).

**Material examined.** TAIWAN 2001: 2 s, NE coasts Taiwan, off Tashi, stn CP101, 24°48'N-122°07'E, 248-257 m (type material).

**Description.** Shell of small size (<5.00 mm in diameter), turbinate, with a high spire formed by 4 ¾ whorls, separated by a marked suture, not carinated and narrowly umbilicated.

The protoconch is formed by ¾ of a whorl, with a smooth surface and has a size of 230 µm in diameter.

The teleoconch has 4 whorls and its periphery is rounded. Ornamentation formed by spiral cords, axial ribs and microgranules. Cords and ribs cover the entire surface of the teleoconch, forming a regular reticle of rectangular/quadrangular spaces; there are no nodules at the intersection points. There is no predominance of axial or spiral ornamentation although the spiral cords project slightly more but

**Figure 3A-F**

*Crosseola inverta* (Hedley, 1907). A-B. Shell, 3.61 mm, S New Caledonia, 22°44'S-167°17'E, 350-393 m (MNHN); C. Apex and protoconch; D-F. Sculpture and detail.

without forming angles with the rounded periphery of the teleoconch. In apertural view there can be seen 3 spiral cords at the first and second whorls, 2 at the third, and 7 on the last one, where a broad subsutural region lacks spiral cords. There are no variciform axial thickenings.

A periumbilical cord, scarcely prominent and formed by small nodules due to the crossing of the axial ribs, borders and delimits the umbilicus.

The umbilicus is reduced to a narrow fissure, placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, arched, not reflected towards the umbilicus, with an anterior

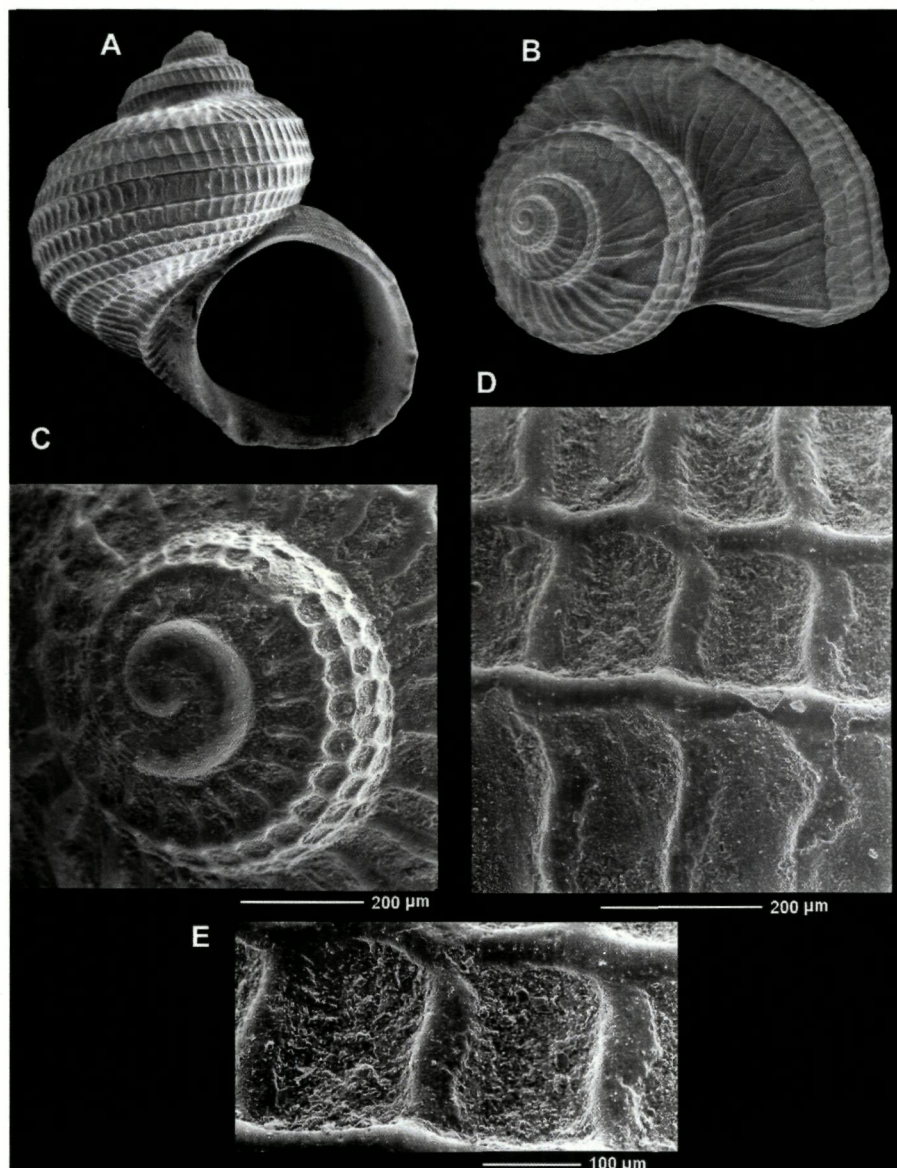
channel at the base. Outer lip scalloped internally with external margin not thickened or variciform.

Dimensions: The holotype is 4.65 mm in height and 4.27 mm in diameter ( $H/D = 1.1$ ).

**Habitat.** Bathyal species dredged at 248-257 m deep.

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

**Remarks.** *Crosseola delicata* n. sp. is characterized by a regular sculpture, with a regular reticle without nodules in the intersection points, a scarcely prominent periumbilical cord and an umbilicus reduced to a fissure.



**Figure 4A-E**

*Crosseola delicata* n. sp. A. Holotype MNHN-IM-2000-34417, 4.65 mm in height, NE coast Taiwan, off Tashi 248-257 m; B. Paratype MNHN-IM-2000-34418, 4.54 mm, same locality; C. Protoconch of the paratype; D-E. Sculpture and detail.

*Crosseola foveolata* (Barnard, 1963) has more numerous axial ribs and spiral cords, with the rectangles very small.

See differences in remarks of *Crosseola latumlabrum* n. sp., *C. prosoclina* n. sp., *C. sexlata* n. sp., *C. minireticula* n. sp. and *C. oclusa* n. sp.

**Etymology.** The specific name alludes to the small and uniform sculpture of the shell, from the Latin *delicatus*, a, um “delicate”.

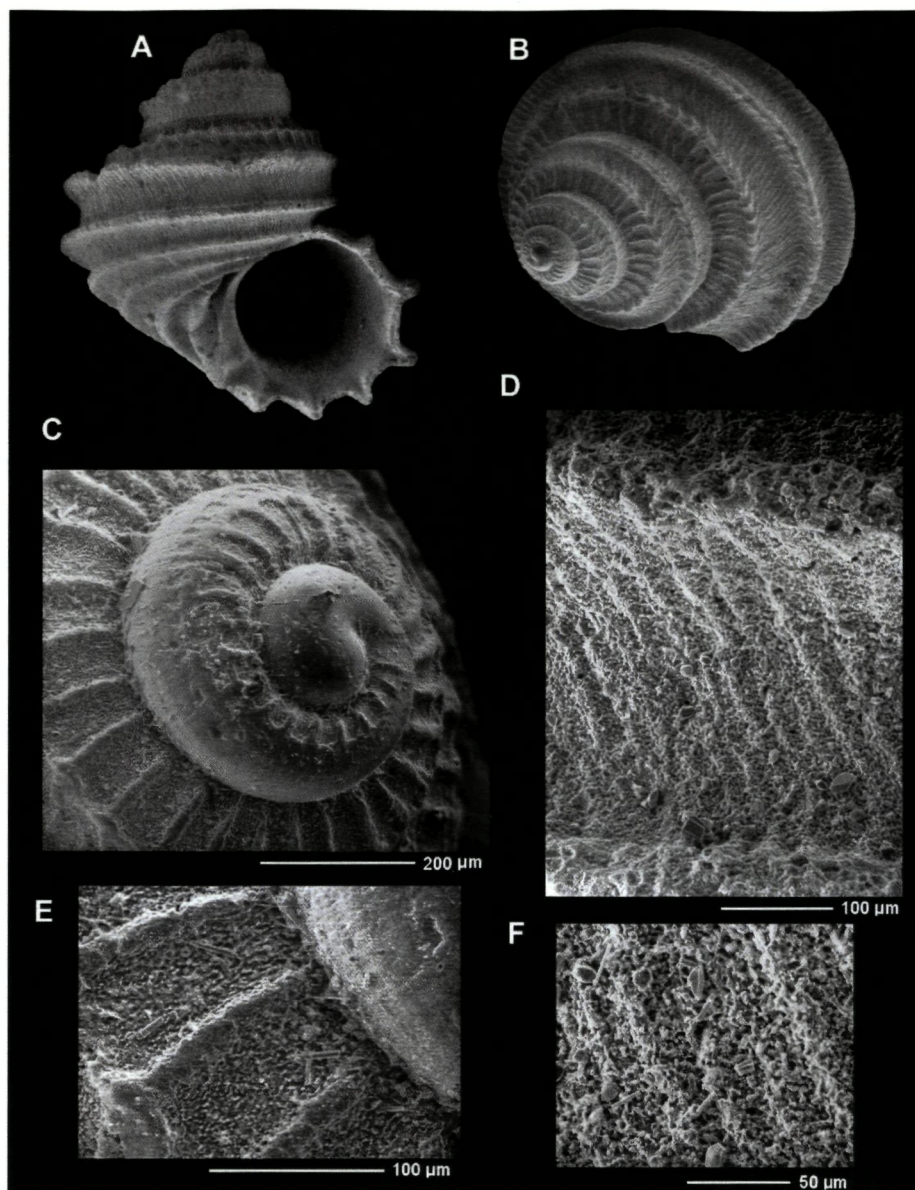
***Crosseola mayottensis* n. sp.**

Fig. 5A-F

**Type material.** Holotype MNHN-IM-2000-34419 (Fig. 5A) and 2 paratypes MNHN-IM-2000-34420 (Fig. 5B).

**Type locality.** Mayotte, NE Récif Nord, 12°30'S-45°02'E, 450 m (BENTHEDI: stn DS71).

**Material examined.** BENTHEDI, stn DS71, 3 s, Mozambique Channel, Mayotte, NE Récif Nord, 12°30'S-45°02'E, 450 m.

**Figure 5A-F**

*Crosseola mayottensis* n. sp., A. Holotype MNHN-IM-2000-34419, 2.43 mm in height, Mayotte, NE Récif Nord, 12°30'S-45°02'E, 450 m; B. Paratype MNHN-IM-2000-34420, 2.42 in diameter, same locality; C. Protoconch of the paratype; D-F. Sculpture and detail.

**Description.** Shell of small size (<3.0 mm), robust, turbiniform, with a high spire formed by about 4 whorls separated by a wide and deep suture, carinated and narrowly umbilicated.

The protoconch is formed by  $\frac{3}{4}$  of a whorl, with a smooth surface and has an approximate size of 200  $\mu\text{m}$  in diameter.

Teleoconch formed by about 3.4 whorls. Ornamentation formed by prominent spiral cords (carinae), axial ribs and microgranules. The spiral cords are prominent and angulate the periphery; in apertural view there can be seen 2 spiral cords at the

first whorl, 3 at the second and 6 carinae on the last one, of which one is subsutural, 3 peripheral and 2 basal. There are no intermediate spiral cords. The spaces between carinae are very concave.

Axial ribs cross the spiral cords forming nodules on the intersection points, more evident in the subsutural cord. In the first two whorls the axial ribs cross the spiral cords forming a regular reticle of quadrangular/rectangular spaces; adapically, the axial riblets are thick and spaced between the subsutural cord and the suture, while they become more



numerous and tight towards the last whorl. Microgranules cover the entire teleoconch surface.

A prominent periumbilical cord, formed by successive fine axial ridges, borders and delimits the umbilicus, forming a keel. Umbilicus reduced to a narrow fissure, placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, straight, reflected basally towards the umbilicus, with an anterior channel at the base. Outer lip with scalloped margin, modified by the spiral carinae; external margin not thickened or variciform. The soft parts are unknown.

Dimensions: The holotype is 2.43 mm in height, and 2.24 mm in diameter (H/D = 1.08). There is a paratype of larger dimensions but with the protoconch broken.

**Habitat.** Bathyal species dredged at 450 m deep.

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

**Remarks.** *Crosseola mayottensis* n. sp. is characterized by its strong carinae; by its finely nodular subsutural cord and by the axial ribs which are transformed in the last whorls into thin and very tight axial threads.

See remarks under *C. bicarinata* n. sp., *C. anodyna* n. sp., *C. serrata* n. sp., *C. indigaxial* n. sp. and *C. uniformis* n. sp.

**Etymology.** The specific name refers to the type locality.

*Crosseola microstriata* n. sp.

Fig. 6A-F

**Type material.** Holotype MNHN-IM-2000-34421 (Fig. 6A-B).

**Type locality.** Fiji, S Viti Levu, 18°19'S-°78°05'E, 234-361 m (MUSORSTOM 10: stn CP1390).

**Material examined.** MUSORSTOM 10, stn CP1390, 1 s, Fiji, S Viti Levu, 18°19'S-°78°05'E, 234-361 m.

**Description.** Shell of small size (<3.0 mm), robust, turbiniform, with a high spire formed by 4.6 whorls separated by a wide suture, not carinated and narrowly umbilicated.

Protoconch with  $\frac{3}{4}$  of a whorl, with a smooth surface and an approximate size of 220  $\mu$ m in diameter.

The teleoconch is formed by 3  $\frac{3}{4}$  whorls and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow and cover the entire surface of the teleoconch.

The axial ribs cross the spiral cords forming nodules on the intersection points, more evident in the subsutural cord.

In the first whorl, the axial ribs crossing the spiral cords form a regular reticle of rectangular/quadrangular spaces; towards the last

whorl where the axial sculpture disappear. The interspaces are covered by microgranules.

A prominent periumbilical cord, formed by fine spiral cords on its inner side and small oblique ribs on its outer side, borders and delimits the umbilicus forming a funicle. Umbilicus narrow, deep, and placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thick and reflected basally towards the umbilicus, with an anterior channel at the base. Outer lip with a smooth internal margin and extended to outside; the external margin is thickened or variciform, with three consecutive axial layers. The soft parts are unknown.

Dimensions: The holotype is 2.6 mm in height and 2.77 mm in diameter (H/D = 0.94)

**Habitat.** Bathyal species dredged at 234-361 m deep.

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

**Remarks.** *Crosseola microstriata* n. sp. is characterized by its very convex periphery and by lacking carinae; the surface of the teleoconch is completely covered by spiral cords with microgranules in their intervals; it is also characterized by the ornamentation of its periumbilical cord and by the ornamentation of its outer lip.

Its peculiar traits make it differ drastically from the rest of congeneric species.

**Etymology.** The specific name alludes to the very fine spiral microsculpture.

*Crosseola latumlabrum* n. sp.

Figs 7A-F, 8A-E

**Type material.** Holotype MNHN-IM-2000-34422 (Fig. 7A-B) and one paratype MNHN-IM-2000-34423 (Fig. 8A-B).

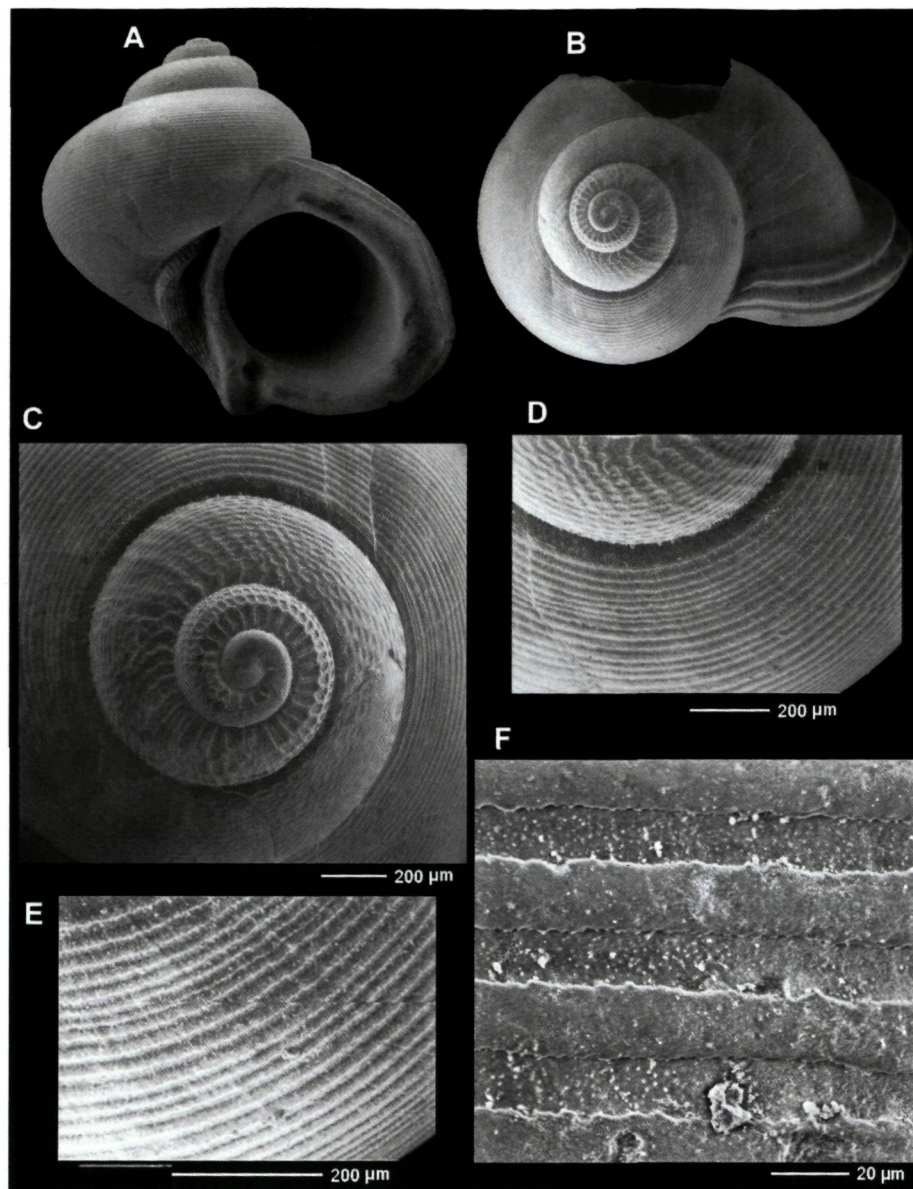
**Type locality.** Papua New Guinea, Solomon Sea, Ainto Bay, SE New Britain, 06°05'S-149°18'E, 240-250 m. (MADEEP, stn CP4335).

**Material examined.** MADEEP, stn CP4335, 2 s, Papua New Guinea, Solomon Sea, Ainto Bay, SE New Britain, 06°05'S-149°18'E, 240-250 m, (type material).

**Description.** Shell of small size (<2.50 mm), turbiniform, with a high spire formed by 4.1 whorls separated by a marked suture, slightly carinated and narrowly umbilicated.

The protoconch is formed by  $\frac{3}{4}$  of a whorl, with a smooth surface and has a size of about 240  $\mu$ m in diameter.

The teleoconch has 3 whorls and its periphery is rounded and slightly carinated. Ornamentation formed by spiral cords, axial ribs and microgranules. Cords

**Figure 6A-F**

*Crosseola microstriata* n. sp. A-B. Holotype MNHN-IM-2000-34421, 2.6 mm in height, Fiji, S Viti Levu, 18°19'S-178°05'E, 234-361 m; C. Protoconch and first teleoconch whorl; D-F. Sculpture and detail.

and ribs cover the entire surface of the teleoconch, forming a regular reticle of rectangular/quadrangular spaces and marked nodules at the points of intersection. The spaces between cords and ribs are covered by microgranules.

There is no predominance of axial or spiral ornamentation; only the spiral cords project slightly over the ribs, angulating the periphery of the shell. In apertural view, there can be seen 4-5 spiral cords at first and second whorls and 10 at the last. There are no variciform axial thickenings.

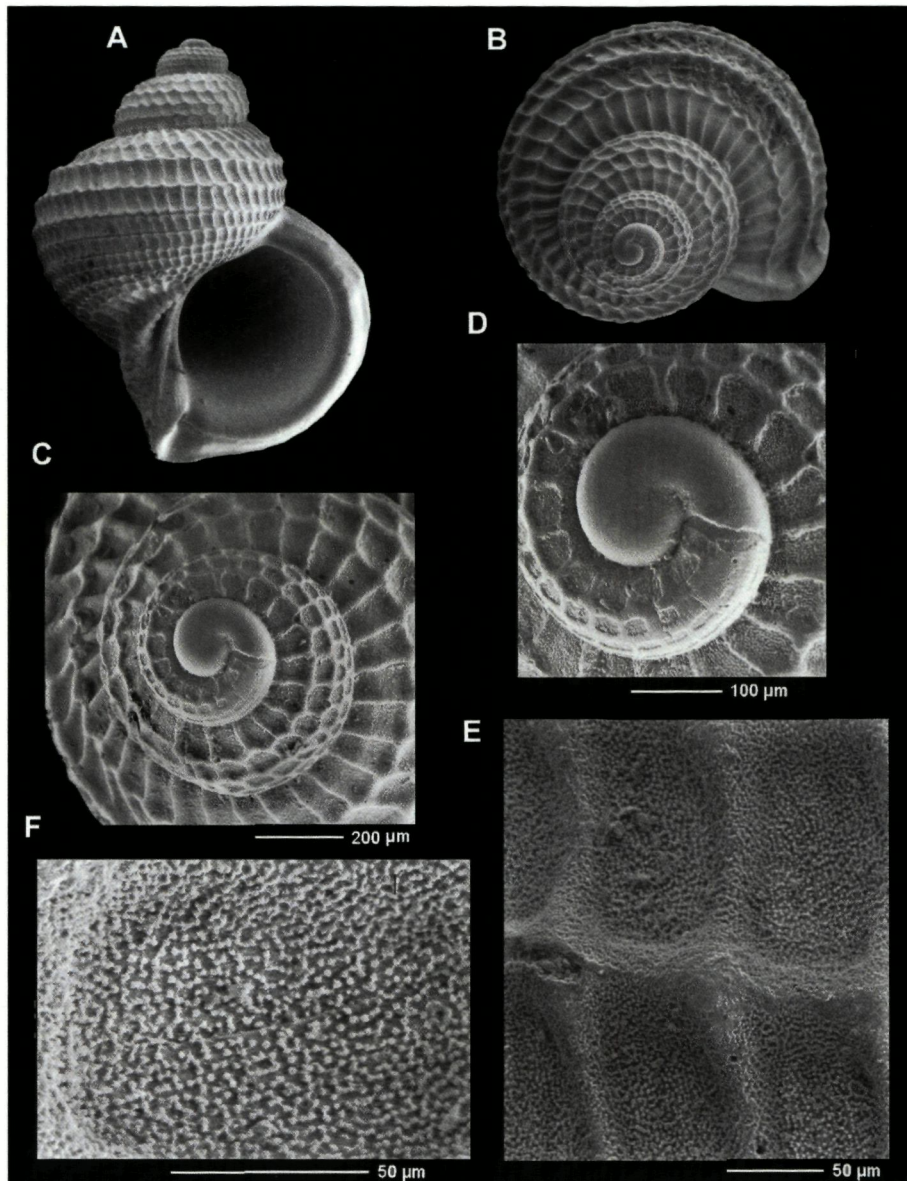
A periumbilical cord, very prominent, formed by thick oblique cords, borders and delimits the umbilicus

which is reduced to a narrow fissure placed between the periumbilical cord and the columellar lip. Aperture oval, prosocline; columella thin, slightly arched, widened at its base and reflected towards the umbilicus, with an anterior channel at the base. Outer lip smooth internally with the external margin thickened or variciform.

Dimensions: The holotype is 2.26 mm in height and 1.79 in diameter ( $H/D = 1.26$ ).

**Habitat.** Bathyal species dredged at 240-250 m deep.

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



**Figure 7A-F**

*Crosseola latumlabrum* n. sp. A-B. Holotype MNHN-IM-2000-34422, 2.26 mm, Papua New Guinea, Solomon Sea, Ainto Bay, SE New Britain, 240-250 m; C-D. Apex and protoconch; E-F. Sculpture and detail.

**Remarks.** The paratype (Fig. 8A-B) in spite of being rather similar in a first view, has small differences with the holotype: the diameter of the protoconch is a little smaller (36 µm less than in the holotype); the outer lip is also different, although it is obvious that this is due to a difference in maturity; the paratype has some less spiral cords on the last whorl and its columella shape differs slightly as well. Having few material, we decided to provisionally include both specimens in the same taxa until more samples will be available.

There are no congeneric species which may be confused with *Crosseola latumlabrum*.

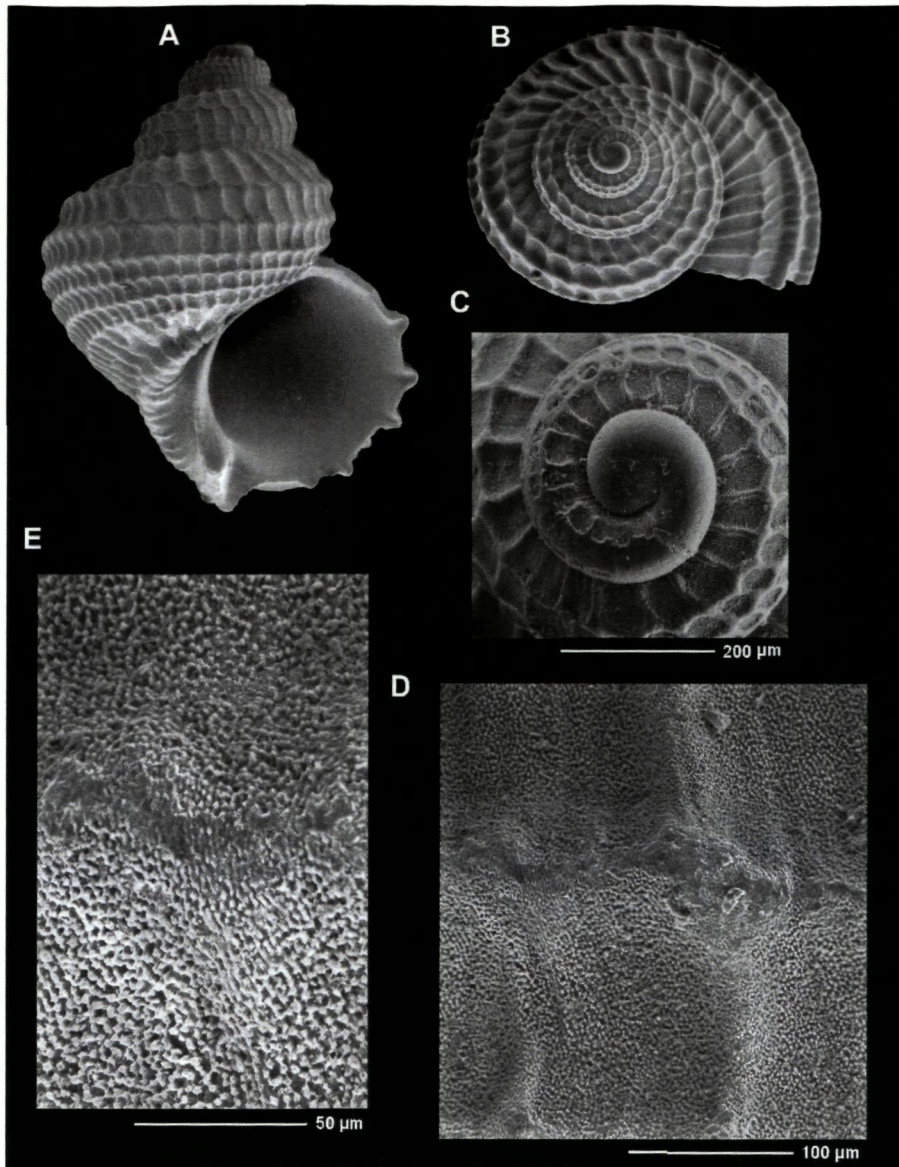
**Etymology.** The specific name alludes to the width of the external lip: from the Latin words *latus*, *a*, *um*, “wide” and *labrum*, *i*, “lip”.

*Crosseola distorta* n. sp.

Fig. 9A-G

**Type material.** Holotype MNHN-IM-2000-34424 (Fig. 9A-B) and 3 paratypes MNHN-IM-2000-34425 (Figs 9C-D).

**Type locality.** Solomon Is, N Malaita, 8°19'S-160°40'E, 98-200 m (SALOMON 1: DW1767).



**Figure 8A-E**

*Crosseola latumlabrum* n. sp. A-B. Paratype MNHN-IM-2000-34423, 2.57 mm, Papua New Guinea, Solomon Sea, Ainto Bay, SE New Britain, 240-250 m; C. Apex and protoconch; D-E. Sculpture and detail.

**Material examined.** SALOMON 1, stn DW1767, 4 s, Solomon Is, 8°19'S-160°40'E, 98-200 m.

**Description.** Shell of small size (<3.5 mm), robust, turritiform, with a high spire formed by 4.3 whorls separated by a wide suture, not carinated and the last whorl disjunct.

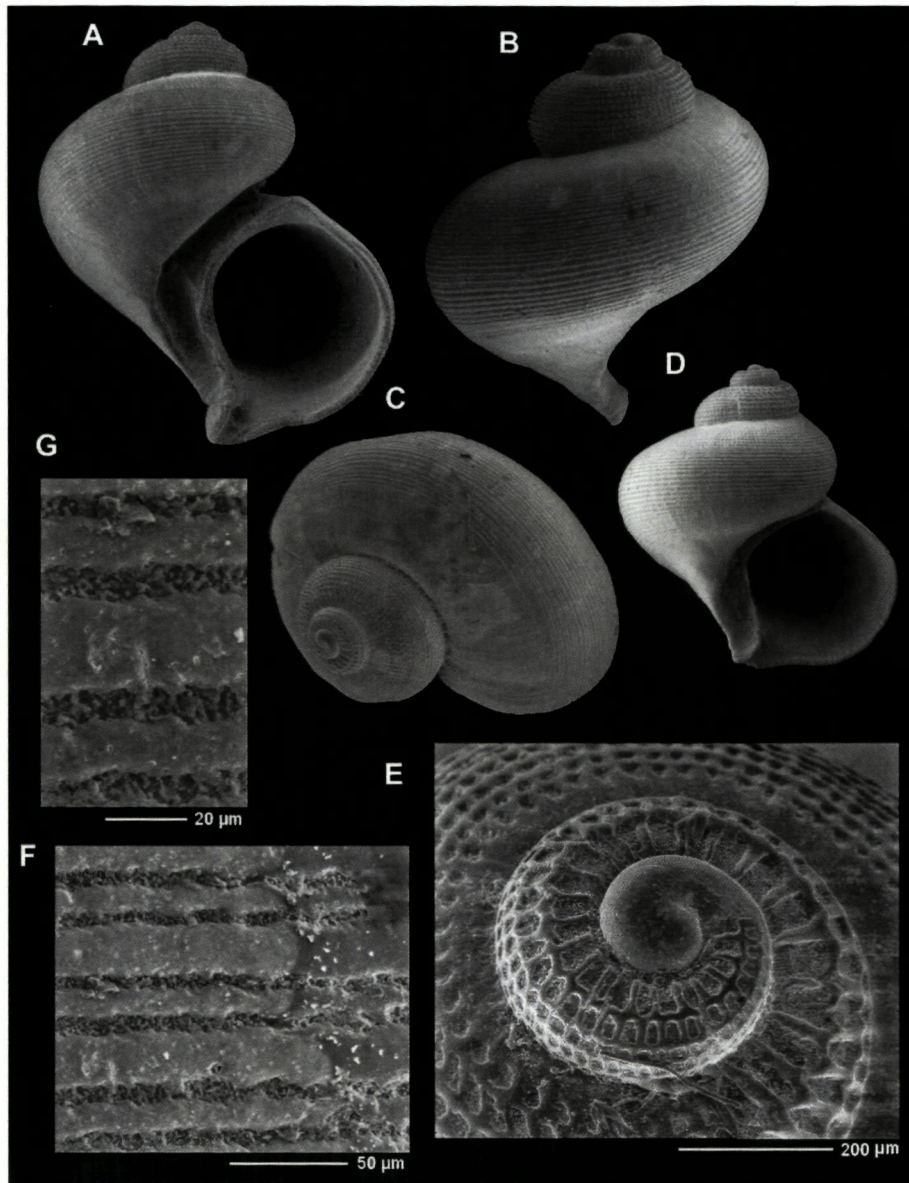
The protoconch is formed by a little less than 3/4 whorls, smooth surface and has an approximate size of 220 µm in diameter.

The teleoconch is formed by 3.5 whorls and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow and cover the entire

surface of the teleoconch, except one broad subsutural area that starts at the second whorl and a periumbilical one which is visible at the base.

In the first two whorls the axial ribs crossing the spiral cords form a regular reticle of rectangular/quadrangular spaces; towards the last whorl, the spaces lengthen until they become progressively into narrow and shallow spiral grooves. The interspaces are covered by microgranules.

A prominent smooth cord borders and delimits the umbilical area; the umbilicus as such disappears because the last whorl is disjunct and is transformed into a concave area that extends between the cord and the columella.



**Figure 9A-G**

*Crosseola distorta* n. sp. A-B. Holotype MNHN-IM-2000-34424, 3.05 mm in height, Solomon Is., Stn DW1767, 8°19'S-160°40'E, 98-200 m; C. Paratype MNHN-IM-2000-34425, 2.67 mm in diameter; D. Paratype MNHN-IM-2000-34425, juvenile, 2.21 in height (same locality); E. Protoconch and first teleoconch whorl; F. Detail of the sculpture.

Aperture rounded, prosocline; columella thick, not reflected towards the umbilicus, with a prominent anterior channel at the base. Outer lip with the internal margin finely crenulated; the external margin is not thickened or variciform.

Dimensions: The holotype is 3.05 mm in height and 2.57 mm in diameter ( $H/D = 1.18$ ).

**Habitat.** Circalittoral to bathyal species dredged at 98-200 m deep.

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

**Remarks.** *Crosseola distorta* n. sp. is characterized by the separation of the last whorl from the previous one. This is not a malformation because in the paratypes (more juvenile) it is already possible to see that the last whorl is clearly separated.

There is no other species having this character which can be compared with *Crosseola distorta*.

**Etymology.** The specific name alludes to the unusual form of the holotype from the Latin *distortus*, *a, um* which means “misshapen” or “deformed”.

*Crosseola catenata* n. sp.

Fig. 10A-F

**Type material.** Holotype MNHN-IM-2000-34426 (Fig. 10A-B).

**Type locality.** Philippines, SW Mindoro, 12°31.3'N-120°39.5'E, 92-97 m (MUSORSTOM 3: DR117).

**Material examined.** MUSORSTOM 3, stn DR117, Philippines, 1 s, 12°31.3'N-120°39.5'E, 92-97 m (holotype).

**Description.** Shell of very small size (<2.5 mm), robust, turbiniform, formed by 3.8 whorls separated by a marked suture, carinated and narrowly umbilicated.

The protoconch is formed by 0.8 whorls, with a smooth surface and has an approximate size of 224 µm in diameter.

The teleoconch is formed by 3 whorls and is carinated. The ornamentation is formed by prominent spiral cords (carinae), spiral threads, axial ribs and microgranules. After the first whorl, the subsutural cord disappears, while the peripheral ones persist. The spiral cords are prominent and angulate at periphery; in apertural view there can be seen 3 spiral cords at the first and second whorls and 6-7 carinae at the last one, of which 5 are peripheral and 1-2 are basal. There are intermediate spiral threads, which are distributed as following: 10 between the suture and the first peripheral carina and 1-2 between the lower peripheral carina and the basal cord; both the intermediate and basal cords are nodular. The spaces between carinae are strongly concave.

Axial ribs cross the spiral cords forming sharp-pointed nodules on the intersection points, which are more evident in the last whorl carinae, and a regular reticle of quadrangular/rectangular spaces. On the last whorl, the spiral cords are transformed into sharp carinae, the peripheral ones being the most prominent. All the carinae show in the last whorl, on either side of the margin, small ribs perpendicular to the axis of the shell.

Microgranules cover the entire teleoconch surface, including cords and ribs.

A prominent periumbilical cord, formed by successive thick nodules and cords on its inner side, skirts and delimits the umbilicus, which is reduced to a narrow fissure, placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, straight, reflected basally towards the umbilicus, with an anterior channel at the base. Outer lip with margin strongly scalloped, modified by the spiral carinae; external margin not thickened or variciform.

Dimensions: The holotype is 2.11 mm in height and 1.8 mm in diameter (H/D = 1.17).

**Habitat.** Circalittoral species dredged at 92-97 m deep.

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

**Remarks.** *Crosseola catenata* n. sp. is characterized by the disappearance of the subsutural cord after the first whorl of the teleoconch; by the presence of intermediate spiral threads and sharp-pointed nodules on the intersection points; by the number of peripheral carinae and by the small axial microriblets perpendicular to the peripheral cord on the last whorl.

*Crosseola latumlabrum* n. sp. has more numerous and finer axial ribs and spiral cords, and a more prominent subsutural carina. The upper carina has no axial microriblets.

*Crosseola dentata* n. sp. has a narrower periumbilical cord, smaller aperture, and the crenulations in the outer lip are larger and more regular.

**Etymology.** The specific name alludes to the presence of an upper spiral cord on the last whorl with the aspect of a "chain" (in Latin *catena-ae*) (see Fig. 10E).

*Crosseola dentata* n. sp.

Fig. 11A-E

**Type material.** Holotype MNHN-IM-2000-34427 (Fig. 11A-B).

**Type locality.** Philippines, Bohol Seas, off Balicasag Island, 9°32'N-123°44'E, 164-176 m (PANGLAO 2005: stn DW2339).

**Material examined.** PANGLAO 2005, stn DW2339, 1 s, Philippines, Bohol Seas, off Balicasag Island, 9°32'N-123°44'E, 164-176 m.

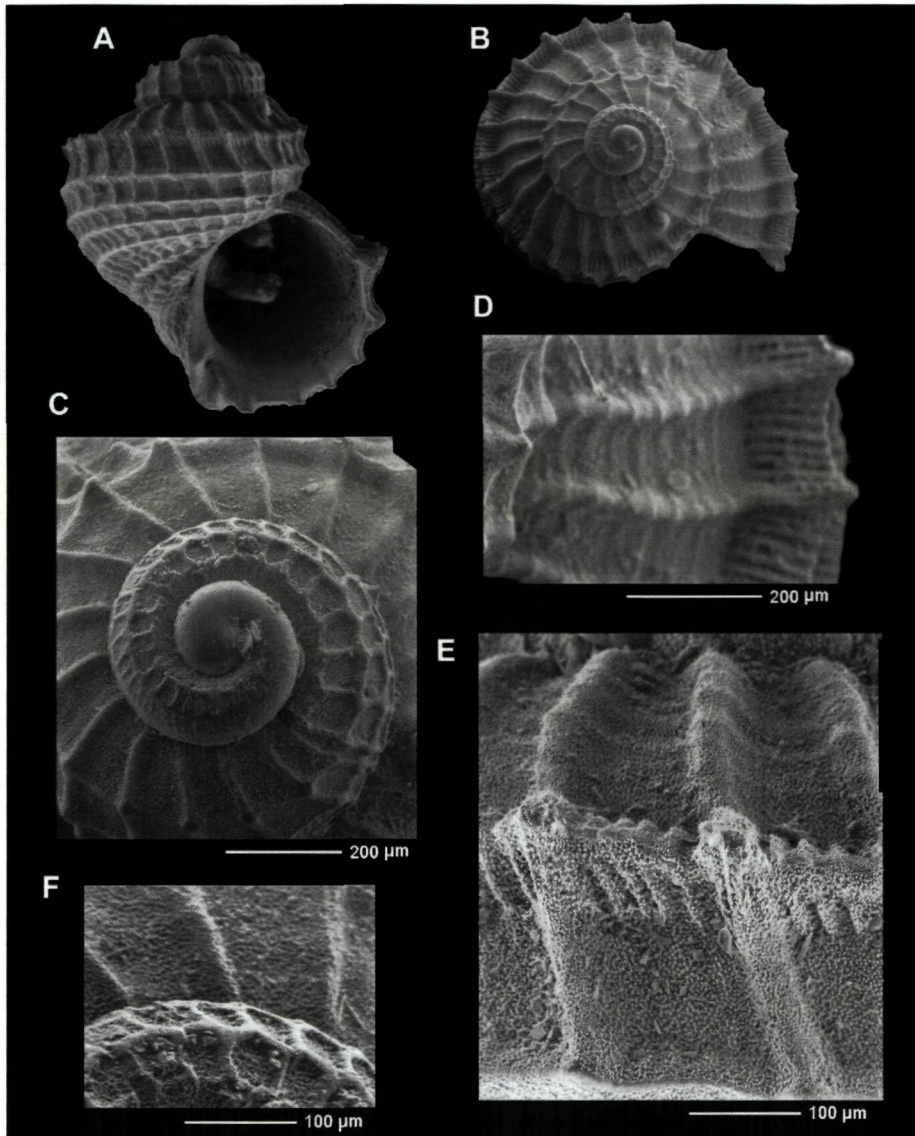
**Description.** Shell of very small size (<2.5 mm), robust, turbiniform, formed by 3 ¾ whorls separated by a marked suture, carinated and narrowly umbilicated.

The protoconch is formed by 0.6 whorls with a smooth surface and has an approximate size of 205 µm in diameter.

The teleoconch is formed by 3.3 whorls and is carinated; the spaces between carinae are very concave.

The ornamentation is formed by prominent spiral cords (carinae), axial ribs and microgranules. The spiral cords are prominent and angulate the periphery; in apertural view there can be seen 4 spiral cords at the first and second whorls and 5 carinae at the last one, of which 4 are peripheral and 1 is basal. There are no intermediate spiral threads.

Axial ribs cross the spiral cords forming pointed nodules on the intersection points, more evident in the last whorl carinae and also forming a regular reticle of quadrangular/rectangular spaces. On the last whorl,

**Figure 10A-F**

*Crosseola catenata* n. sp. A-B. Holotype MNHN-IM-2000-34426, 2.11 mm, Philippines, Stn DR117, 12°31.3'N-120°39.5'E, 92-97 m; C. Protoconch and first teleoconch whorl; D-F. Detail of the sculpture.

the spiral cords are transformed into sharp carinae of which the peripherals are the most prominent.

In the last whorl and a half, the subsutural cord disappears forming a larger, convex space between the suture and the first peripheral carina, which is occupied by numerous and high axial ribs. Microgranules cover the entire teleoconch surface, including cords and ribs.

A prominent periumbilical cord formed by successive thick lamellae skirts and delimits the umbilicus, which is narrow and is placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, arched and reflected basally towards the umbilicus, with an anterior channel at the base. Outer lip with margin strongly scalloped and modified

by the spiral carinae; external margin not thickened or variciform.

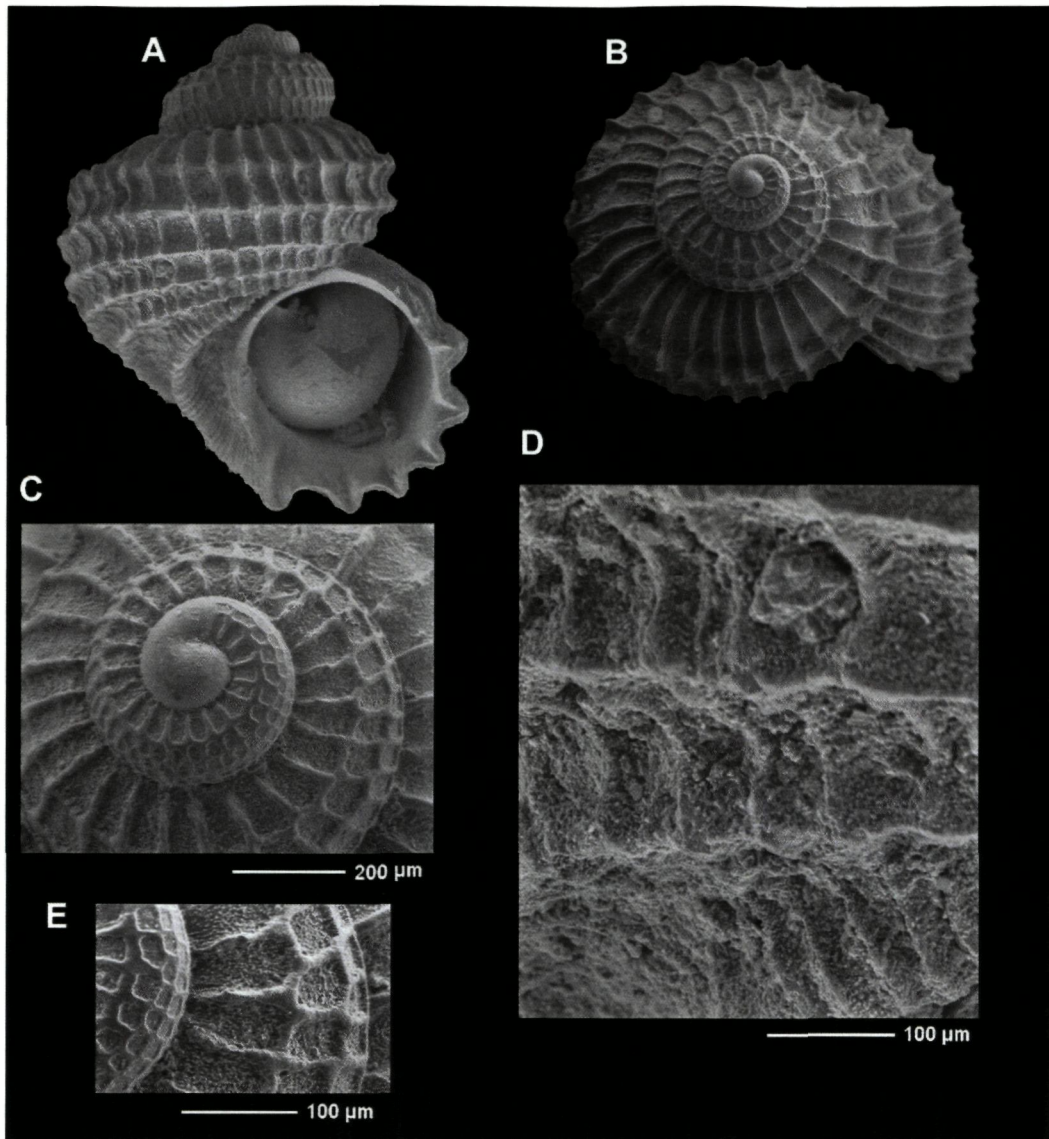
Dimensions: The holotype is 2.1 mm in height and 1.74 in diameter ( $H/D = 1.2$ ).

**Habitat.** Bathyal species dredged at 164-176 m deep.

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

**Remarks.** *Crosseola dentata* n. sp. is characterized by the strong teeth on the outer lip, which provide it with a saw-like shape.

*Crosseola anodyna* n. sp. has a similar form, but the number of the axial ribs are smaller (in last whorl 29 vs 36 in *C. dentata*); also the protoconch is slightly

**Figure 11A-E**

*Crosseola dentata* n. sp. A-B. Holotype MNHN-IM-2000-34427, 2.1 mm, Philippines, Bohol Seas, off Balicasag Island, 164-176 m; C. Protoconch and first teleoconch whorl; D-E. Detail of the sculpture

larger (205  $\mu\text{m}$ , vs 235) and the the prominences are smaller within the outer lip.

See also remarks under *C. catenata* n. sp.

**Etymology.** The specific name alludes to the outer lip which has prominent teeth, from the Latin *dentatus*, *a, um* "with teeth".

*Crosseola anodyna* n. sp.

Fig. 12A-D

**Type material.** Holotype MNHN-IM-2000-34428 (Fig. 12A).

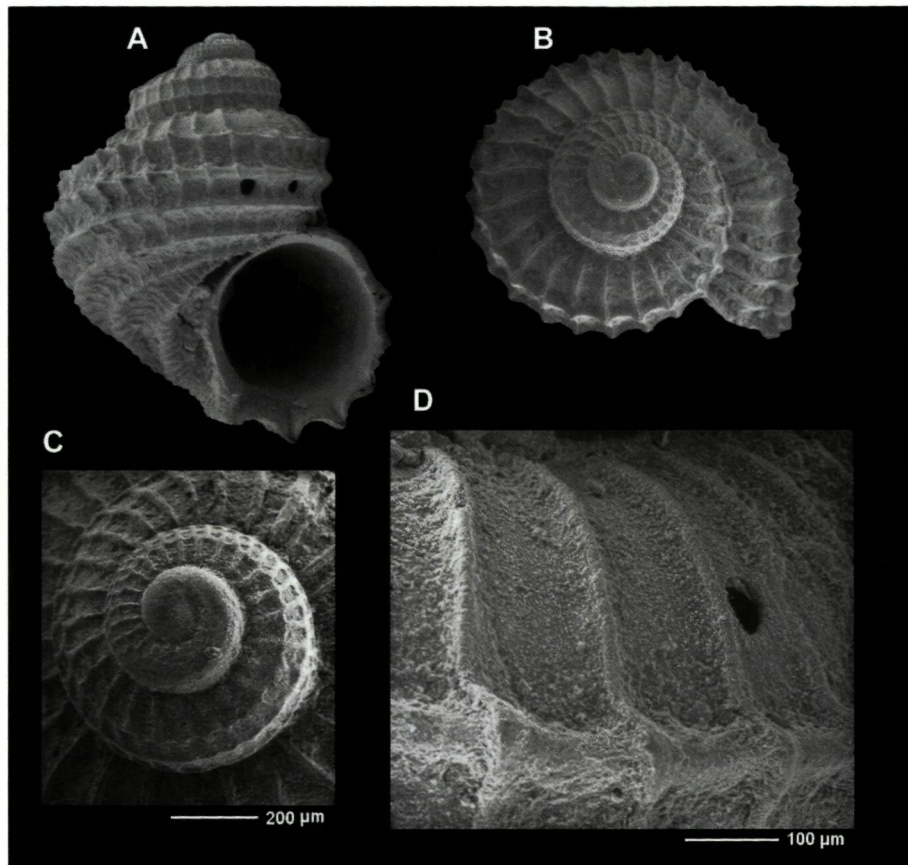
**Type locality.** Philippines, Bohol/Sulu Seas sill, 9°01'N-123°26'E, 427 m (PANGLAO 2005: DW2364).

**Material examined.** PANGLAO 2005, stn DW2364, 1 s, Philippines, Bohol/Sulu Seas sill, 09°01'N-123°26'E, 427 m (holotype).

**Description.** Shell of very small size (<2.5 mm), robust, turbiniform, formed by 3.8 whorls separated by a marked suture, with whorls, carinated and narrowly umbilicated.

The protoconch is formed by  $\frac{3}{4}$  of a whorl, with a smooth surface and has a size of 235  $\mu\text{m}$  in diameter.



**Figure 12A-D**

*Crosseola anodyna* n. sp. A-B. Holotype MNHN-IM-2000-34428, 2.25 mm in height, Philippines, Bohol/Sulu Seas sill, 9°01'N-123°26'E, 427 m; C. Protoconch; D. Microsculpture.

The teleoconch is formed by little more than 3 whorls and is carinated; the spaces between carinae are very concave.

Prominent spiral cords (carinae) define the ornamentation together with axial ribs and microgranules. The spiral cords are prominent and angulate the periphery; in apertural view 4 spiral cords can be seen at the first whorl, 3 at the second and 5 carinae at the last one, of which 4 are peripheral and 1 is basal. There are no intermediate spiral threads. The basal carina is very similar to the periumbilical cord.

Axial ribs cross the spiral cords forming pointed nodules on the intersection points, which are more evident on the last whorl carinae and form a regular reticle of quadrangular/rectangular spaces. On the last whorl, the spiral cords are transformed into sharp carinae, the peripheral ones being the most prominent. In the last whorl, the subsutural cord disappears forming a broad convex interval between the suture and the first peripheral carina, which is occupied by numerous long axial ribs. Microgranules cover the entire teleoconch surface, including cords and ribs.

A prominent periumbilical cord crossed by numerous axial ribs skirts and delimits the umbilicus, which is

narrow and is placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thick, arched and reflected basally towards the umbilicus, with an anterior channel at the base. Outer lip with margin strongly scalloped and modified by the spiral carinae; external margin not thickened or variciform.

Dimensions: The holotype is 2.25 mm in height and 1.82 mm in diameter ( $H/D = 1.24$ ).

**Habitat.** Bathyal species dredged at 427 m deep.

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

**Remarks.** *Crosseola anodyna* n. sp. is characterized by a regular sculpture and a narrow periumbilical cord.

*Crosseola mayottensis* n. sp. has wider and more prominent carinae and a much finer axial sculpture.

*Crosseola serrata* n. sp. has very fine short axial riblets in the carinae, very obvious in the last two whorls in perpendicular sense, which are not present in *C. anodyne* n. sp., which has a small number of axial ribs.

See also remarks under *C. dentata* n. sp.

**Etymology.** The specific name alludes to the fact that this species has scarce differential characteristics, from the Latin *anodynus* which means “anodyne, insignificant and/or simple”.

*Crosseola serrata* Rubio, Rolán & Gori n. sp.

Fig. 13A-F

**Type material.** Holotype MNHN-IM-2000-34429 (Fig. 13A-B).

**Type locality.** Mozambique, Narenque, Fernando Veloso, 14°26.9'S-40°40.7'E, 38 m.

**Material examined.** Mozambique, 1 s, Narenque, Fernando Veloso, 14°26.9'S-40°40.7'E, 38 m (holotype, ex CSG).

**Description.** Shell of small-size (<4.5 mm), robust, turbiniform, formed by about 5 whorls, separated by a marked suture, carinated and narrowly umbilicated.

The protoconch is formed by 0.8 whorls, with a smooth surface and is about 260 µm in diameter.

The teleoconch is formed by about 4.5 whorls; with an ornamentation composed of thick spiral cords (carinae), spiral threads, axial ribs, axial riblets and microgranules. The spiral cords (carinae) are prominent and angulate the periphery; in apertural view there can be seen 3 spiral cords at the first whorl, 2 carinae at the second and third and 6 carinae on the last one, of which 4 are peripheral and 2 are basal. On the last whorl, about 20 intermediate spiral cordlets are distributed as follows: 12 between the suture and the first peripheral carina and 4-8 between each of the remaining carinae. The spaces between carinae are very concave. Axial ribs cross the interspaces forming a regular reticle of quadrangular/rectangular spaces. All the carinae present in the two last whorls, have on either side of the edge, small riblets perpendicular to the carinae in the sense of the axis of the shell. Microgranules cover the entire teleoconch surface, including cords and ribs.

A prominent periumbilical cord formed by successive spiral cords, including its inner side, skirts and delimits the umbilicus, which is narrow, deep and is placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, straight and not reflected, with an anterior channel at the base. Outer lip with margin strongly scalloped and modified by the spiral carinae; external margin not thickened or variciform.

Dimensions: The holotype measures 4.41 mm in height and 4.04 mm in diameter (H/D = 1.09).

**Habitat.** Infralittoral species collected by diving at 38 m deep.

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

**Remarks.** *Crosseola serrata* n. sp. is characterized by its high spire, by its strong peripheral carinae with axial riblets on each side of the edge, by its intermediate spiral threads, by its narrow umbilicus and by the shape of the periumbilical cord.

*Crosseola mayottensis* n. sp. has more numerous and finer axial riblets between the spiral cords, and it lacks the very short ones that *Crosseola serrata* has on the carinae walls.

**Etymology.** The specific name alludes to the form of the spiral carinae that, because of their numerous small teeth, provide the shell with a saw-like shape.

*Crosseola indigaxial* Rubio, Rolán & Gori n. sp.

Fig. 14A-E

**Type material.** Holotype MNHN-IM-2000-34430 (Fig. 14A-B).

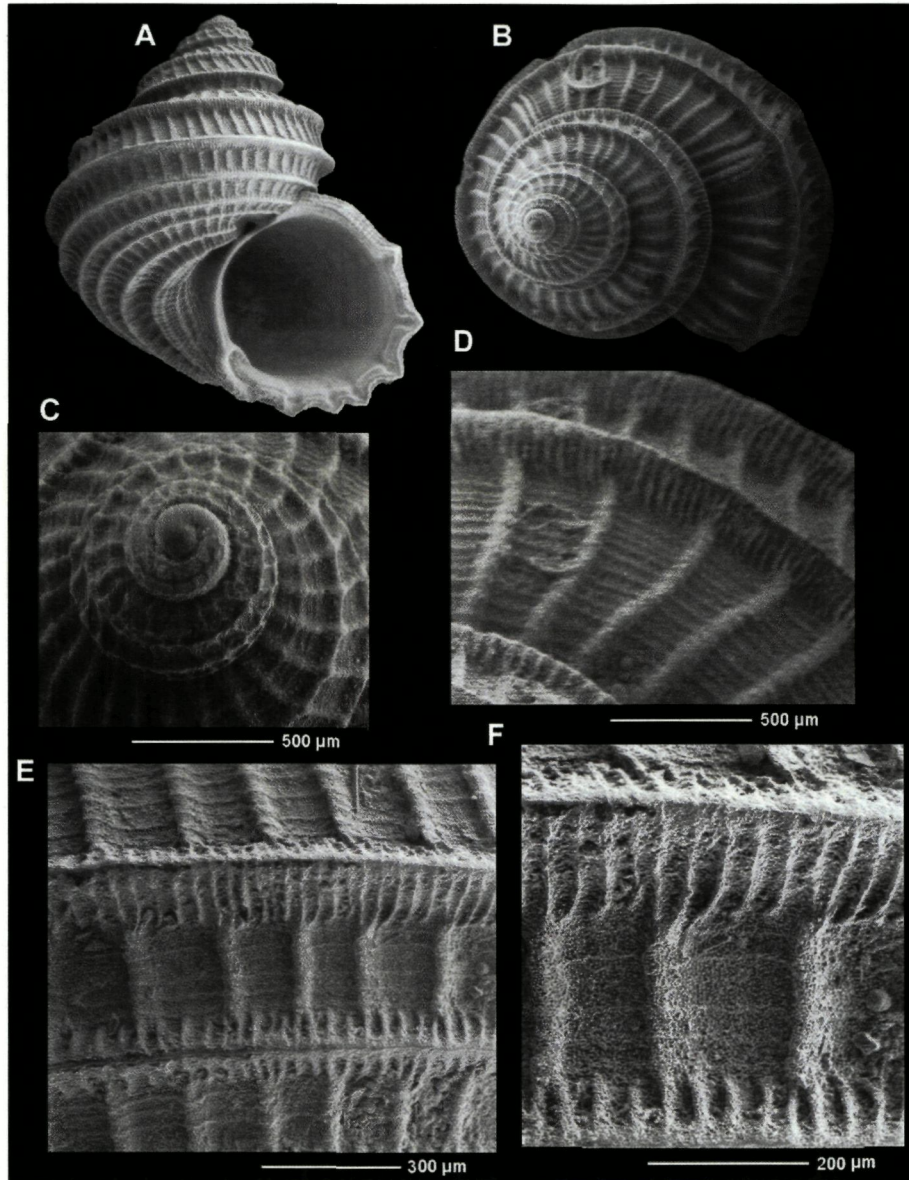
**Type locality.** Maldives, Guraidhoo Kandu, S Male Atoll, 03°54'N-73°28'E, 20 m, sand in small cave

**Material examined.** Maldives, 1 s, Guraidhoo Kandu, S Male Atoll, 03°54'N-73°28'E, 20 m, sand in small cave (holotype, ex CSG).

**Description.** Shell of small size (<4.0 mm), robust, turbiniform, formed by little more than 4.1 whorls, separated by a wide and deep suture, carinated and narrowly umbilicated.

The protoconch is formed by 0.8 whorls, with a smooth surface and is about 328 µm in diameter. The teleoconch is formed by about 3.3 whorls; with an ornamentation formed by thick spiral cords (carinae), spiral threads and axial ribs. The spiral cords (carinae) are prominent and angulate the periphery; in apertural view there can be seen 2 spiral cords at the first and second whorls and 6 carinae at the last one, of which 4 are peripheral and 2 are basal. Intermediate spiral cordlets can be found distributed in the last whorl: 9-10 between the suture and the first peripheral carina, and 4-6 between each of the remaining carinae excluding the basal ones. The spaces between carinae are very concave. Axial ribs cross the interspaces forming a regular reticle of quadrangular/rectangular spaces. On the last whorl, interspaces are covered by axial ribs and spiral cordlets, except in some sections where the axial ribs disappear and only the spiral cords are visible.

A periumbilical cord, formed by successive axial ribs, penetrates inside the umbilicus and delimits it. The umbilicus is narrow and deep, and is placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thick, with a groove in its middle zone and an anterior channel at the base. Outer lip with inner margin strongly scalloped; external margin not thickened or variciform.



**Figure 13A-F**

*Crosseola serrata* n. sp. A-B. Holotype MNHN-IM-2000-34429, 4.41 mm, Mozambique, Narenque, Fernando Veloso, 14°26.9'S-40°40.7'E, 38 m; C. Protoconch and first teleoconch whorl; D-F. Sculpture and details.

**Dimensions:** The holotype is 3.64 in height and 3.36 mm in diameter ( $H/D = 1.08$ )

**Habitat.** Infralittoral species collected by diving at 20 m deep on sand in a small cave in rocky bottom.

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

**Remarks.** *Crosseola indigaxial* n. sp. is characterized by having well delimited spiral cords which, except in the middle part, have axial ribs in between.

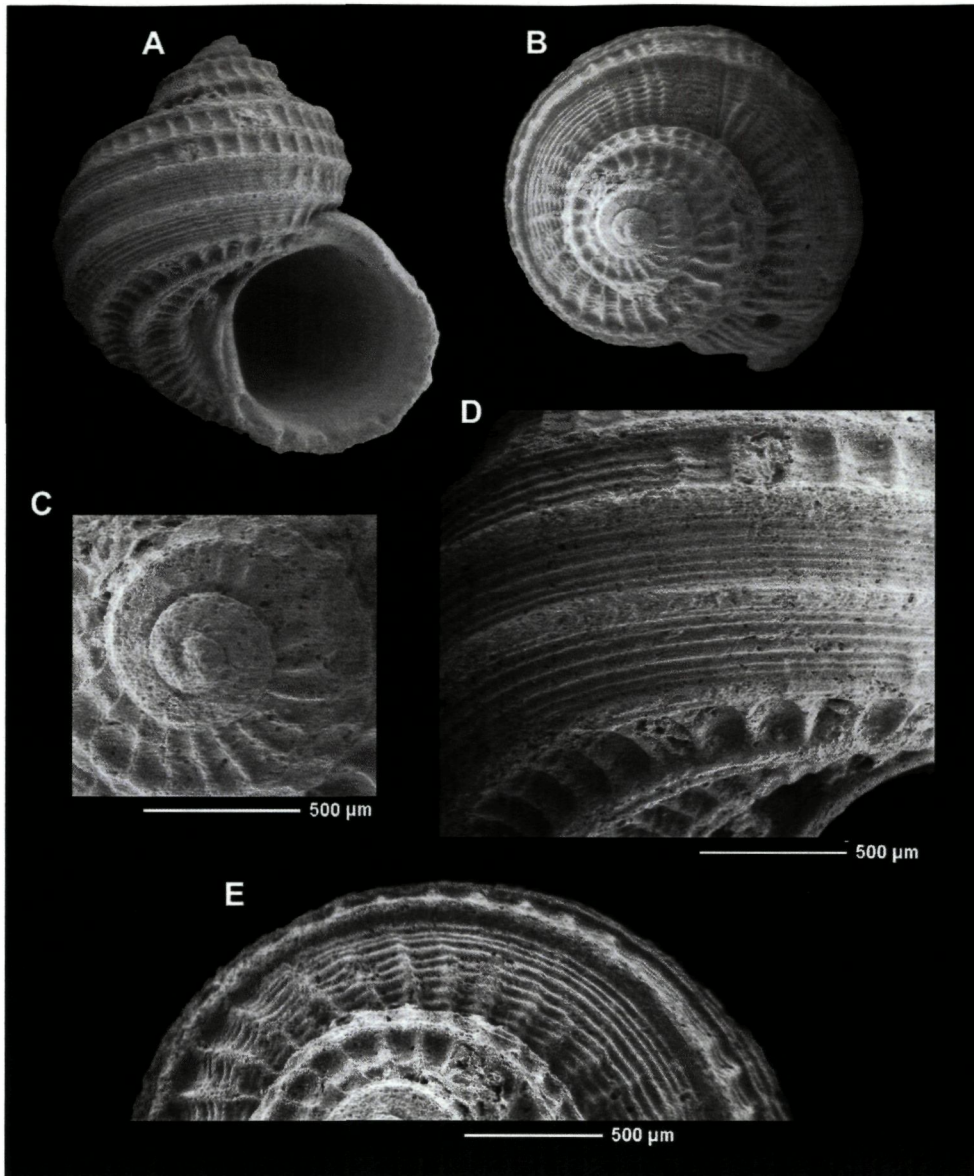
*Crosseola serrata* n. sp. has a similar profile but the axial cordlets are present in the periphery of the last

whorl, the carinae are more prominent, and very small and dense microriblets cross its spiral sculpture.

*Crosseola uniformis* n. sp. (see below) is also rather similar but the axial riblets are present in the interspaces between the carinae and there is no continuous spiral sculpture between them.

*Crosseola mayottensis* n. sp. has wider and more prominent spiral carinae while the axial sculpture is much finer and tighter.

**Etymology.** The specific name is derived from the Latin words *axial* (referred to the axial sculpture) and *indigens* which means “those who lack”, meaning that

**Figure 14A-E**

*Crosseola indigaxial* n. sp. A-B. Holotype MNHN-IM-2000-34430, 3.64 mm in height, Maldives, Guraidhoo Kandu, S Male Atoll, 03°54'N-73°28'E, 20 m; C. Protoconch and first teleoconch whorls; D-E. Detail of the sculpture.

in some spaces between the spiral cords, there is no axial sculpture.

*Crosseola uniformis* Rubio, Rolán & Gori n. sp.  
Fig. 15A-E

**Type material.** Holotype MNHN-IM-2000-34431 (Fig. 15A-B).

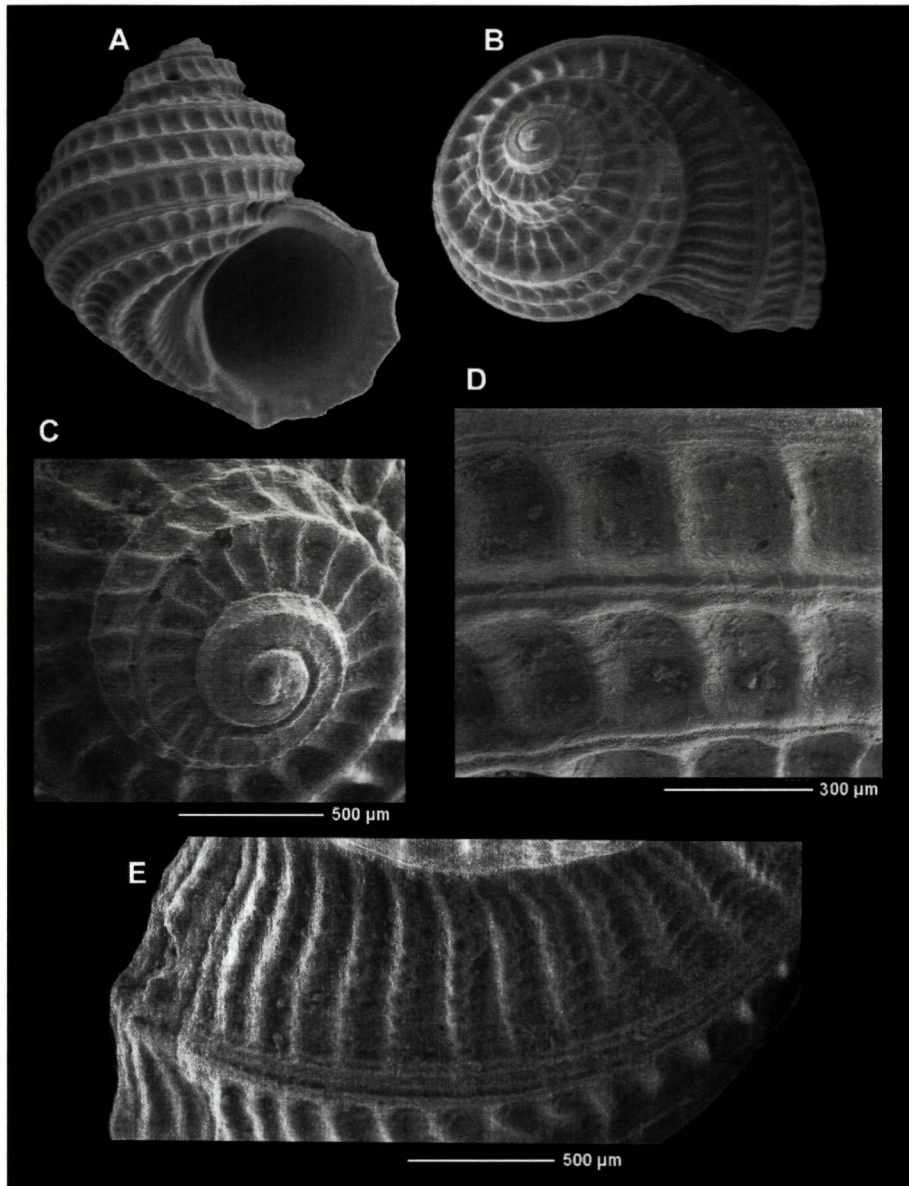
**Type locality.** Maldives, Old Shark Point, Villingili, N Male Atoll, 30 m, sand in a small cave.

**Material examined.** Maldives, 1 s, Old Shark Point, Villingili, N Male Atoll, 30 m, sand in small cave (holotype, ex CSG).

**Description.** Shell of small size (<4.0 mm), robust, turbiniform, formed by slightly over 4.3 whorls, separated by a wide and deep suture, carinated and narrowly umbilicated.

The protoconch is formed by 0.8 whorls, with a smooth surface and is about 328 µm in diameter.

The teleoconch is formed by about 3.5 whorls; ornamentation comprising thick spiral cords (carinae), spiral cordlets, axial ribs and microgranules. The



**Figure 15A-E**

*Crosseola uniformis* n. sp. A-B. Holotype MNHN-IM-2000-34431, 3.63 mm in height, Maldivas, Old Shark Point, Villingili, N Male Atoll, 30 m; C. Protoconch and first teleoconch whorl; D-E. Details of the sculpture.

spiral cords (carinae) are prominent and angle the periphery; in apertural view there are 2 spiral cords at the first and second whorls and 6 carinae at the last one, of which 4 are peripheral and 2 are basal. If we look at the edge of each carina, we see that it is formed by two very close cords with a narrow groove between them. There are intermediate spiral cordlets, which are distributed in the last whorl: there are 9-10 between the suture and the first peripheral carina while the ones placed between the remaining carinae are scarcely visible. The spaces between carinae are very concave.

Axial ribs cross the interspaces forming a regular reticle of quadrangular/rectangular spaces. In the last

whorl, in the space between the suture and the first peripheral carina, the spiral cordlets cross the axial ribs forming small nodules in the intersection points. Microgranules cover the entire teleoconch surface.

The periumbilical cord is high and its nodular edge is formed by the successive axial ribs that cross it.

Umbilicus narrow and deep, placed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella very thick, with a groove in its middle zone and an anterior channel at its base. Outer lip with inner margin strongly scalloped; external margin not thickened or variciform.

Dimensions: The holotype is 3.63 mm in height and 3.4 mm in diameter (H/D = 1.06).

**Habitat.** Infralittoral species collected by diving at 30 m deep on sand in small cave.

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

**Remarks.** *Crosseola uniformis* n. sp. is characterized by a regular axial and spiral sculpture, with very fine spiral cordlets which mount on tight axial ribs in the last whorl.

See Remarks of *Crosseola indigaxial* n. sp.

*Crosseola mayottensis* n. sp. has the spiral carinae wider and more prominent, while the axial sculpture is much finer and much tighter.

**Etymology.** The specific name is from the Latin word *uniformis*, *e* which means “regular” and alludes to the regularity of its sculpture.

*Crosseola intercalaris* n. sp.

Fig. 16A-F

**Type material.** Holotype MNHN-IM-2000-34432 (Fig. 16A) and 16 paratypes MNHN-IM-2000-34433 (Fig. 16B-C).

**Type locality.** S New Caledonia, 22°38'S-167°10'E, 124 m (BATHUS 2: DW714).

**Material examined.** BATHUS 2, stn DW714, 17 s, S New Caledonia, 22°38'S-167°10'E, 124 m (type material).

**Description.** Shell minute (<2.0 mm), robust, turbiniform, formed by 3.0 whorls, nodular and narrowly umbilicated.

The protoconch is formed by 0.7 whorls, with smooth surface and has a size of about 180 µm in diameter.

The teleoconch is formed by 2.5 whorls, and its periphery has an ornamentation formed by spiral cords, axial ribs and microgranules.

In apertural view there are 4 spiral cords at the first whorl and 7 at the last one; the cords on the first whorl are distributed in a zigzag pattern crossing the axial ribs, and forming a reticulate pattern of rectangular cells and small thickenings at the intersections; towards the anterior pole, the cords and ribs thicken progressively forming ever thicker nodules at the intersections and at the last whorl a regular reticle of quadrate spaces.

The entire shell surface is covered by microgranules that are aligned forming fine threads that occupy the interior of the cells of the reticle.

A prominent spiral ridge borders and delimits the umbilicus.

Aperture rounded, prosocline. Thickened parietal lip; columellar lip thick, arched and reflected towards the umbilicus. Thick outer lip; external margin modified by the spiral cords.

**Dimensions:** The holotype measures 1.68 mm in height and 1.57 in diameter (H/D = 1.07). The paratypes are more juvenile.

**Habitat.** Bathyal species dredged at 124 m depth.

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

**Remarks.** *Crosseola intercalaris* n. sp. is characterized by the prominent sculpture more than any other studied in this genus.

**Etymology.** The specific name alludes to the crossing between the axial and spiral sculpture, from the Latin word *intercalaris*, *e* “intercalate”.

*Crosseola prosocline* n. sp.

Fig. 17A-F

**Type material.** Holotype MNHN-IM-2000-34434 (Fig. 17A).

**Type locality.** Vanuatu, 19°25'S-169°27'E, 160-182 m (MUSORSTOM 8: DW976).

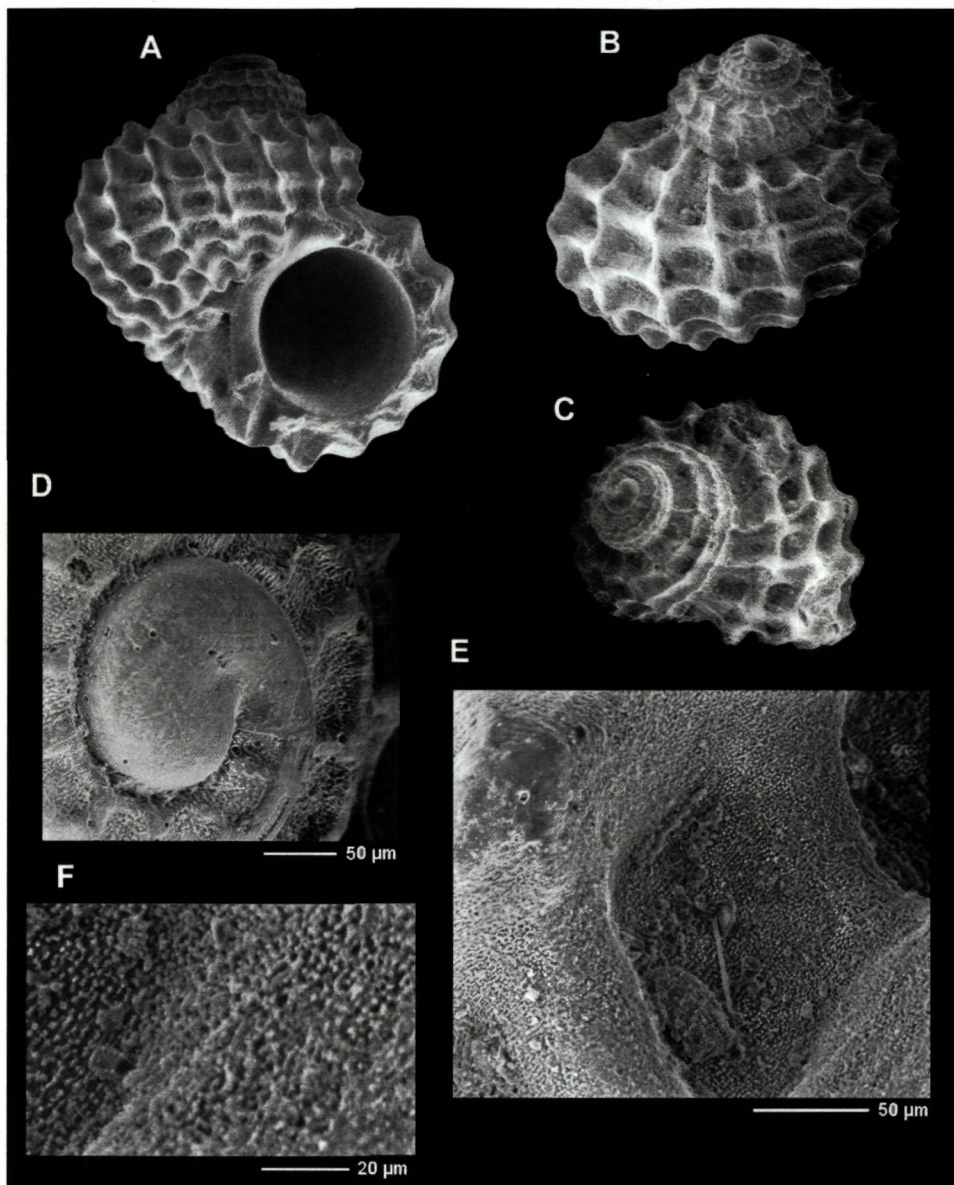
**Material examined.** MUSORSTOM 8, stn DW976, 1 s, Vanuatu, 19°25'S-169°27'E, 160-182 m (holotype).

**Description.** Shell of small size (<4.0 mm), globose to turbinate, as high as wide, formed by 3.7 whorls separated by a marked suture; with a very convex periphery and narrowly umbilicated.

The protoconch is smooth, formed by about ¾ of whorl and with a size of 260 µm in diameter. The teleoconch is formed by 3.1 whorls and its periphery is rounded. Ornamentation formed by spiral cords, axial ribs and microgranules. In apertural view there are 3 spiral cords on the first and second whorls and 12-14 on the last one; the cords on the first whorl are distributed in a zigzag pattern crossing the axial ribs, and forming a reticulate pattern of regular shape and small thickenings at the intersections; towards the base, the axial ribs thicken progressively, raise separate widely from each other; the number of spiral cords increases, maintaining the same thickness as on the initial whorls but the nodules at the intersections with the axial ribs are smaller on the last whorl.

The entire shell surface is covered by microgranules. A prominent, spiral ridge formed by successive axial folds, borders and delimits the umbilicus, forming a keel.

The umbilicus is limited to a deep cleft formed between the periumbilical cord and the columellar lip. Aperture rounded, prosocline; columella thin, arched, reflected towards the umbilicus, with an anterior channel at the base. Outer lip sinuous; smooth edged, not modified by the spiral cords; external margin not thickened or variciform.

**Figure 16A-F**

*Crosseola intercalaris* n. sp. A. Holotype MNHN-IM-2000-34432, 1.68 mm in height, S New Caledonia, 22°38'S-167°10'E, 124 m; B-C. Paratypes MNHN-IM-2000-34433, 1.5 and 1.34 mm in diameter, same locality; D. Protoconch; E-F. Microsculpture and detail.

**Dimensions:** The holotype measures 3.97 mm in height and 3.74 mm in diameter.

**Habitat.** Bathyal species dredged at 160-182 m depth.

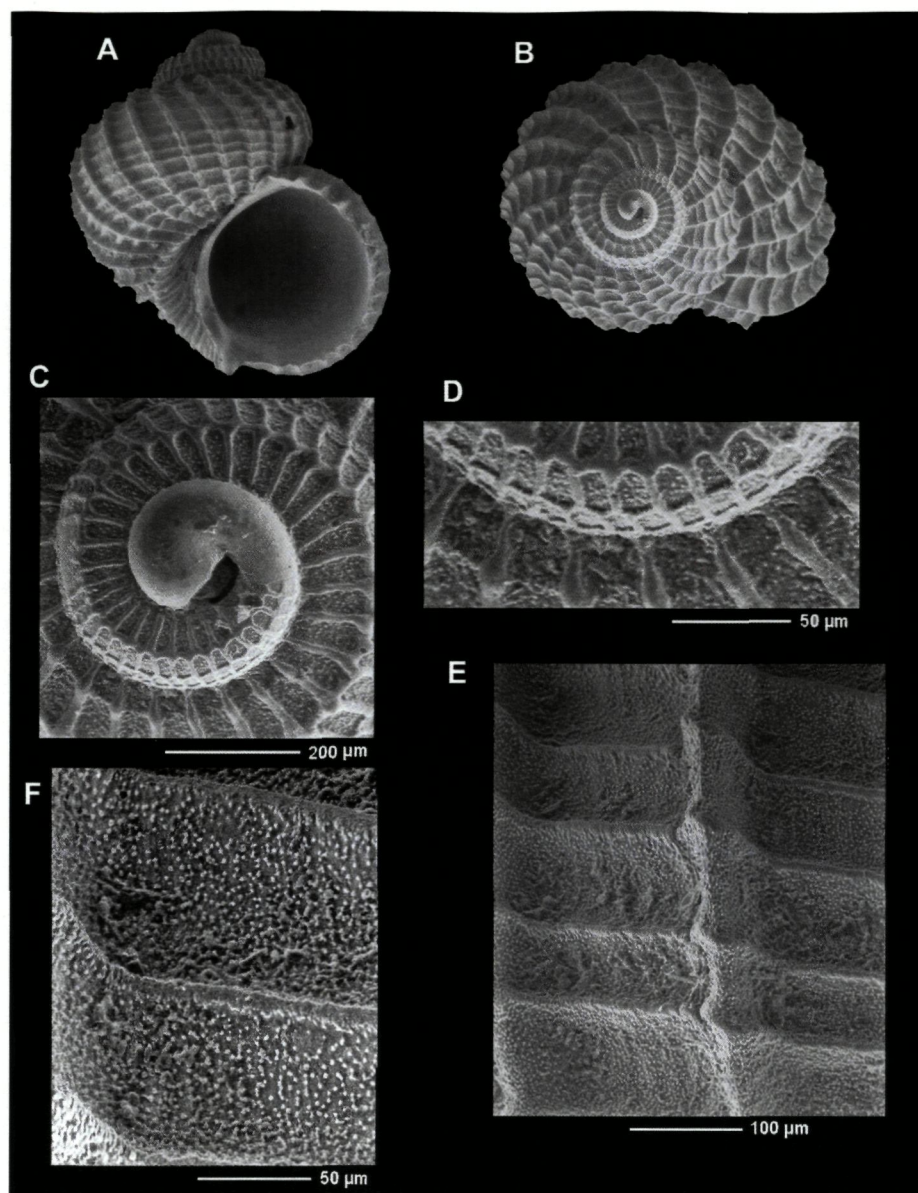
**Distribution.** Only known from the type locality.

**Remarks.** *Crosseola prosocline* n. sp. is characterized by a regular sculpture with strongly prosocline axial ribs. The periumbilical cord is narrow and prominent, with elevations which are prolongations of the axial ribs.

*Crosseola delicata* n. sp and *C. latumlabrum* n. sp. may seem to be similar, but their axial sculptures are formed by short riblets which are narrower than those of *C. prosocline* n. sp.; furthermore they are not prosocline.

*Crosseola dentata* n. sp., *C. anodyna* n. sp., *C. uniformis* n. sp. and *C. serrata* n. sp have a clear predominance of spiral carinae over the axial sculpture.

*Crosseola sexlata* n. sp. has also prosocline axial ribs, but in smaller quantity, the periumbilical cord is evidently much wider, the outer lip is very thickened and the base more prolonged.

**Figure 17A-F**

*Crosseola prosoclina* n. sp. A-B. Holotype MNHN-IM-2000-34434, 3.97 mm, Vanuatu, 19°25'S-169°27'E, 160-182 m; C. Protoconch; D-F. Sculpture and microsculpture.

**Etymology.** The specific name alludes to the direction on the axial sculpture of the last whorl, which is more prosocline than in other species of the genus.

*Crosseola osgrandis* n. sp.

Fig. 18A-F

**Type material.** Holotype MNHN-IM-2000-34436 (Fig. 18A-C).

**Type locality.** Philippines, Bohol Sea, Pamilacan Island, 9°30'N-123°5'E, 196-216 m (PANGLAO 2005: CP2348).

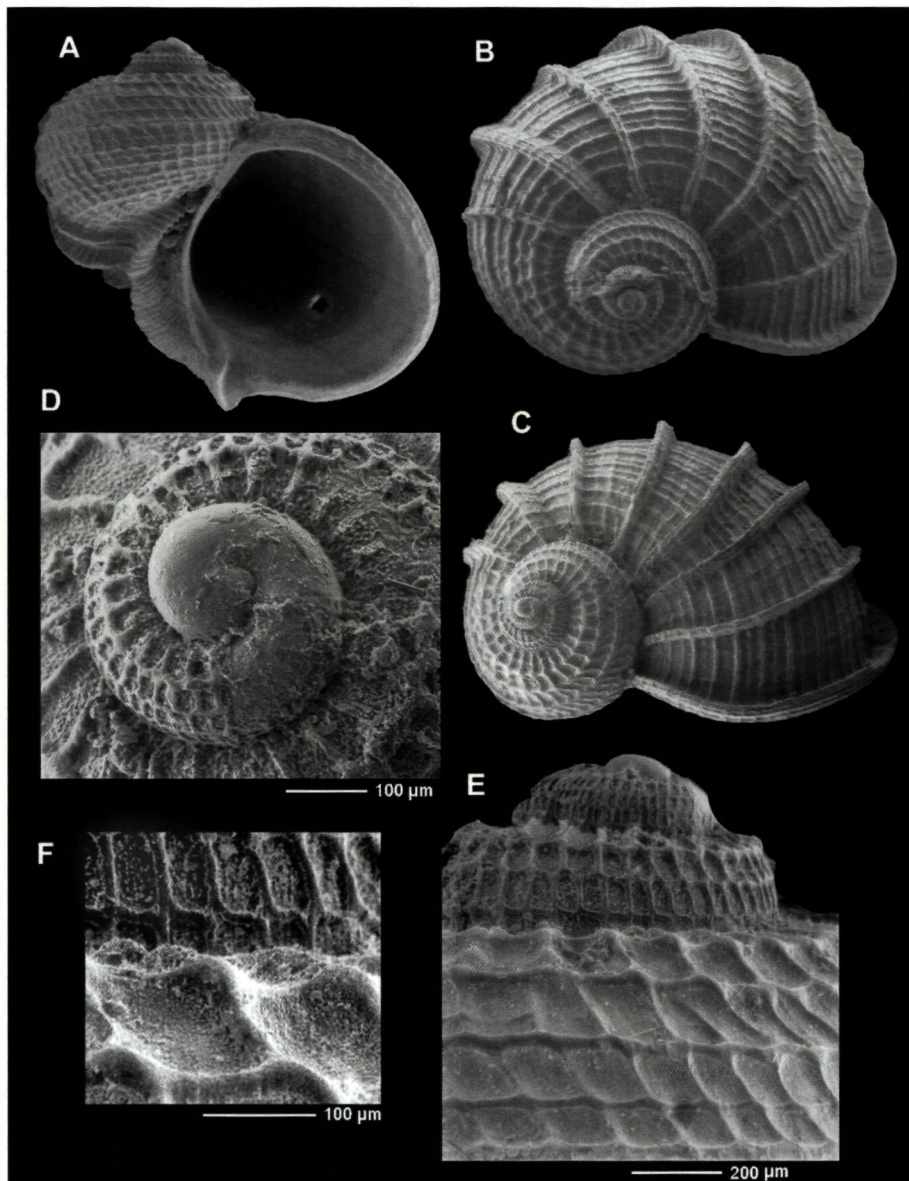
**Material examined.** PANGLAO 2005, stn CP2348, 1 s, Philippines, Bohol Sea, Pamilacan Island, 9°60'N-123°53'E, 196-216 m (holotype).

**Description.** Shell of small size (<4 mm), not very robust, turbiniform, very low spire formed by 3 ½ whorls separated by a deep suture, not carinated and with a large last whorl.

The protoconch is formed by almost 1 whorl after the nucleus with a smooth surface and has a size of 240 µm in diameter.

The teleoconch has 3.5 whorls and its periphery is very convex. The ornamentation is formed by spiral





**Figure 18A-F**

*Crosseola osgrandis* n. sp. A-C. Holotype MNHN-IM-2000-34436, 3.53 mm in height, Philippines, Bohol Sea, Pamilacan Island, 9°30'N-123°5'E, 196-216 m; D. Protoconch; E-F. Lateral view of the protoconch and detail.

cords, axial ribs and microgranules. The spiral cords are narrow and cover the entire surface of the teleoconch. In the first whorl there are 3 cords, there are 4 in the second and on the last whorl (which has a greater size) there are about 22. The axial ribs are present in the two first whorls but disappear in the last half whorl, where they are substituted by labial enlargements. The axial ribs crossing the spiral cords form a regular reticle of rectangular spaces, mostly with an elevation at the intersections. On the last half whorl the rectangles at the crossing with the persistent labial enlargements are elongated. The interspaces are covered by microgranules.

A prominent cord borders and delimits the umbilical area; it has numerous fine prominent cordlets; the

umbilicus as such is absent; the columella is fine and slightly curved with an extension below the aperture which looks like a siphonal fold.

Aperture rounded, large, without any prominence and only with an external enlargement on which the spiral cordlets cross.

Dimensions: The holotype is 3.53 mm in height and 3.80 mm in diameter ( $H/D = 0.93$ ).

**Habitat.** Bathyal species dredged at 196-216 m in depth.

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

**Remarks.** *Crosseola osgrandis* n. sp. is characterized by its enormous aperture and the presence of eight apertural enlargements which are preserved. These characters make it different from any other species.

**Etymology.** The specific name alludes to the large size of the aperture, from the Latin *os*, *oris* “mouth” and *grandis*, *e* “large”.

*Crosseola sexlata* n. sp.  
Fig. 19A-D

**Type material.** Holotype MNHN-IM-2000-34437 (Fig. 19A-B).

**Type locality.** Philippines, Bohol Island/Sulu Seas sill, Dipolog Bay, 8°35'N-123°16'E, 172-175 m (PANGLAO 2005: DW2371).

**Material examined.** PANGLAO 2005, stn DW2371, 1 s, Philippines, Bohol/Sulu Seas sill, Dipolog Bay, 8°35'N-123°16'E, 172-175 m (holotype).

**Description.** Shell of small size (<2 mm), robust, turbiniform, with a medium short spire formed by slightly over 3 whorls separated by an evident suture, not carinated.

The protoconch is formed by  $\frac{3}{4}$  of a whorl, with a smooth surface and has a size of about 250  $\mu$ m in diameter. The teleoconch is formed by 2  $\frac{3}{4}$  whorls, and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow and cover the entire surface of the teleoconch, except a narrow subsutural area that goes from the beginning to the last whorl where the spiral sculpture appears again. The spiral cords are much narrower than their interspaces, and can number up to 14-15.

The axial ribs begin in the suture. They are scarce in the subsutural band on the two first whorls (about 19 on the first whorl). They are placed between the spiral cords, most of them form a nodule at the crossing point, forming an irregular reticle of rectangular spaces; in the lower part of the whorls, the axial ribs are stronger and are closer together. All the interspaces are covered by microgranules and occasionally by smaller cordlets.

A prominent cord borders and delimits the umbilical area; this cord is sculptured by many fine dense riblets, almost horizontal at the beginning and vertical later, lacking prolongations from the axial ribs of the last whorl. The umbilicus is reduced to a very narrow fissure that is practically occluded between the periumbilical cord and the columella. The columella is fine and slightly curved, with a reflected extension to the lower part of the aperture and finishes in a low neck or depressed line forming a siphonal fold, which extends below the aperture.

Aperture rounded and smooth. Peristome wide; the external margin is strongly thickened and in the last half whorl can be observed 6 more similar before the apertural one.

Dimensions: The holotype is 1.82 mm in height and 1.61 mm in diameter (H/D = 1.13).

**Habitat.** Bathyal species dredged at 172-175 m deep.

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

**Remarks.** The most important characters of *Crosseola sexlata* n. sp. are the last axial ribs, which are wider than the previous ones; the axial and spiral sculpture, which are crossed; and the prominence in the base which surpasses the lower border of the aperture.

*Crosseola solomonensis* Rubio & Rolán, 2017, has a similar form and sculpture, but it has otherwise several differences: it has a smaller protoconch diameter (220  $\mu$ m vs 250 in the present species); The axial sculpture of the teleoconch is not regular, having 20 ribs on the first whorl and 24 on the second (vs 20 on the first one and 30 on the second in *C. sexlata* n. sp.); in *C. solomonensis* the axial ribs on the last whorl are 15 but rather similar, having only the last ones larger interspaces between; in contrast the last 6 axial ribs in *C. sexlata* n. sp. are evidently wider than the previous; the lowest part on the last whorl in *C. solomonensis* is the lower apertural border, while in *C. sexlata* it is the prolongation of the periumbilical cord; Finally, in the last whorl, the subsutural spiral cords, in *C. solomonensis*, are moved away from the suture while others are appearing; in contrast, in *C. sexlata* n. sp. the spiral cordlets also are moving away, but no new ones are formed keeping a subsutural band without any spiral cordlets.

**Etymology.** The specific name is formed by the Latin words *sex* “six” and *latus*, *a*, *um* “wide”, alluding to the facts that the last axial ribs, at the last whorl, are wider than the previous ones.

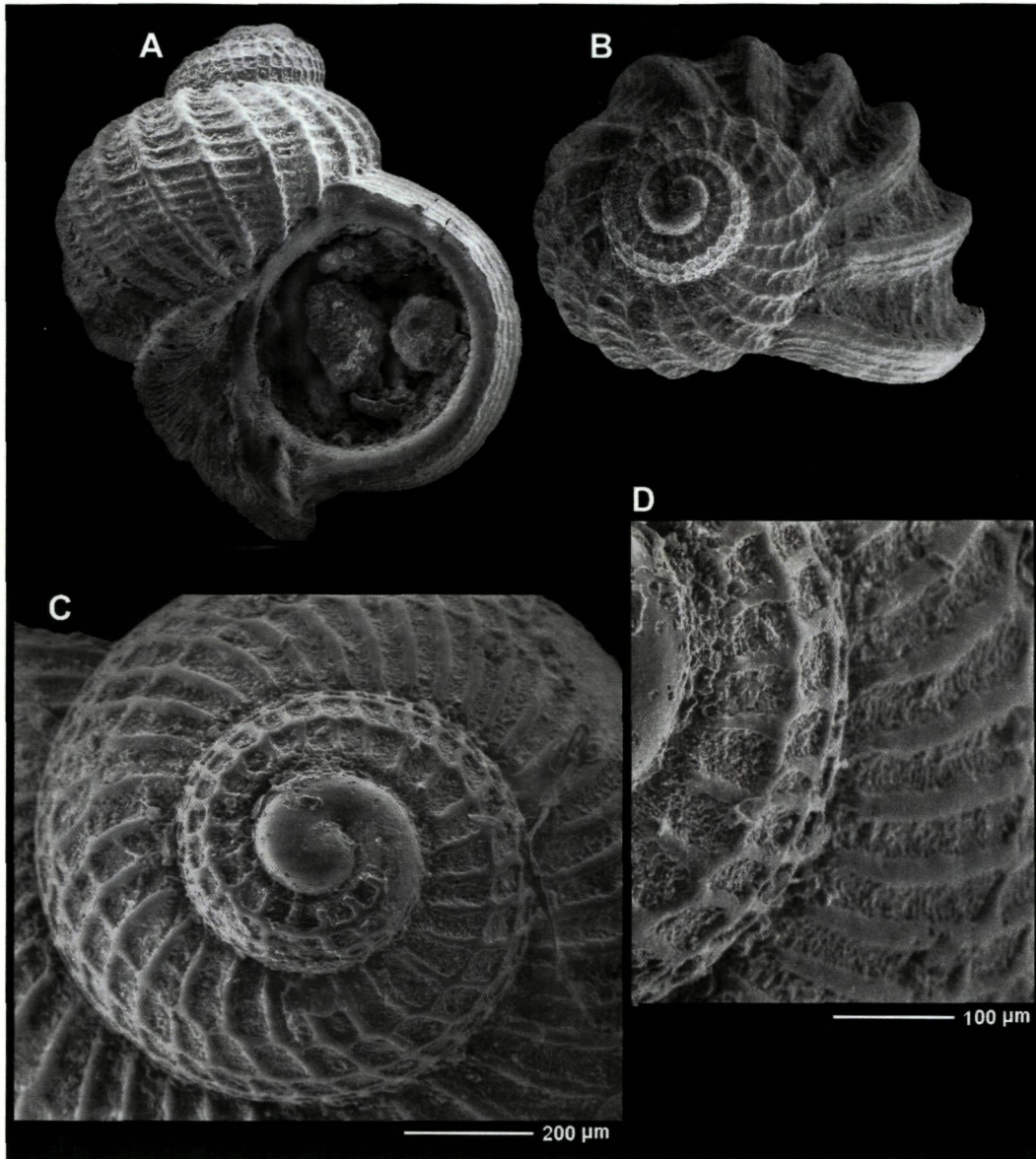
*Crosseola benedotata* n. sp.  
Fig. 20A-F

**Type material.** Holotype MNHN-IM-2000-34438 (Fig. 20A-B).

**Type locality.** New Caledonia, East Coast, 20°35'S-165°07'E, 380-400 m (BATHUS 1: DW683).

**Material examined.** BATHUS 1, stn DW683, 1 s, New Caledonia, East Coast, 20°35'S-165°07'E, 380-400 m (holotype).

**Description.** Shell of small size (<2 mm), robust, turbiniform, with a medium sized spire formed by



**Figure 19A-D**

*Crosseola sexlata* n. sp. A-B. Holotype MNHN-IM-2000-34437, 1.82 mm, Philippines, Bohol Island, Sulu Seas sill, Dipolog Bay, 8°35'N-123°16'E, 172-175 m; C. Apex and protoconch; D. detail.

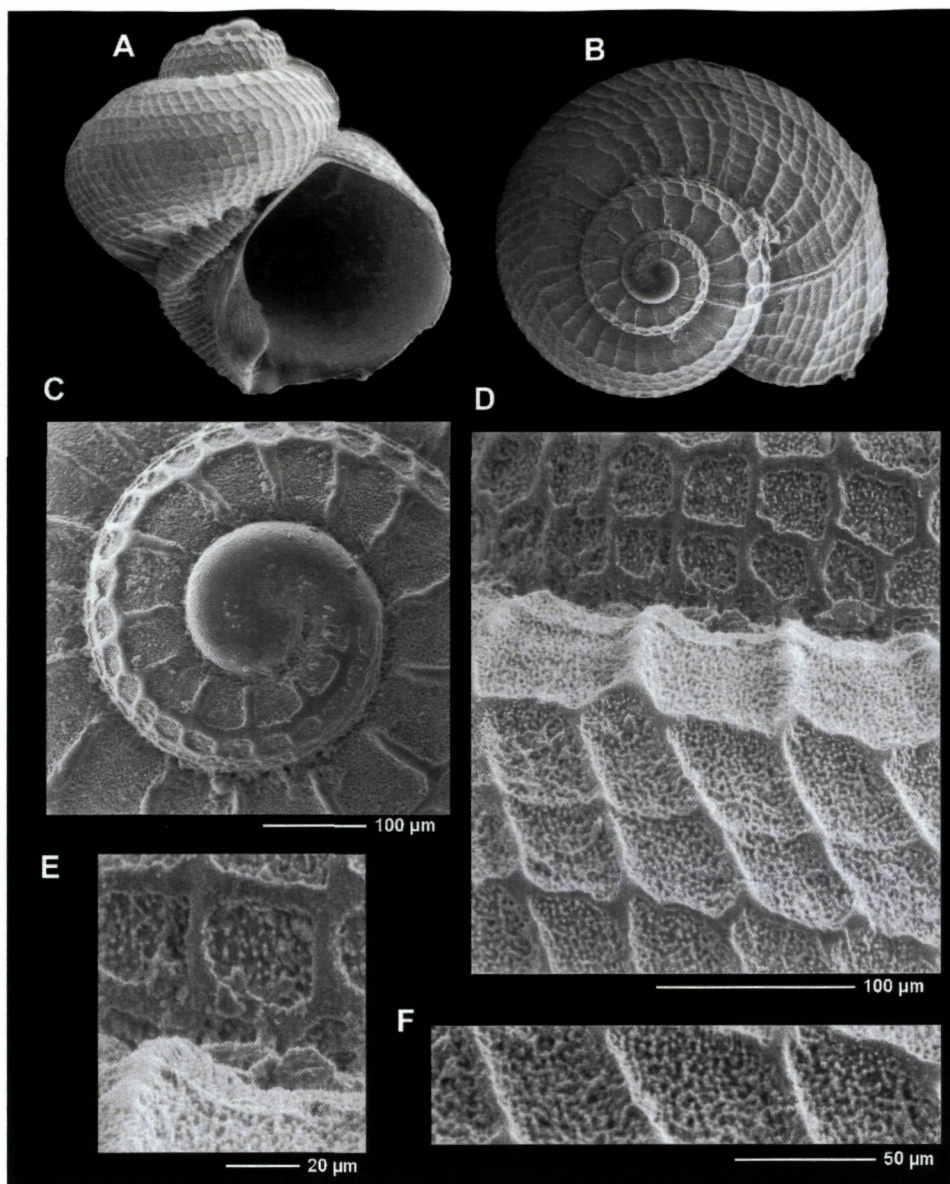
about 3 whorls separated by an evident suture, not carinated.

The protoconch is formed by little more than ½ of a whorl, with a smooth surface and has a size of about 200 µm in diameter. The teleoconch is formed by 2 ½ whorls, and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow, and cover the entire surface of the teleoconch, except a broad subsutural area that goes from the beginning to the last whorls where the spiral sculpture can be seen again. The spiral cords are much narrower than their interspaces.

The axial ribs begin at the suture; they are fewer at the subsutural band than in at the lower part of the two

first whorls. They are crossed by the spiral cords, forming an irregular reticulate of rectangular/quadrangular spaces; in the lower part of the whorls, the axial ribs are more numerous. All the interspaces are covered by microgranules.

A prominent cord borders and delimits the umbilical area; this cord is sculptured by many fine dense axial riblets which protude from those at the last whorl. The umbilicus is reduced to a very narrow fissure that is axially extended between the periumbilical cord and the columella. The columella is fine and slightly curved with two reflected parts, one towards the periumbilical cord, and the other to the inner part of the aperture, as a basal projection like a siphonal fold.

**Figure 20A-F**

*Crosseola benedotata* n. sp. A-B. Holotype MNHN-IM-2000-34438, 1.46 mm, New Caledonia, East Coast, 20°35'S-165°07'E, 380-400 m; C. Protoconch; D-F. Sculpture and detail.

Aperture rounded, smooth. Outer lip very fine and sharp; the external margin is not thickened or variciform.

Dimensions: The holotype is 1.46 mm in height and 1.46 in diameter ( $H/D = 1.0$ ).

**Habitat.** Bathyal species dredged at 380-400 m depth.

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

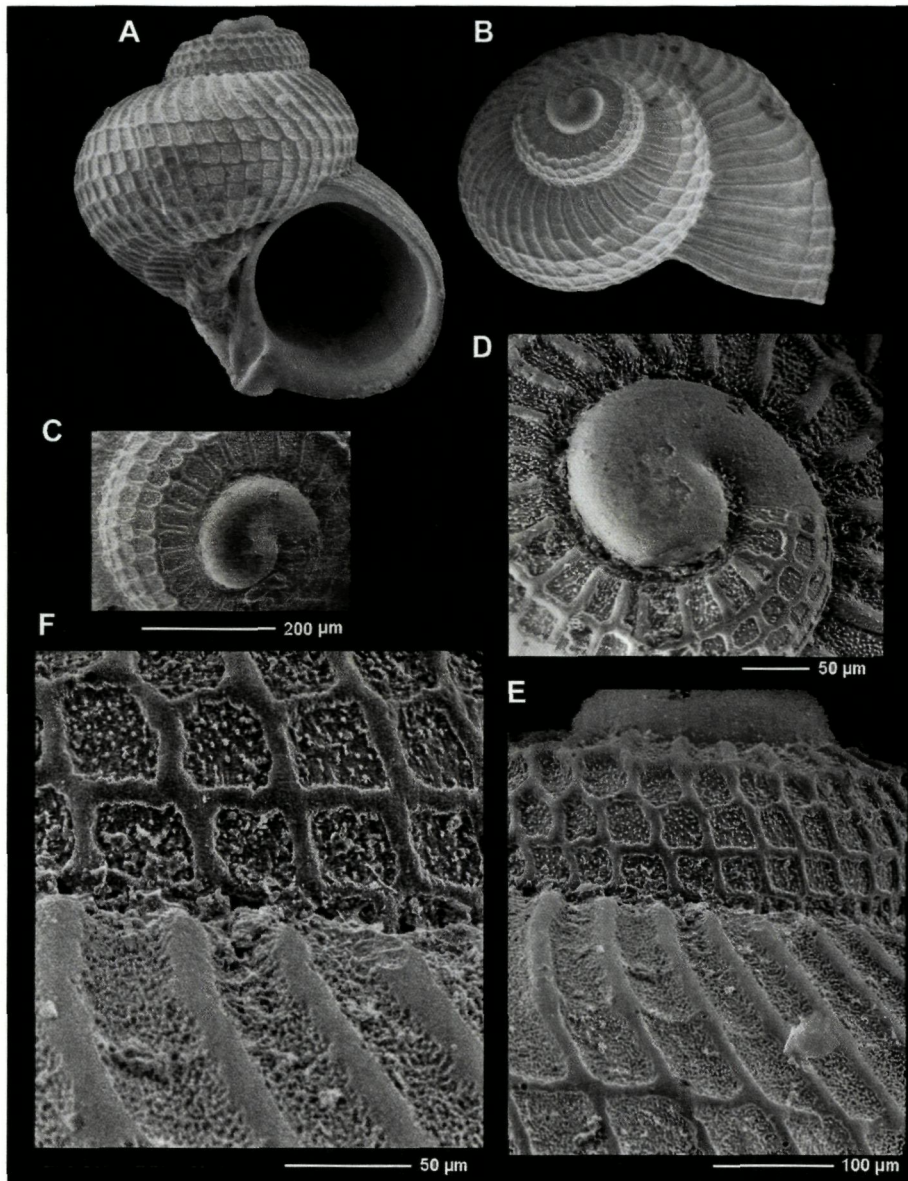
**Remarks.** *Crosseola benedotata* n. sp. is characterized by a sculpture scarcely prominent except the periumbilical cord, which forms smaller reticulation.

Some species have a little similarity: see below for the comparison with *C. axialis* n. sp., *C. minireticula* n. sp. and *C. occlusa* n. sp.

**Etymology.** The specific name is formed by two Latin words: *bene* “well” and *dotatus, a, um* “endowed” which alludes to the fact that the species possesses the typical characters of the genus,

*Crosseola axialis* n. sp.  
Figs 21A-F, 22A-G

**Type material.** Holotype MNHN-IM-2000-34439 (Fig. 21A-B) and 2 paratypes MNHN-IM-2000-34440 (Fig. 22A-D).



**Figure 21A-G**

*Crosseola axialis* n. sp. A-B. Holotype MNHN-IM-2000-34439, 1.26 mm, Fiji, S Viti Levu, 18°11'S-178°23'E, 393-433 m; C-D. Protoconch; E-F. Sculpture and detail.

**Type locality.** Fiji, S Viti Levu, 18°11'S-178°23'E, 393-433 m (MUSORSTOM 10: stn CP1369).

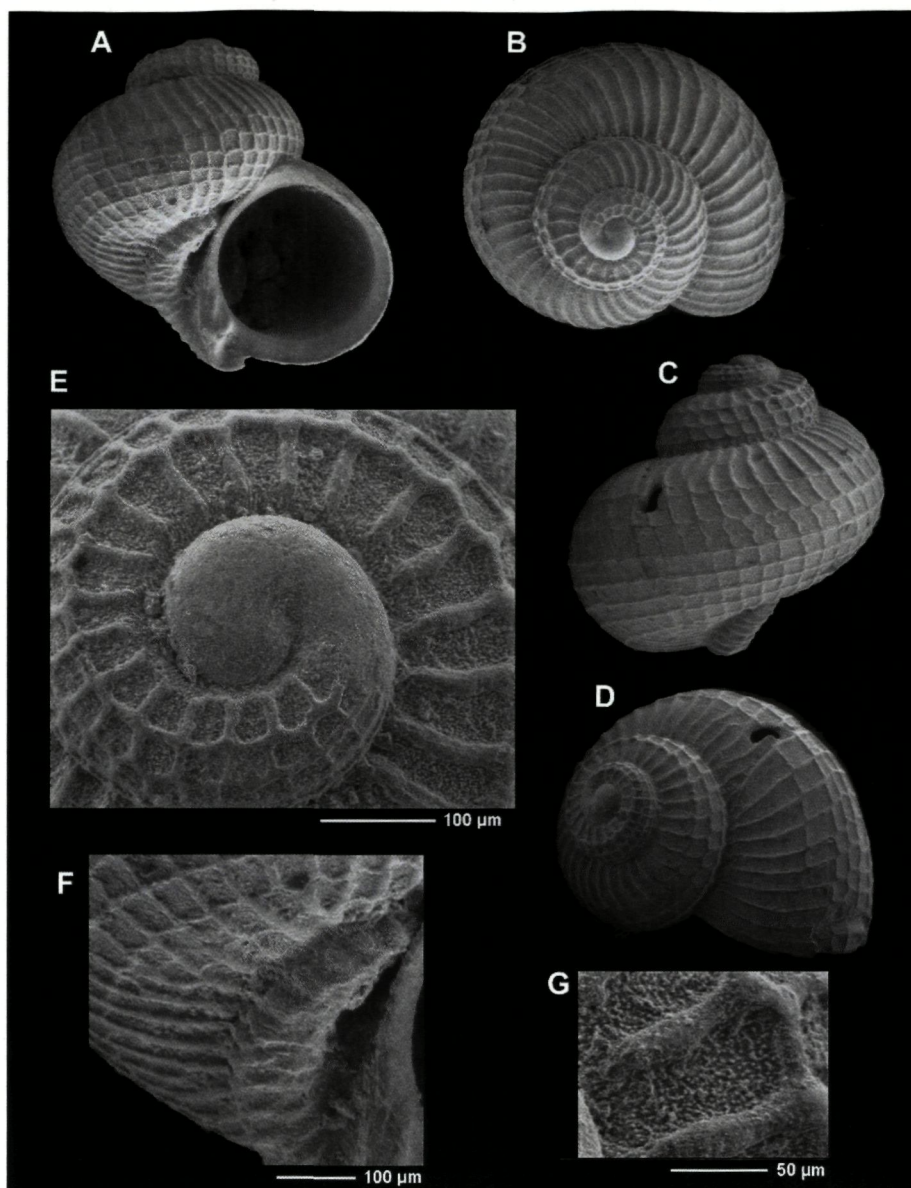
**Material examined.** MUSORSTOM 10, stn CP1369, 1 s, Fiji, S Viti Levu, 18°11'S-178°23'E, 393-433 m (holotype); 2 s, S Viti Levu, stn DW1381, 18°18'S-177°54'E, 275-430 m (paratypes).

**Description.** Shell of small size (<2 mm), robust, turbiniform, with a spire of medium size formed by about 3 whorls separated by an evident suture, not carinated.

The protoconch is formed by little more than ½ of a whorl with a smooth surface and is about 210 µm in diameter. The teleoconch is formed by almost 2 ½

whorls and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow, about 8 on the last whorl, and cover the entire surface of the teleoconch, except a broad subsutural area that goes from the beginning to the last whorl, where it is more evident; the spiral cords are narrower than their interspaces.

The axial ribs begin in the suture, and except in the subsutural band, are crossed by the spiral cords, forming an irregular reticle of rectangular/quadrangular spaces; later, the axial ribs continue but are only on the lower part. The interspaces are covered by microgranules.

**Figure 22A-G**

*Crosseola axialis* n. sp. A-B. Paratype MNHN-IM-2000-34440, 1.21 mm, Fiji, S Viti Levu, 18°18'S-177°54'E, 275-430 m; C-D. Paratype MNHN-IM-2000-34440, 1.14 mm in height, same locality; E. Protoconch of one paratype; F-G. Details of the umbilical area and microsculpture.

A prominent cord borders and delimits the umbilical area; this cord is sculptured by many fine axial riblets. The umbilicus is reduced to a narrow fissure that is axially extended between the periumbilical cord and the columella.

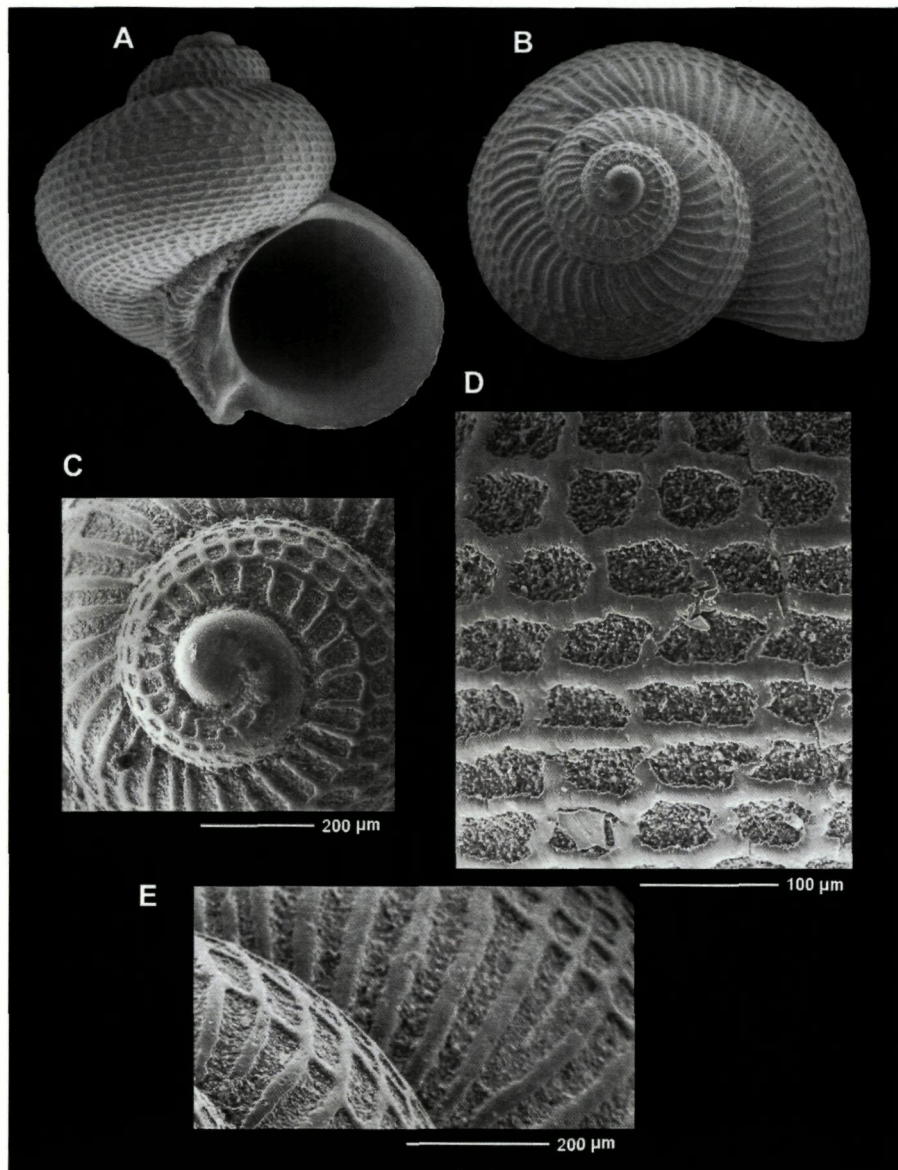
Aperture rounded, prosocline; columella narrow, fine and a little reflected towards the base, where is prominent and has an axial small depression below which reminds to a siphon. Outer lip smooth; the external margin is not thickened or variciform.

Dimensions: The holotype measures 1.26 mm in height and 1.21 mm in diameter ( $H/D = 1.11$ ).

**Habitat.** Bathyal species dredged between 168-393 m.

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

**Remarks.** Similar species are the following: *Crosseola benedotata* n. sp. has a fewer axial riblets at the beginning of the spire (12 on the first whorl compared to the 22 in *C. axialis* n. sp.); it has otherwise more spiral cordlets (15 on the last whorl compared to the 8 in *C. axialis* n. sp.). The sculpture of this species is very irregular, in contrast to the regularity of *C. axialis*.



**Figure 23A-E**

*Crosseola minireticula* n. sp. A-B. Holotype MNHN-IM-2000-34441, 1.77 mm in height. Philippines, Bohol Island, Sulu Seas sill, Dipolog Bay, 08°41'N-123°18'E, 150-163 m; C. Protoconch; D-E. Detail of the sculpture.

*Crosseola similiter* (see Rubio & Rolán, 2017a) from Solomón Is. has a similar aspect but with more spiral cordlets (11 vs 6 on the last whorl in *C. axialis*). Also the subsutural band, without spiral cords, is smaller in this species.

**Etymology.** The specific name alludes to the axial sculpture which is extended in all the surface of the shell, while it is reduced in the subsutural area.

*Crosseola minireticula* n. sp.

Fig. 23A-E

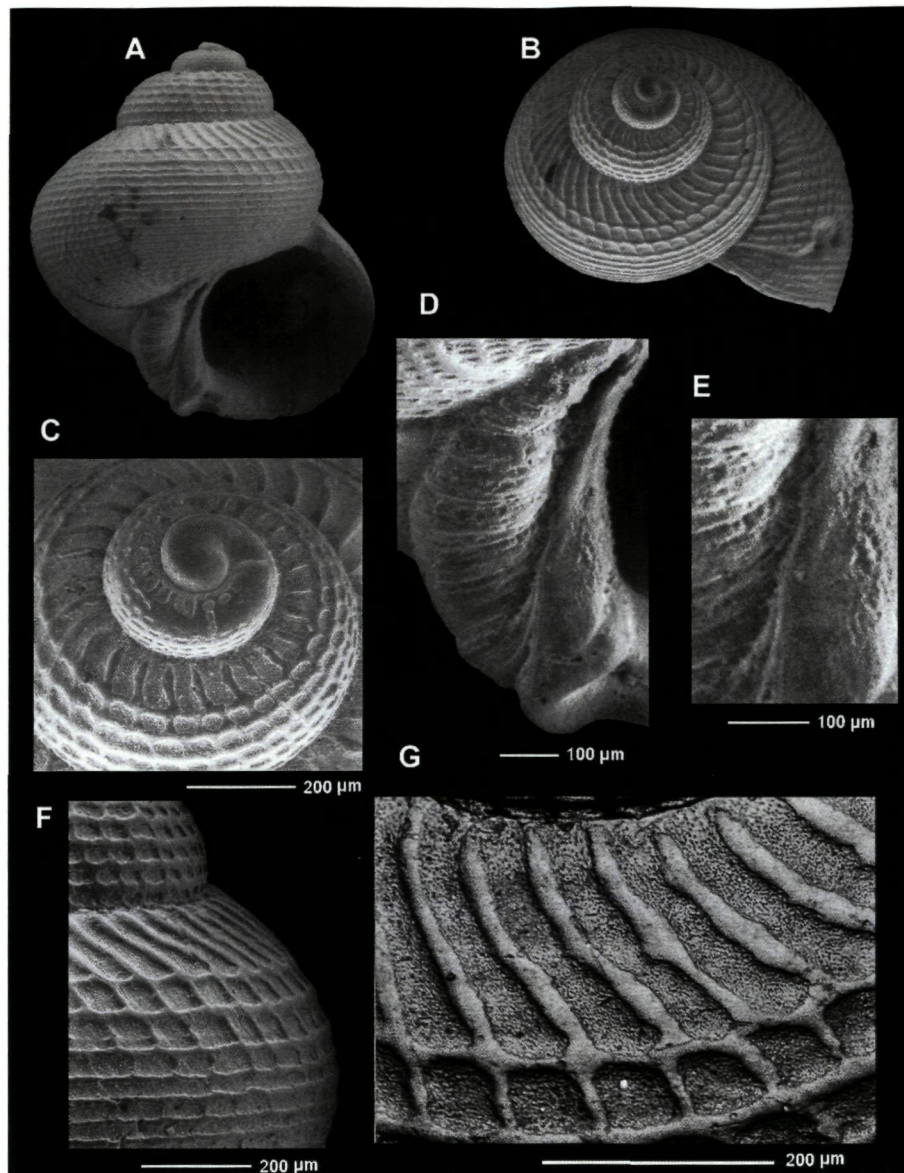
**Type material.** Holotype MNHN-IM-2000-34441 (Fig. 23A-B).

**Type locality.** Philippines, Bohol Island, Sulu Seas sill, Dipolog Bay, 8°41'N-123°18'E, 150-163 m (PANGLAO 2005: CP2380).

**Material examined.** PANGLAO 2005, stn CP2380, 1 s, Philippines, Bohol Island, Sulu Seas sill, Dipolog Bay, 8°41'N-123°18'E, 150-163 m.

**Description.** Shell of small size (<2 mm), robust, turbiniform, with a medium sized spire formed by little more than 3 whorls separated by an evident suture, not carinated.

The protoconch is formed by about 0.5 whorls, a smooth surface and has an approximate size of 240 µm in diameter.

**Figure 24A-F**

*Crosseola occlusa* n. sp. A-B. Holotype MNHN-IM-2000-34442, 1.83 mm, Solomon Is., 08°40'S-160°04'E, 396-411 m; C. Protoconch; D-E. Umbilical area and detail; F-G. Sculpture and detail.

The teleoconch is formed by little more than  $2\frac{1}{2}$  whorls and its periphery is very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow, and cover the entire surface of the teleoconch, except a broad subsutural area that goes from the beginning and finishes on the last whorl, where there are 25 more conspicuous spiral cords; the spiral cords are narrower than their interspaces.

The axial ribs begin in the suture, and in the first two whorls they cross the spiral cords forming an irregular reticle of numerous rectangular/quadrangular or oval spaces; later, the axial ribs continue but the spiral sculpture is shallower. The interspaces are covered by microgranules.

A moderately strong cord borders and delimits the umbilical area; this cord is sculptured by many fine axial riblets. The umbilicus is reduced to a narrow fissure that is extended between the periumbilical cord and the columella.

Aperture rounded, prosocline, columella narrow, fine a little reflected towards the base, where it is prominent and has an axial small depression below which looks like a siphon. Outer lip smooth; the external margin is not thickened or variciform.

Dimensions: The holotype measures 1.77 mm in height and the same in diameter ( $H/D = 1.0$ ).

**Habitat.** Bathyal species dredged at 150-163 m deep.



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

**Remarks.** *Crosseola minireticula* n. sp. is characterized by having its surface totally covered by a reticle, with the exception of the subsutural area, where there is no spiral sculpture, and the area around the periumbilical cord.

*Crosseola benedotata* n. sp. has a somewhat similar shell, but a closer look reveal several different characters: it has a smaller protoconch (200  $\mu\text{m}$  compared to the 240 in *C. minireticula*); the axial sculpture is not so abundant on the first two whorls (12 riblets compared to the about 25 in *C. minireticula*); the number of the spiral cordlets is clearly smaller; finally, the internal expansion of the columella is a little larger and the aperture is a little more irregular.

*Crosseola axialis* n. sp. from Fiji is rather similar but this species is a little smaller, the reticular sculpture is coarser (about 7 spiral cordlets from the last whorl down to the umbilicus compared to the 14 in *C. minireticula*); the periumbilical cord is wider and the prolongation of the axial ribs which cover it are less pronounced. The protoconch is a little smaller (210 compared to the 240  $\mu\text{m}$  in *C. minireticulata*).

*Crosseola similiter* (Rubio & Rolán, 2017) from Solomon Is. has a similar aspect but with fewer spiral cordlets (11 compared to the 6 on the last whorl in *C. minireticulata*). Also the subsutural band, without spiral cords, is smaller in this species.

**Etymology.** The specific name alludes to the fine, net-like sculpture of the shell, from the Latin *minus*, *a, um* "very small" and *reticulatus, a, um* "netted".

*Crosseola occlusa* n. sp.

Fig. 24A-G

**Type material.** Holotype MNHN-IM-2000-34442 (Fig. 24A-B).

**Type locality.** Solomon Is., 8°40'S-160°04'E, 396-411 m (SALOMON 1: stn DW1762).

**Material examined.** SALOMON 1, stn DW1762, 1 s, Solomon Is, 8°40'S-160°04'E, 396-411 m.

**Description.** Shell of small size (<2 mm), robust, turbiniform, with a medium sized spire formed by about 3  $\frac{3}{4}$  whorls separated by an evident suture, not carinated.

The protoconch is formed by about 0.5 whorls, a smooth surface and has an approximate size of 200  $\mu\text{m}$  in diameter.

The teleoconch has 3  $\frac{1}{4}$  whorls and its periphery is

very convex. The ornamentation is formed by spiral cords, axial ribs and microgranules. The spiral cords are narrow, and cover the entire surface of the teleoconch, except a broad subsutural area that starts at the beginning, being more evident on the last whorl; these spiral cords are narrower than their interspaces.

The axial ribs begin in the suture, and cross the spiral cords at the first two whorls forming a regular reticle of rectangular/quadrangular spaces; later, the spaces lengthen becoming progressively into narrow and shallow grooves. The interspaces are covered by microgranules.

A prominent cord borders and delimits the umbilical area; the umbilicus is reduced to a narrow fissure that extends between the periumbilical cord and the columella. The surface of this cord is completely covered by irregular axial riblets

Aperture rounded, prosocline; columella narrow, a little reflected towards the base, where it is prominent and has a small, basal, notch-like indentation. Outer lip smooth; the external margin is not thickened or variciform.

Dimensions: holotype is 1.82 mm in height and 1.62 mm in diameter (H/D = 1.12).

**Habitat.** Bathyal species dredged at 396-411 m deep.

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

**Remarks.** *Crosseola occlusa* n. sp. is characterized by an abundant spiral sculpture and a broad periumbilical cord.

*Crosseola benedotata* n. sp. and *C. axialis* n. sp. have a coarser sculpture, wider rectangles and a narrower periumbilical cord.

*Crosseola minireticula* n. sp. has almost the same number of spiral cordlets on the last whorl, but while *C. occlusa* has 6 on the previous whorl, *C. minireticula* has 4; also the periumbilical cord is narrower than that of *C. occlusa*.

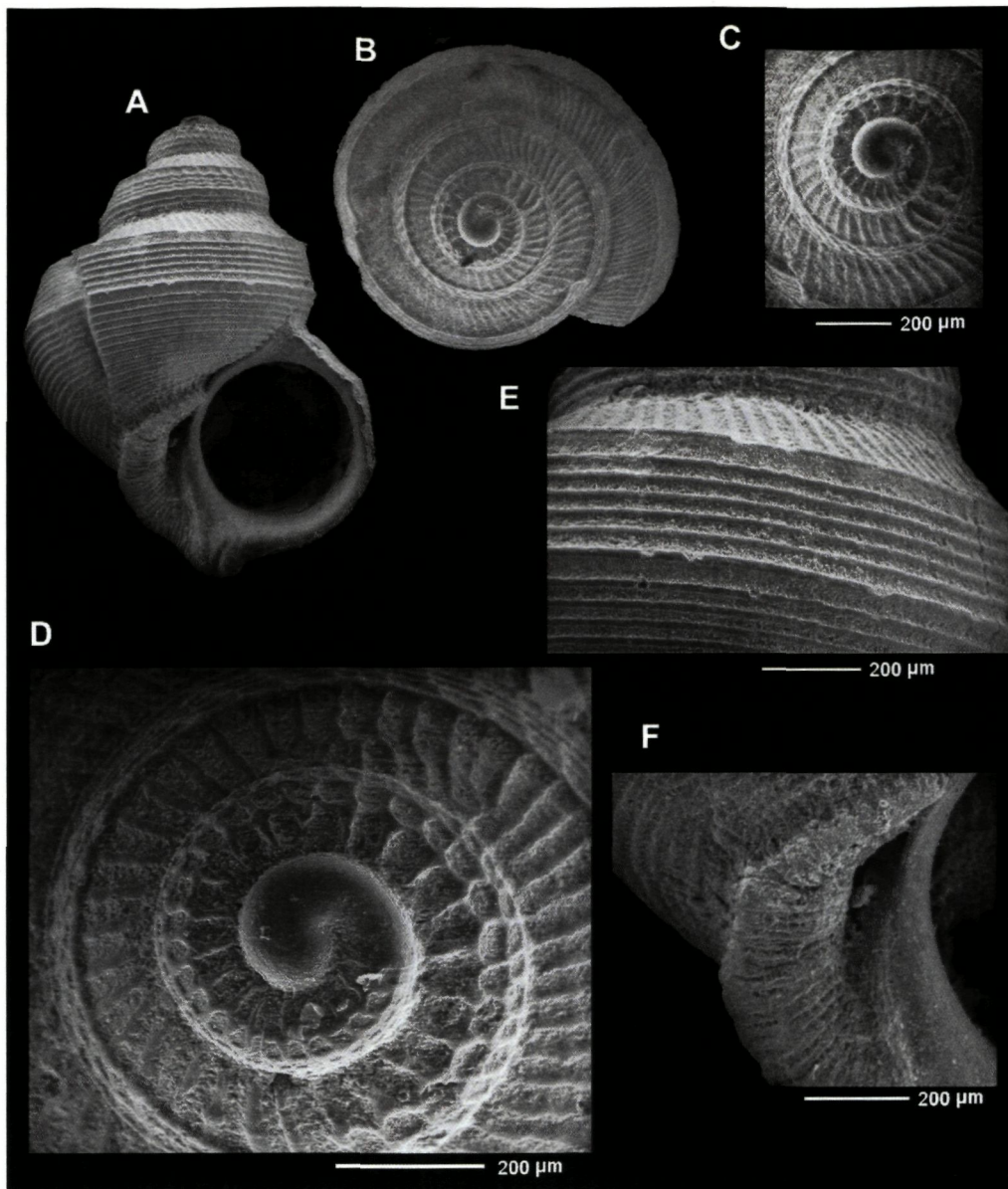
*Crosseola similiter* (Rubio & Rolán, 2017) from Solomón Is. has a similar aspect but with many more spiral cordlets and with a periumbilical cord much larger.

**Etymology.** The specific name alludes to the almost closed umbilicus due the size of the periumbilical cord.

## Addendum

When we had this paper ready for publication, we were noticed that one species which we had in the list of the new species was recently published by Poppe, Tagaro & Goto (2018) in a different genus.

In order to show this information, we present this species in this addendum:

**Figure 25A-F**

*Crosseola escondida* (Poppe, Tagaro & Goto, 2018). A-B: shell, 2.22 mm in height, Philippines, Bohol/Sulu Seas sill, 9°00.7'N-123°25.5'E, 427 m (MNHN); C-D: protoconch and first teleoconch whorl; E-F: sculpture

***Crosseola escondida***

(Poppe, Tagaro & Goto, 2018) n. comb  
Figs 25A-F, 26

*Lophocochlias escondidus* Poppe, Tagaro & Goto, 2018: 99, pl. 6, figs 1-2 (Type locality: Mactan Island, Punta Engaño, Malingin, Philippines).

**Type material.** Holotype and paratype examined by photographs. Paratype MNHN-IM-2014-6942, ex coll. G. Poppe, examined by photograph (Fig. 26).

**Material examined.** PANGLAO 2005, stn DW2364, 1 s, Philippines, Bohol/Sulu Seas sill, 9°00.7'N-123°25.5'E, 427 m.

**Description.** Original description in Poppe, Tagaro & Gotto (2018).

**Habitat.** Bathyal species dredged between 200-427 m deep.

**Distribution.** Only known from Mactan and Bohol Island, Philippines.

**Remarks.** *Lophocochlias escondidus* was described by Poppe, Tagaro & Goto (2018) and placed in the genus *Lophocochlias* Pilsbry, 1921 for its apparent similarity with *Lophocochlias procerus* Rubio & Rolán, 2015. However, *L. escondidus*, unlike its congeners, has a paucispiral protoconch, more typical of a Vetigastropod, with only 0.8 whorls, of rough surface and two spiral cords.

In addition to the characters of the protoconch, *L. escondidus* has the typical characters of the genus *Crosseola*, described by Hickman (2013): “Shell turbinate with characteristic sculpture (regular reticulate of rectangular / quadrangular spaces) at beginning of the teleoconch; unique umbilical keel; narrow pseudo-umbilicus and columella with an anterior canal at the base”.

For all these reasons, we consider that *Lophocochlias escondidus* has to leave its systematic position in *Lophocochlias* (Tornidae) and be assigned *Crosseola* (Conradiidae).



**Figure 26**

*Crosseola escondida* (Poppe, Tagaro & Goto, 2018). Paratype MNHN-IM-2014-6942, 1.50 mm in height, Philippines, Mactan Island, Punta Engaño, Malingin, 400 m.

Genus *Crossolida* n. gen.

**Remarks.** When we studied the species we had initially assigned to the genus *Crosseola*, we were surprised by the discovery of three of them which had very different characters from those of the species studied so far, although undoubtedly belonging to different species. So the idea that it could be an undescribed genus seemed logical to us. This idea was reinforced when we examined the protoconchs, which also had similar and different characters to those of *Crosseola*. We are therefore describing these species in a new genus.

**Type species:** *Crossolida robusta* n. sp.

**Diagnosis:** Shell small (the known species are smaller than 2.5 mm), very solid, with sculpture being mainly

spiral. Spire elevated, obtuse at the apex; periphery and base convex. Protoconch of between 320-380  $\mu\text{m}$  and formed by little more than one whorl, sculptured by tubercles (sometimes numerous and small, in others fewer and larger) which have tendency to be concentrated in a spiral cord on its convexity. Teleoconch formed by 2-3 whorls with a rapid increase in size and spiral sculpture. Umbilicus may be almost closed or opened but always surrounded by a very wide and prominent periumbilical cord, and sometimes by a second one smaller and closer to the umbilicus. Aperture rounded, columella curved; at the end of the spire there is a characteristic strong reinforcement of the outer lip.

**Remarks.** The species in this new genus may be separated from those of the genus *Crosseola* by its wide protoconch, always with tubercles, which are concentrate in the median line forming a cord that is never smooth (in opposition, the protoconch of *Crosseola* is always smaller than one whorl and its surface is smooth); the shell is stronger, with predominance of spiral sculpture, a separate and prominent periumbilical wide cord, and usually a second one that is smaller and closer to the umbilicus; outer lip strongly thickened.

Revising the literature we have found that a species recently described had these characters we have mentioned in the new genus. This species is *Crosseola marquesensis*, described and figured in Rubio, Rolán & Letourneux (2017: 22, fig. 3) from which the following is referred in the text: “Protoconch of 1.25 whorls with a maximum diameter of 380  $\mu\text{m}$ ; it has a strong spiral cord that begins in the nucleus and continues as a keel until near the end of the protoconch; its surface is covered by irregular microgranules”. For this reason and the other characters of the shell, this species is clearly into the new genus, and so its correct name would be *Crossolida marquesensis* (Rubio, Rolán & Letourneux, 1917).

**Etymology.** The genus name is derived from the fusion of the beginning of the name *Crosseola* and the Latin word *solidus*, a, um which means “solid, robust” making allusion to their solid aspect. *Crossolida* is a feminine name

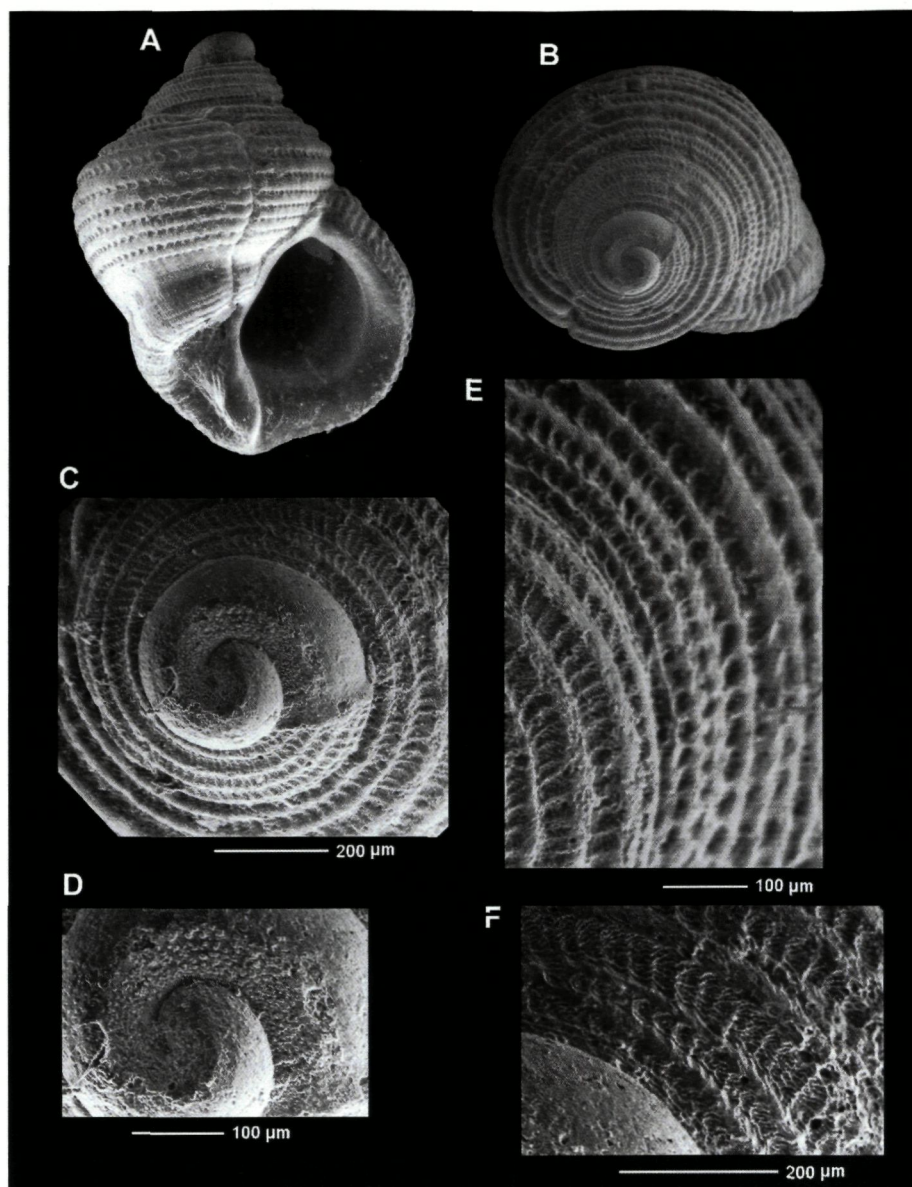
*Crossolida robusta* n. sp.

Fig. 27A-F

**Type material.** Holotype MNHN-IM-2000-34443 (Fig. 27A-B).

**Type locality.** French Polynesia, Fatu-Hiva Is., 10°29'S-138°40.2'W, 49 m (SMCB: stn D86).

**Material examined.** SMCB, stn D86, 1 s, French Polynesia, Fatu-Hiva Is., 10°29'S-138°40.2'W, 49 m.

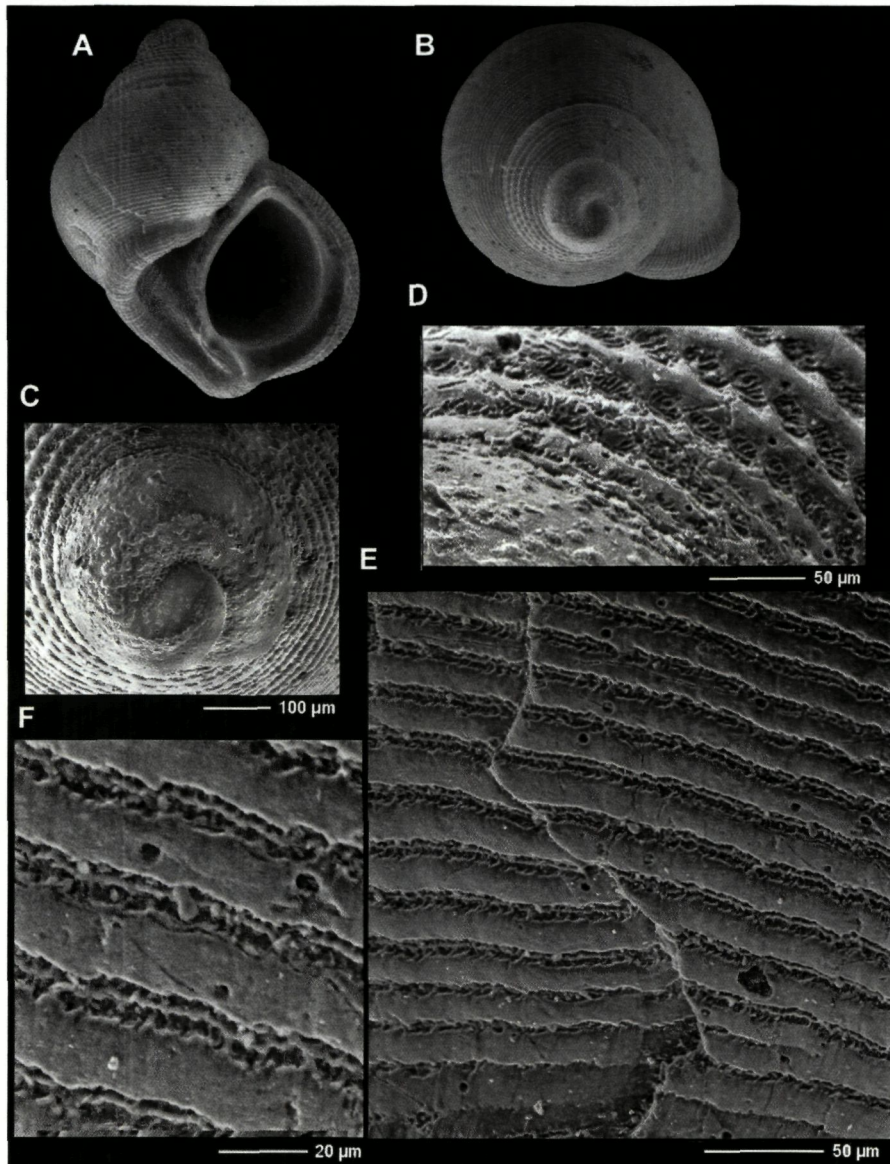
**Figure 27A-F**

*Crossolida robusta* n. sp. A-B. Holotype MNHN-IM-2000-34443, 1.78 mm in height, French Polynesia, Ile de Fatu-Hiva, 10°29'S-138°40.2'W, 49 m; C-D. Protoconch and detail; E-F. Sculpture and detail.

**Description.** Shell of small size (<2.00 mm), turbiniform, with a high spire formed by 3 whorls separated by a shallow suture, with an axial varicose outer lip and a narrow umbilicus. Protoconch formed by 1.2 whorls with a maximum diameter of 380  $\mu$ m; it has a strong spiral cord that begins in the nucleus and continues as a keel until near the end of the protoconch; its surface is covered by many irregular and very small microgranules. The teleoconch is formed by little more than 2 whorls and its periphery is rounded. The ornamentation is formed by spiral cords, very fine in the first whorl and wider in the second one; on the first whorl, the five spiral cords have wide interspaces where numerous axial

prosocline riblets are present. In the second whorl, the spiral cords are about 10, those at the middle of the whorl being wider; the interspaces are narrower than at the cords and there are numerous axial riblets and growth lines in them. Below the spiral cords there is an almost smooth depressed area and, immediately after, a wide strong spiral cord appears and finishes at the extreme of the base. This cord is placed around the umbilicus and has 6-8 fine spiral cords.

Aperture oval almost rounded, columella arched, reflected towards the umbilicus, outer lip very wide with a thickened external margin. Umbilicus narrow and deep, formed between the periumbilical cord and

**Figure 28A-F**

*Crossolida satspiralis* n. sp. A-B. Holotype MNHN-IM-2000-34444, 1.6 mm, Vanuatu, 14°52'S-167°18'E, 1550-1620 m; C. Protoconch; D-F. Sculpture and details.

the columellar lip. Outer lip fine, modified at the base and elongated by the end of the periumbilical cord. Dimensions: The holotype measures 1.78 mm in height and 1.3 in diameter ( $H/D = 1.37$ ).

**Habitat.** Circalittoral species collected at 49 m deep.

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

**Remarks.** *Crossolida robusta* n. sp. is characterized by those characters which are present on the new genus, of which it is the type species: its differentiation must be made with the congeneric species.

*Crossolida satspiralis* n. sp. has a spiral sculpture smaller and delicate, with very numerous spiral cordlets (about 40 on the last whorl down to the periumbilical cord, compared to the 12 present in *C. robusta* n. sp.); the axial sculpture can only be appreciated on the first teleoconch whorl; the umbilicus is wider while it is almost absent in *C. robusta* n. sp.; the periumbilical cord is not so wide and it is more separate from the umbilicus; the protoconch is smaller (360 µm compared to the 460 in *C. robusta* n. sp.).

*Crossolida papuaensis* n. sp. has an umbilicus but small; the periumbilical cord is a little narrower; the thickening of the outer lip is not so strong; the spiral

sculpture is finer, and consequently there are more cords (14-15 cords compared to the 12 of *C. robusta* n. sp.); the diameter of the protoconch is smaller (320  $\mu\text{m}$  compared to the 380 of *C. robusta*).

*Crossolida marquesensis*, described and figured in Rubio, Rolán & Letourneux (2017) has more spiral cords (about 21 compared to the 12 of *C. robusta* n. sp.); the axial sculpture is very evident with numerous prosocline axial riblets which cross or almost cross the spiral cords. The protoconch has a prominent apical carinae and the sculpture is formed by smaller irregular tubercles. The periumbilical cord has spiral sculpture. The microsculpture between de spiral cords is very different to any other species (see below).

**Etymology.** The specific name alludes to the robust aspect of the shell.

*Crossolida satspiralis* n. sp.

Fig. 28A-F

**Type material.** Holotype MNHN-IM-2000-34444 (Fig. 28A-B).

**Type locality.** Vanuatu, 14°52'S-167°18'E, 1550-1620 m (MUSORSTOM 8: CP1109).

**Material examined.** MUSORSTOM 8, stn CP1109, 1 s, Vanuatu, 14°52'S-167°18'E, 1550-1620 m.

**Description.** Shell small (<2 mm), trochiform, with about 3 whorls, strong, with an elevated apex. Protoconch wide formed by little more than 1 whorl, with a nucleus of about 100  $\mu\text{m}$  and a diameter of 360  $\mu\text{m}$ ; its surface is covered by large tubercles which are more dense in the middle where they are fused forming like a central elevation.

The teleoconch is formed by little more than 2 whorls with a rapid increase in diameter, convex and spirally sculptured. The first whorl has 7 spiral cords, wider than their interspaces in which there are numerous axial ribs; the second whorl is formed by about 43 very fine spiral cordlets separated by a fine groove and with very irregular and fine cordlets at each side; this part finishes on the periumbilical cord, which is wide, prominent and also sculptured with about 10 spiral cordlets. These cordlets are crossed by axial spiral riblets which penetrate into the umbilicus where there is a smaller periumbilical cord. The umbilicus is wide, limited by the columella which is curved and separated from the last whorl, and has two extensions corresponding to the points reached by the two periumbilical cords; the lower one is the most prominent. Aperture ovoid, with the upper part a little angled. Peristome smooth, a little extended in the outer lip and with an external thickening.

**Dimensions:** The holotype measures 1.58 mm in height and 1.28 mm in diameter ( $H/D = 1.23$ ).

**Habitat.** Bathyal species dredged at 1550-1620 m deep.

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

**Remarks.** *Crossolida satspiralis* n. sp. is characterized by its surface that, although looking smooth, presents a very fine spiral sculpture (about 40 cordlets on the last whorl); the umbilicus is evident; the periumbilical cord is wider and there is a second cord towards the inner part of the umbilicus.

By these characters it is easily differentiated from the other species of the genus.

**Etymology.** The specific name is formed by two Latin words: *satis*, which means "enough" and *spiralis* which is referred to the sculpture, which is very typical.

*Crossolida papuaensis* n. sp.

Fig. 29A-D

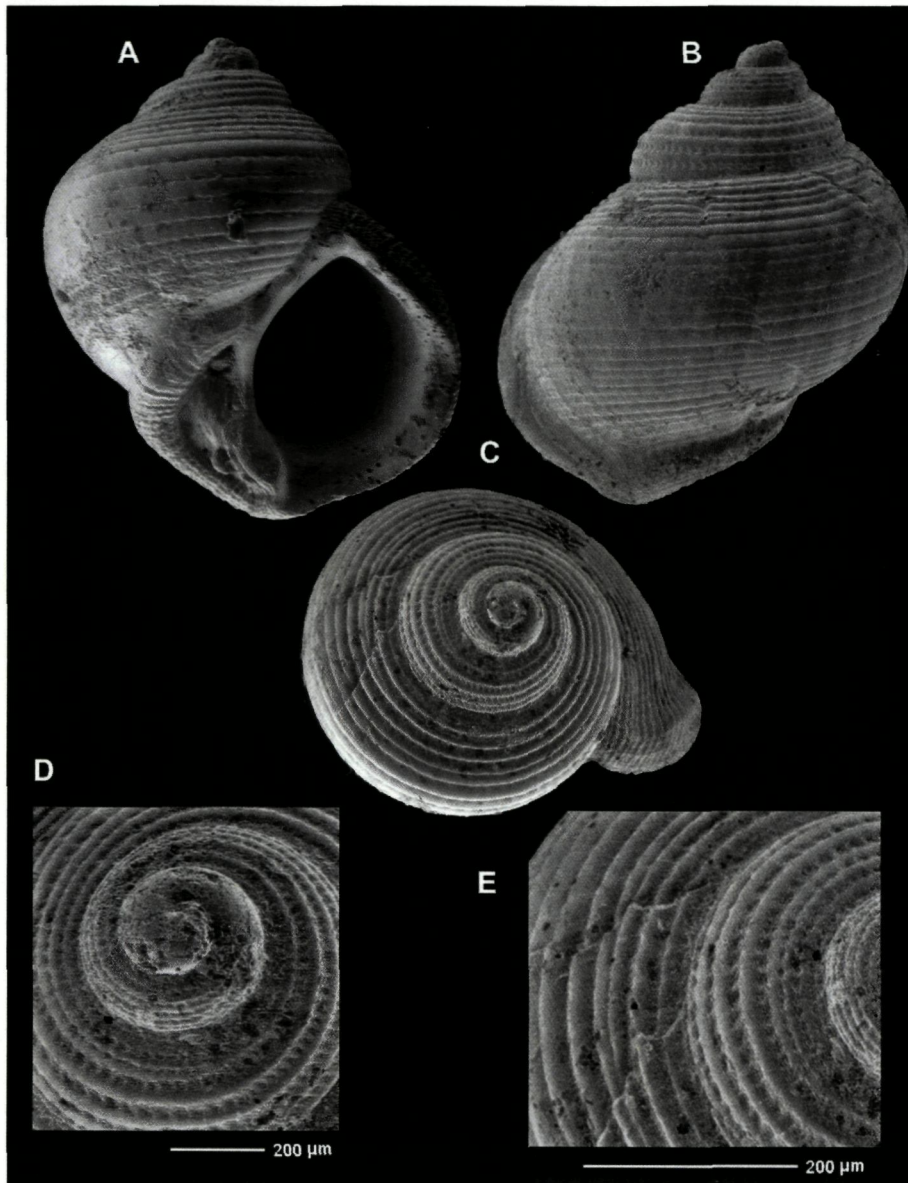
**Type material.** Holotype MNHN IM-2000-34582 (Fig. 29A-D).

**Type locality.** Papua New Guinea, Alexishafen, S Megas Islet, stn PD19, 05°05.4'S-145°48.5'E, 3-10 m (PAPUA NIUGINI: stn PD19).

**Material examined.** PAPUA NIUGINI, stn PD19, 1 s, Papua New Guinea, Alexishafen, S Megas Islet, 05°05.4'S-145°48.5'E, 3-10 m.

**Description.** Shell small (<2.5 mm), trochiform, with about 4 whorls, strong, with an elevated apex. Protoconch formed by about 1 whorl and eroded with a diameter of 320  $\mu\text{m}$ .

The teleoconch is formed by about 3 whorls with a quick increase in diameter, convex and spirally sculptured. The first whorl has 5 spiral cords, wider than their interspaces, where there are numerous axial ribs; the second whorl has 7-8 spiral cords a little wider than their interspaces being smaller in the subsutural area. Also in these interspaces is evident the presence of very numerous and small axial ribs; in the last whorl, there are about 16-17 spiral flat threads separated by narrower grooves. The five threads on the subsutural part are more obvious and narrower, with deeper grooves between them; below, the cords are wider but less marked and only in the lower part the grooves are evident again but not at the end. In the lower part of the last whorl there are no axial ribs in the interspaces, but ovoid spaces in the narrow grooves between the cords. also decreasing to the lower part. Below these spiral cords, a wide prominent and axially striated cord can be seen around the umbilical area ending at lower part of the aperture like a prominence. The umbilicus is small and limited on



**Figure 29A-E**

*Crossolida papuaensis* sp. A-C. Holotype MNHN-IM-2000-34582, 2.13 mm in height, Papua New Guinea, Alexishafen, S Megas Islet, 05°05.4'S-145°48.5'E, 3-10 m; D. Protoconch; E. Sculpture.

its lower part by a second wide cord which ends in an expansion of the columella, which is curved; the aperture is ovoid with an angle in its upper part. The outer lip finishes in a narrow peristoma but is very thickened externally.

Dimensions: The holotype measures 2.13 mm in height and 1.8 mm in diameter ( $H/D = 1.18$ ).

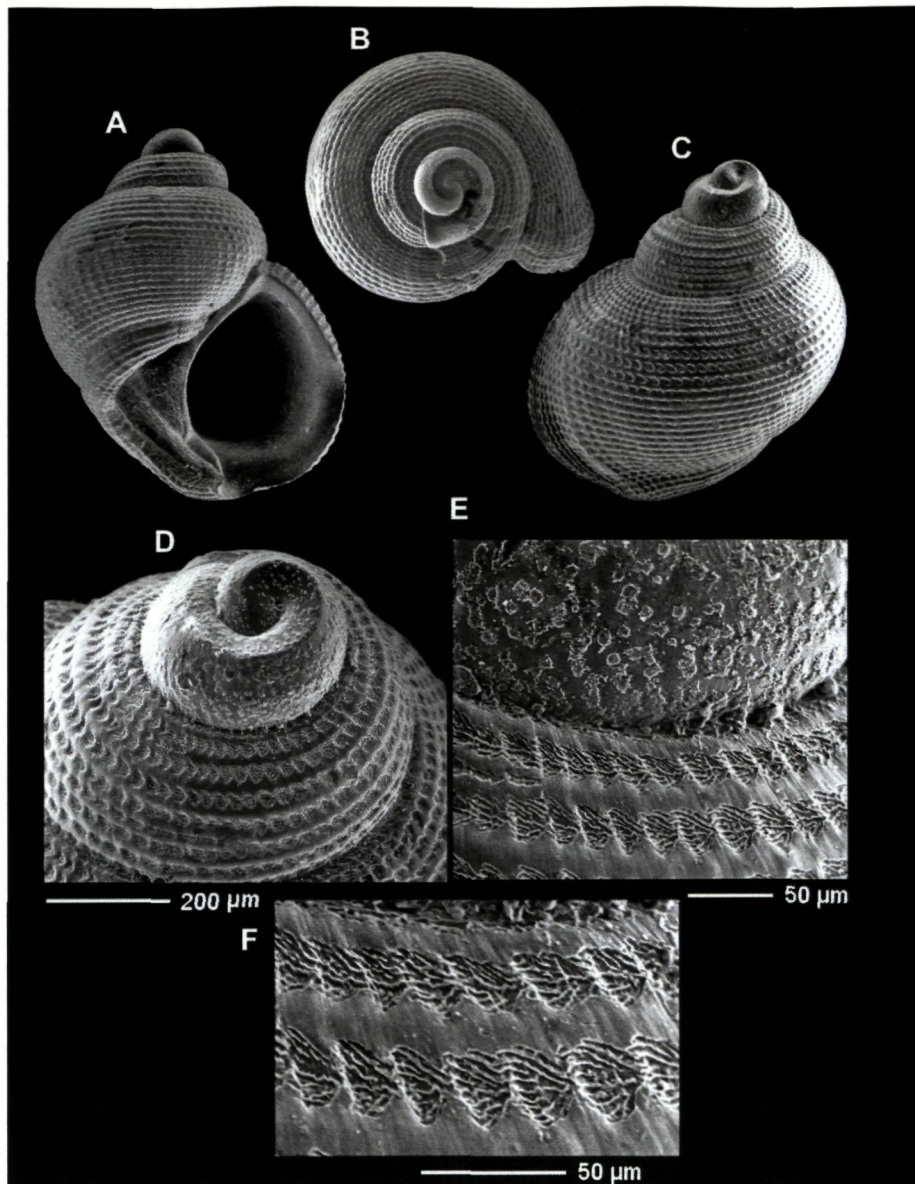
**Habitat.** Infralittoral species collected at 3-10 m deep.

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

**Remarks.** *Crossolida papuaensis* n. sp. is characterized by its spiral sculpture which is less prominent in the middle of the last whorl where axial sculpture is absent.

It may be easily differentiated from the congeneric species: *Crossolida satspiralis* n. sp. has more spiral cordlets at the last whorl (about 43 vs about 14 in *C. papuaensis*) since those are very small.

*Crossolida robusta* n. sp. has less spiral cords on the last whorl, but here the axial sculpture is evident, the protoconch is wider and with many very small tubercles.

**Figure 30A-F**

*Crossolida marquesensis* (Rubio, Rolán & Letourneux, 2017). A-C. Holotype MNHN-IM-2000-32820, 1.5 mm in height, Marquesas Islands, Ua Pou I., Haakuti Bay, Pointe Punakukua, 68 m; D. Protoconch; E. microsculpture of the protoconch; F. microsculpture of the teleoconch (figured in *Novapex* 18, fig. 3).

*Crossolida marquesensis* (Rubio, Rolán & Letourneux, 2017)  
Fig. 30A-F

*Crosseola marquesensis* Rubio, Rolán & Letourneux, 2017: 22, fig. 3.

**Type material.** Holotype MNHN-IM-2000-32820; 2 paratypes MNHN-IM-2000-32821.

**Type locality.** Marquesas Is, Ua Pou Id, Haakuti Bay, Pointe Punahukua, 68 m.

**Remarks.** *Crossolida marquesensis* can be easily separated from the other species because of its very different microsculpture and the wide umbilicus. Originally, when the other now congeneric species had not been studied yet, this species was included in the genus *Crosseola*.

But now, after the description of the new genus, *Crossolida*, we have observed that this species adjust better to this last genus.



## REMARKS AND CONCLUSIONS

In this second part of the revision of Indo-Pacific species of the family Conradiidae Golikov & Starobogatov, 1987, we have studied the genus *Crosseola* formed by 23 species, of which 3 were already known and 19 are new species. As a final addition, we have described a new genus in which one species was already known (although assigned to a different genus) and 3 more are described for the first time.

It is surprising (as it also occurred in the first part of this paper devoted to the genus *Crossea*) to see the small number of specimens collected during a large number of expeditions and hundreds of samplings carried out by the MNHN in collaboration with the IRD. As on the previous occasion, our belief is that there is a difficulty for the collection of abundant material due to the habitat in which the species of this genus live: in depth and in caves, and hidden places. This has been confirmed with the collaboration of the malacologist Sandro Gorí who put at our disposal material collected on many of his travels and in which he dived down to 30-40 m. In that material (also with isolated specimens) it was stated that on several occasions the collection was made in sediments found in underwater caves.

To resume, the depth of the material collected for the various species studied in this work was approximately within the following limits:

### Genus *Crosseola*

- Between 1-3 m: no material.
- Between 4-20 m 1 species (*C. indigaxial*).
- Between 21-100 m: 4 species (*C. bellula*, *C. catenata*, *C. serrata*, *C. uniformis*).

- Between 101-300 m: 11 species (*C. foveolata*, *C. delicata*, *C. microstriata*, *C. sexlata*, *C. latumlabrum*, *C. distorta*, *C. dentata*, *C. intercalaris*, *C. prosoclina*, *C. osgrandis*, *C. minireticula*).

- Between 301-500 m: 7 species (*C. inverta*, *C. mayottensis*, *C. anodyna*, *C. benedotata*, *C. axialis*, *C. occlusa*, *C. escondida*).

### Genus *Crossolida*

- Between 4-20 m 1 species (*C. papuaensis*)
- Between 21-100, 1 species (*C. robusta*)
- More than 1550 m, 1 species (*C. satspiralis*)

The difficulty of collecting specimens is demonstrated by the limited number of shells available for each species.

There was only one species for which 16 shells were available. For one species only 3 specimens have been obtained. For two species, two specimens/each have been studied. In the remaining species, only one shell per species was available for study.

Despite this small number of specimens there was no problem for their separation because in these genera there is an abundant amount of characters that allow separation: The diameter and the sculpture of the protoconch. The sculpture of the teleoconch whorls, the number of whorls, the periumbilical cord, the umbilicus, the size and shape, the columella, the aperture, the apertural edge, etc.

The geographical distribution of the studied material is as follows:

Seven species were collected in the Philippines, 3 in New Caledonia, 2 species were collected in: Maldives, Solomon, Fiji, Papua New Guinea, Vanuatu and French Polynesia. Only 1 species was collected in the following countries: Japan, Taiwan, South Africa, Mayotte and Mozambique.

**Table 1.** Detailed list of localities where the studied species were collected.

<i>Crosseola bellula</i> A. Adams, 1865 .....	Japan
<i>C. foveolata</i> (Barnard, 1963).....	South Africa
<i>C. inverta</i> (Hedley, 1907) .....	New Caledonia
<i>C. escondida</i> (Poppe, Tagaro & Goto, 2018).....	Philippines
<i>C. delicata</i> n. sp. ....	Taiwan
<i>C. mayottensis</i> n. sp. ....	Mayotte
<i>C. microstriata</i> n. sp.....	Fiji
<i>C. latumlabrum</i> n. sp.....	Papua New Guinea
<i>C. distorta</i> n. sp.....	Solomon
<i>C. catenata</i> n. sp. ....	Philippines
<i>C. dentata</i> n. sp. ....	Philippines
<i>C. anodyna</i> n. sp. ....	Philippines
<i>C. serrata</i> n. sp.....	Mozambique
<i>C. indigaxial</i> n. sp. ....	Maldivas
<i>C. uniformis</i> n. sp.....	Maldivas
<i>C. intercalaris</i> n. sp.....	New Caledonia
<i>C. prosoclina</i> n. sp. ....	Vanuatu
<i>C. osgrandis</i> n. sp. ....	Philippines
<i>C. sexlata</i> n. sp. ....	Philippines
<i>C. benedotata</i> n. sp. ....	New Caledonia
<i>C. axialis</i> n. sp.....	Fiji
<i>C. minireticula</i> n. sp.....	Philippines
<i>C. occlusa</i> n. sp.....	Solomon
<i>Crossolida robusta</i> n. sp. ....	French Polynesia
<i>C. satispiralis</i> n. sp. ....	Vanuatu
<i>C. papuaensis</i> n. sp. ....	Papua New Guinea
<i>C. marquesensis</i> (Rubio, Rolán & Letourneux, 2017).....	Marquesas Is.

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Also we thank to Sandro Gori, Italian malacologist, his cooperation giving material collected by himself and making donation of the holotypes to de MNHN.

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