New records of Indo-Pacific Epitoniidae (Mollusca: Gastropoda) with the description of nineteen new species.

Emilio Fabián GARCIA
115 Oakcrest Dr.
Lafayette, LA 70503, U.S.A
efg2112@louisiana.edu

KEYWORDS. Epitoniidae, Indo-Pacific.

ABSTRACT. Thirty Indo-Pacific species of Epitoniidae are recorded, with range extensions for *Acrilloscala xenicima* (Melvill & Standen, 1903), *Amaea gazeoides* Kuroda & Habe, 1950, *Cirsotrema rugosum* (Kuroda & Ito, 1961), *Cirsotrema plexis* Dall, 1925, *Claviscala solar* Nakayama, 1995, *Cylindriscala humerosa* (Schepman, 1909), and *Epitonium (Parviscala) bevdeynzerae* García, 2001. Nineteen new species are described. These include five species in the genus *Amaea*: *A. apexroseus, A. boucheti, A. diluta, A. elegantula, A lennyi*; one species in the genus *Boreoscala*: *Boreoscala ponderosa*; three species in the genus *Cirsotrema; C. (C.) excelsum, C. (Dannevigena) richeri, C. (Discoscala) herosae*; two species in the genus *Claviscala: C. pellisanserina, C. vivienneae*; one species in the genus *Cylindriscala: Cylindriscala paradoxa*; one species in the genus *Gregorioiscala*: *Gregorioiscala nevillei*; one species in the genus *Gyroscala: Gyroscala mikeleei*; four species in the genus *Epitonium: E. (Hirtoscala) deschampsi, E. (Lamelliscala) maestratii, E. (Parviscala) kastoroae, and E. (P.) juanitae;* one species in the genus *Periapta: Periapta weili.*

INTRODUCTION

Recent biodiversity exploration by Institut de Recherche pour le Développement (IRD, Nouméa) and Muséum national d'Histoire naturelle (MNHN, Paris) has brought to light many hundreds of new or little known species of molluscs and other benthic invertebrates. Much of these explorations have been focussed in the South-West Pacific, especially New Caledonia, with more scattered results from South-East Asian seas and the SW Indian Ocean. Background information on the expeditions, with narratives of the cruises, station lists, maps, etc. can be found in Forest (1981, 1986, 1989: MUSORSTOM 1, 2 and 3 cruises to the Philippines), Crosnier *et al.* (1997: KARUBAR cruise to eastern Indonesia), Richer de Forges (1990, 1991, 1993) and Richer de Forges & Chevillon (1996: New Caledonia cruises), Richer de Forges & Menou (1993: MUSORSTOM 7 cruise to Wallis and Futuna), Richer de Forges *et al.* (1996: MUSORSTOM 8 cruise to Vanuatu; 1999: MUSORSTOM 9 cruise to the Marquesas; 2000a and b: Fiji cruises), and Roux (1994: submersible cruise off New Caledonia).
As a result of these expeditions over 400 new species of molluscs have been described from the deep waters off New Caledonia alone (see, among others, Crosnier & Bouchet 1991, Bouchet 1994, Bouchet & Marshall 2001). So far, *Cirsotrema bennettorum* Garcia, 2000 is the only species of Epitoniidae that has been described based on this material, housed in MNHN. The present paper is the first of several that will contain the descriptions of new species and report new distribution records in the family Epitoniidae.

This article deals mainly with the larger-sized taxa of Epitoniidae, such as *Amaea*, *Boreoscala*, *Cirsotrema*, *Claviscala*, *Cylindriscala*, *Gyroscala*, the larger *Epitonium* species, and *Periapta*. Among the material studied, nineteen undescribed species were found. However, I have also included species that have already been described to show relative number of species in a geographical area, as well as their relative abundance.

The most commonly spread species were *Amaea gazeoides* Kuroda & Habe, 1950, *Cirsotrema (Cirsotrema) plexis* Dall, 1925, *Epitonium (Epitonium) pallasi* (Kiener, 1838), and *Epitonium (Parviscala) bevdeynzerae* García, 2001.

Bouchet & Warén (1986: 469) have pointed out that the spartan morphological variation among the groups in Epitoniidae probably reflects a low degree of specialization. This similarity of form has created a lack of concensus among epitoniid workers on the validity, or usefulness, of supraspecific taxonomy, which is almost exclusively based on shell morphology. After seeing the almost endless «variations on a theme» of the epitoniid material housed at MNHN, I have taken a rather liberal approach to the taxonomy of the genus *Epitonium*, by far the largest in number of species, realizing that some of the supraspecific taxa, as currently recognized in the family Epitoniidae, are not

necessarily natural groupings, but a practical way to deal with such a large family of similar-looking species.

Kilburn (1985: 241) suggested that although the protoconch may provide the best guide to relationships within the Epitoniidae, ecological factors may prove to influence protoconch form. Robertson (1994) took this assumption to test and studied the protoconch of *Cycloscala echinaticosta* along depth gradients from near 0 m to 52 m. His conclusion was that the protoconch of *C. echinaticosta* ranges from 330 to 790 µm in length along these gradients, and theorized that such changes may occur in other planktotrophic species. I have included pictures of protoconchs whenever possible, but have been more concerned with the number of whorls, shape, and coloration than with size.

It has been reported (Bouchet *et al.*, 2002) that in a massive collecting effort in a 295-km sq. site, off the west coast of New Caledonia, the amazing amount of 2738 species of marine mollusks were collected, of which 46 were species of Epitoniidae. The authors conclude in their study that the richness of macrofaunal species in the Indo-Pacific has been grossly underestimated. Taking the authors' thesis into consideration, it can be observed in this epitoniid study that, in spite of the hundreds of dredging hauls done by the different expeditions mentioned above, the vast majority of the specimens were collected dead. Moreover, most taxa are represented by only one or two specimens but, while some well-known species, such as *Epitonium marmoratum* (Sowerby, 1844), are represented by one specimen, *Cirsotrema herosae,* n. sp., is represented by ten. This shows the great difficulties posed in assessing the rarity of a species, its true geographical range, and the number of species that inhabit certain areas. The numerous new species described in this study, even when limited to larger, more obvious supraspecific taxa, attest to the potential for the future discovery of many more new species in Epitoniidae and other molluscan families.

All of the material cited in this report, unless otherwise stated, is housed at the Muséum national d'Histoire naturelle, Paris.

Abbreviations of repository institutions

ANSP: The Academy of Natural Sciences, Philadelphia, U.S.A.
PPPO-LIPI: Institute of Oceonology, Jakarta, Indonesia.
MNHN: Muséum national d'Histoire naturelle, Paris, France.
NM: Natal Museum, Pietermaritzburg, South Africa.
SBMNH: Santa Barbara Museum of Natural History, Santa Barbara, California, U. S. A.

SYSTEMATICS

Superfamily **EPITONIOIDEA**
Family **EPITONIIDAE** S. S. Berry, 1910
Genus *Amaea* H. Adams & A. Adams, 1853
Type species: *Scalaria magnifica* Sowerby, 1844 (S. D. de Boury 1909).

Amaea apexrosens n. sp.

Figs. 4-6

Type material. Holotype MNHN length 14.9 mm, width 4.7 mm.

Type locality. New Caledonia, Noumea area, 22° 22'S, 166°15'E, 70 m [LAGON sta. 265].

Material examined. Known only from the type material

Distribution. New Caledonia, Noumea area, at 70 m (shell only).

Description. Holotype 14.9 mm in length, fragile, narrowly acuminate (width/ length 0.31). Protoconch multispiral (Fig. 6), of about 3.25 whorls, axially striate, opaque, conical, yellow, with a brownish-red band below the suture. Teleoconch of 9 whorls; whorls convex, sculptured with numerous erect, frilly axial lamellae, 41 on penultimate whorl; lamellae creating a fenestrate pattern when crossing over suture. Varicoid costae absent. Spiral sculpture of 8 or 9 strong, well-defined cords, 11 on body whorl; cords creating a fenestrate pattern when intersecting axial lamellae; pattern reaching umbilical area. Spaces between primary sculptural elements almost smooth, shiny, somewhat iridescent under strong light. Base round, without basal disk. Umbilicus covered by slight expansion on columellar area. Aperture oval. Shell egg-white; first six teleoconch whorls reddish, changing with diminishing strength from reddish- pink on the first whorl to pale pink on the sixth.

Remarks. The single specimen is in excellent condition, except for a chipped outer lip. The slightly expanded, slightly thickened columellar area suggests the specimen may have reached maturity. This taxon can only be confused with *Amaea diluta*, n. sp., with which it shares very similar structural pattern; however, their protoconchs differ in whorl count; and *Amaea diluta* is wider, with much more convex, less numerous teleoconch whorls (8.5 whorls in an 18.9 mm specimen vs 9 whorls in a 14.9 mm specimen); with much deeper sutures; and a secondary pattern of spiral striae that shows in the interstices of the fenestrate pattern.

Etymology. - Latin *apex* (noun, meaning tip), used as a prefix; and *roseus* (adj., meaning rose-colored), referring to the coloration of the specimen.

***Amaea boucheti* n. sp.**
Figs. 13-15

Type material. Holotype MNHN length 22.1 mm, width 8.4 mm.

Type locality. Marquesas Islands, off Fatu Hiva, 10° 34' S, 138° 42' W, in 1150- 1250 m [MUSORSTOM 9, sta. DR1247].

Material examined. Known only from the type material.

Distribution. Marquesas Islands, 1150–1250 m (shell only).

Description. Holotype 22.1 mm in length, thick, acuminate (width/ length, 0.38). Protoconch missing. Teleoconch of at least 8 convex whorls. Axial sculpture of thick, round ribs, 18 on penultimate whorl; ribs almost as wide as interstices; without varices on teleoconch whorls. Spiral sculpture of one tenuous subsutural thread and 5 wide spiral bands superimposed one upon another like tiles on a roof; adapical leading edge of bands creating the appearance of spiral cords, forming beads when crossing axial ribs; abapical edge «buried» beneath the next band. Microscopic axial and spiral striae covering surface of shell, more obvious on interspaces. Basal disk conspicuously defined by a basal ridge; disk almost smooth, slightly sculptured by axial growth lines. Aperture sub-quadrate; outer lip erect, strengthened behind by a heavy varix reflecting spiral sculpture of last whorl. Umbilicus closed. Operculum unknown. Shell pale tan.

Remarks. The new species is closest to *Amaea subcancellata* Azuma, 1962, *Amaea decussata* (Lamarck, 1804), and *Amaea cerea* (Masahito, Kuroda & Habe, 1971. *Amaea boucheti* n. sp. differs from these three taxa in the remarkably different structure of its spiral pattern, as well as its prominent, almost smooth basal disk.

Etymology. Named after Dr. Philippe Bouchet, for his important and enthusiastic work in the field of malacology; and in gratitude for his invitation to visit MNHN, and the unique opportunity he has given me to study part of its Epitoniidae.

***Amaea diluta* n. sp.**
Figs. 1-3

Type material. Holotype MNHN length 18.9 mm, width 7.7 mm.

Type locality. Indonesia, off Tanimbar Islands, 09° 26'S, 131°13'E, at 223- 225 m [KARUBAR, sta. CP86].

Material examined. Only known from the type material.

Distribution. Off Tanimbar Islands, Indonesia, at 223-225 m (shell only).

Description. Holotype 18.9 mm in length, fragile, pyramidal (width/ length, 0.4). Protoconch multispiral (Fig. 3), of about 4.5 whorls, axially striate, translucent, conical, amber in color, with reddish-brown line below suture. Teleoconch of 8.5 whorls; whorls very convex, forming a pre-sutural and a sub-sutural shoulder, creating a deep suture. Whorls sculptured with numerous thin, erect, frilled axial lamellae, about 47 on penultimate whorl; lamellae forming a deep, fenestrate pattern when crossing over suture. Varicoid costae absent. Spiral sculpture of 8 or 9 strong, well-defined spiral cords, about 12 on penultimate whorl, forming a fenestrate pattern when joining axial lamellae; less conspicuous spiral striations between cords; fenestrate pattern reaching near umbilical area. Base round, without basal ridge or disk. Umbilicus closed. Aperture round. Operculum unknown. Shell off-white, with amber coloration of protoconch whorls extending with diminishing strength to the first five teleoconch whorls.

Remarks. The single specimen is in excellent condition, except for a chipped aperture due to a very thin lip. This suggests that the specimen is probably a juvenile or a sub-adult. The absence, or even insinuation, of a basal disk separates this taxon from most other *Amaea* of the Indo-Pacific. *Amaea foulisi* Kilburn, 1985, from South Africa, is much smaller, has a concave base, an ovate-quadrate aperture, 20 to 36 axial costae per whorl, and fine spiral lirae. *Amaea optima* (Melvill & Standen, 1903), from the Gulf of Oman, has more closely coiled whorls (10 whorls on a 13 mm specimen), and oblique axial lamellae.

Etymology. Latin *dilutus* (adj., meaning thin, weak), referring to the thinness of the wall.

***Amaea elegantula* n. sp.**
Figs. 20- 22

Type material. Holotype MNHN length 41.4 mm, width 9 mm.

Type locality. Loyalty Ridge, New Caledonia, 23°54'S, 169°48'E, 695-702 m [BATHUS 3, sta. DW787].

Material examined. Known only from the type material.

Distribution. Loyalty Ridge, New Caledonia, at 695-702 m, shell only.

Description. Holotype length 41.4 mm in length, light but solid, orthoconic (width/ length, 0.22). Protoconch missing. Teleoconch of 17 whorls; first three whorls convex, slightly shouldered; next eight whorls with an increasingly sharp carina at periphery of shoulder; later whorls decreasingly carinated, eventually becoming convex. Suture indented. Axial sculpture of crowded, narrow, relatively flat costae; costae slightly narrower than interspaces, about 50 on penultimate whorl; two very thin, erect, varicoid costae on penultimate and body whorls. Spiral sculpture of well-developed cords; cords of equal strength as axial costae, crossing over them, creating low nodules and a fenestrate pattern of almost perfect squares; about 8 strong spiral cords per whorl; much weaker cords near sutural area. Basal ridge present but rather inconspicuous. Basal disk sculptured with flat, subdued axial and spiral pattern. Aperture subcircular; anterior area slightly auriculate. Outer lip broken, but with vestiges of a thin, erect labral varix such as those appearing earlier. Umbilicus closed. Operculum unknown. Shell ivory, with two almost imperceptible brownish maculations on whorls.

Remarks. The symmetrically fenestrate pattern of almost flat axial costae and spiral ribs, and the elongated shell shape separate this species from other *Amaea*. It is closest to *A. gazeoides* Kuroda & Habe, 1950, but differs in having evenly-sized spiral cords, non-lamellate axial costae, and a narrower shell. *A. natalis* (Barnard, 1963), from South Africa, is much smaller, has finer axial and spiral sculpture, and fewer whorls.

Etymology. Latin *elegantulus* (adj., meaning very fine), referring to the elegant shape and sculpturing of the shell.

***Amaea gazeoides* Kuroda & Habe, 1950**
Figs. 18, 19

Material examined. **Fiji**. BORDAU 1: sta. 1465, 18°09'S, 178°39'W, 290-300 m, 1 dd. -Sta. DW1488, 19°01'S, 178°25'W, 500-516 m, 5 dd. -Sta. DW1499, 18°40'S, 178°27'W, 389-400 m, 1 dd.
MUSORSTOM 10: sta. CP1316, 17°14.8'S, 178°22'E, 478-491 m,1 lv.
Indonesia. KARUBAR: sta. DW03, 05°48'S, 132°13'E, 278-301 m, 1 dd -Sta. CP12, 05°23'S, 132°37'E, 413-436 m, 1 dd -Sta. DW28, 05°31'S, 132°54'E, 448-467 m, 2 dd -Sta. CP39, 07°47'S, 132°26'E, 466-477 m 1 dd. - Sta. DE68 08°54'S, 132°01'E, 280-296 m, 1 dd. -Sta. CP69, 08°42'S, 131°53E, 356-368 m, 2 dd. -Sta CP70, 08°41'S, 131°47'E, 410-413 m,1 dd (Fig. 18) -Sta CP77, 08°57'S, 131°27'E, 346-352 m, 1 dd.
New Caledonia. BATHUS 1: sta. CP695, 20°35'S, 164°58'E, 410-430 m, 1 d (Fig. 19).
Philippines. MUSORSTOM 2: sta. CP2, 14°01'N, 120°17'E, 184-186 m, 1 dd. - Sta. CP11, 14°00'N, 120°19'E, 194-196 m, 1 dd. -Sta. CP17, 14°00'N, 120°17'E, 174-193 m, 1 dd. -Sta. CP26, 13°49'N, 120°50'E, 299-320 m, 1 dd. -Sta. DG32, 13°40'N,120°54'E, 192, 220 m, 1 dd. -Sta. CP49, 13°38'N, 121°43'E, 416-425 m,1 dd. - Sta. CP64, 14°01'N, 120°19'E, 191-195 m, 2 dd.

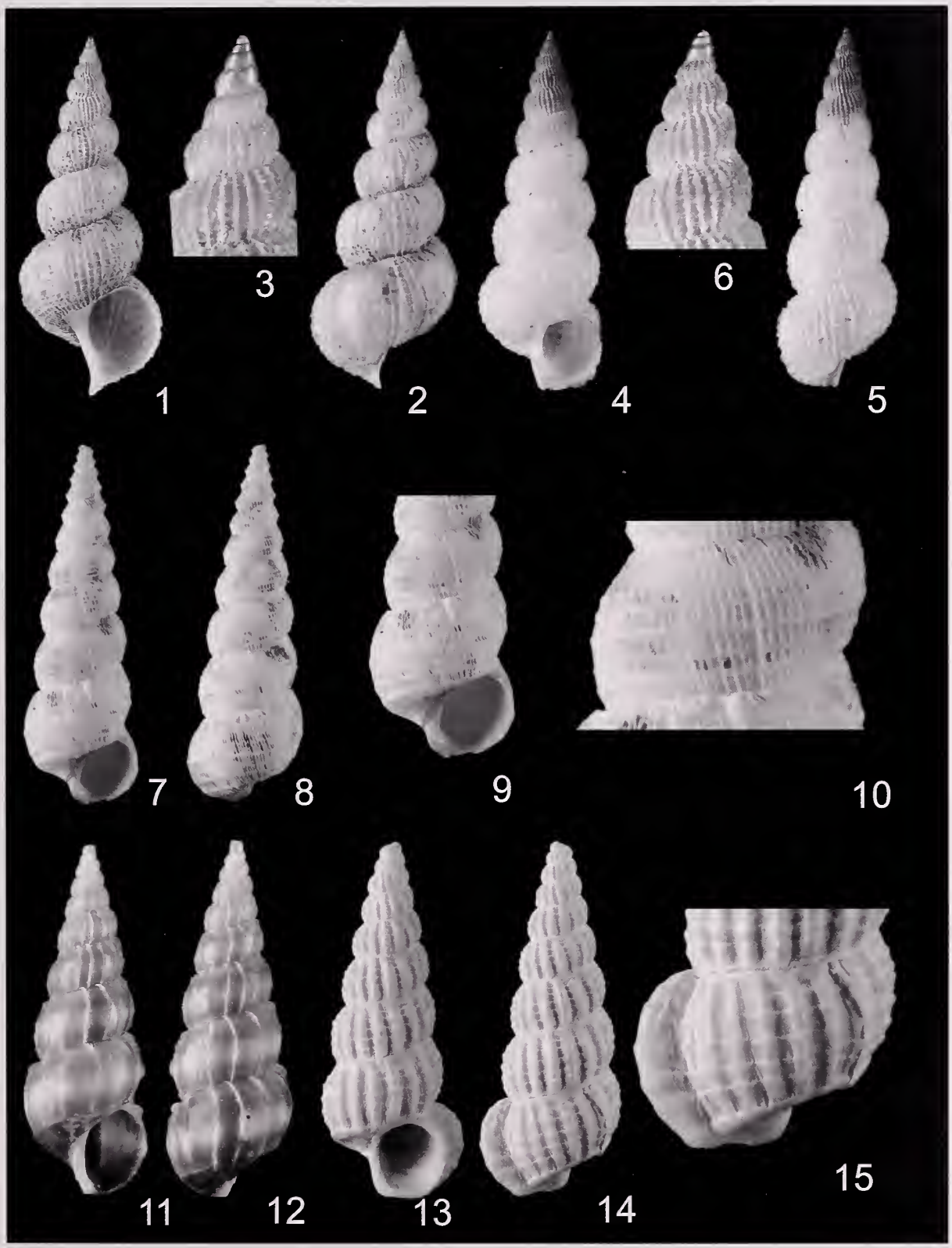
MUSORSTOM 3: sta. CP109, 14°00'N, 120°18'E, 190-198 m, 1 dd.

Distribution. Japan to Indonesia.

Remarks. This is one of the more common species found in the deep-water dredgings. Its conical, multispiral protoconch (Fig. 19) presupposes a long pelagic survival rate, which accounts for its distribution. A live collected specimen was obtained at CP1316, in 478-491 m. It was also at this station where the largest specimen, measuring 42.9 mm, was obtained. It seems that this species had previously been found only as far south as Taiwan (Weil *et al.*, 1999).

Figures 1-15

1-3: *Amaea diluta* n. sp. Indonesia, off Tanimbar Islands, 09° 26'S, 131°13'E, at 223- 225 m [KARUBAR sta. CP86]. Holotype (MNHN) length 18.9 mm, width 7.7 mm. **4-6**: *Amaea apexroseus* n. sp. New Caledonia, Noumea area, 22°22'S, 166°15'E, 70 m [LAGON sta. 265]. Holotype (NMNH) length 14.9 mm, width 4.7 mm. **7-10**: *Amaea lennyi* n. sp. Off Tanimbar Islands, Indonesia, 08°00'S, 132°58'E, 214-215 m [KARUBAR sta. CP63]. Holotype (MNHN) length 30.4 mm, width 9.5 mm. **11-12**: *Gyroscala xenicima* (Melvill & Standen, 1903). New Caledonia, Baie de Touho, 20°46.7' S, 165°13.7' E, 3-6 m [EXPEDITION MONTROUZIER. sta. 1250], length 7.7 mm. **13-15**: *Amaea boucheti* n. sp. Marquesas Islands, off Fatu Hiva, 10° 34' S, 138° 42' W, in 1150- 1250 m [MUSORSTOM 9, sta. DR1247]. Holotype (MNHN) length 22.1 mm, width 8.4 mm.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

***Amaea lennyi* n. sp**
Figs. 7-10

Type material. Holotype MNHN length 30.4 mm, width 9.5 mm.

Type locality. Off Tanimbar Islands, Indonesia, 08°00'S, 132°58'E, 214-215 m [KARUBAR, sta. CP63].

Material examined. Known only from the type material.

Distribution. Of Tanimbar Islands, Indonesia, in 214-215 m (shell only).

Description. Holotype 30.4 mm in length; thin, but solid, acuminate (width/ length 0.31). Protoconch missing. Teleoconch of at least 10 whorls; first 7 whorls diminishingly carinated, last 3 convex. Axial sculpture of numerous low, erect, scalloped lamellae (Fig.10); about 90 on penultimate whorl; slightly peaked at suture, more so on the last two whorls, creating a narrow, deep channel at suture. Spiral structure dominated by one central cord on first seven whorls, creating a carina of diminishing strength. Secondary spiral cords present on either side of central cord, unevenly increasing in strength, some almost equaling central cord in strength on last two whorls; seven such cords on last whorl; many secondary spiral threads covering the whorls. Basal disk modest (Fig. 9), delineated by most abapical spiral cord; structure on basal disk dominated by closely packed axial lamellae, lamellae reaching umbilical area; secondary spiral threads inconspicuously present. Umbilicus closed. Aperture ovate. Outer lip simple, moderately thickened. Operculum unknown. Shell off-white.

Remarks. The new species may be confused with *Amaea thielei* de Boury, 1913, *Amaea gazeoides* Kuroda & Habe, 1950 (Fig.18), and *A. splendida* (de Boury, 1913 (Fig.16). All three of these taxa have a much smaller number of axial costae. Moreover, *A. thielei* lacks carinated whorls, has more pronounced axial lamellae, and lacks the channeled suture of *Amaea lennyi* n. sp.; *A. gazeoides* has a flatter, more conspicuous basal disk, and coarser and less numerous secondary spiral threads; *A. splendida* lacks the carinated whorls, has higher, more frilly axial lamellae, almost evenly-sized spiral cords in all whorls, different secondary spiral structure, and a more conspicuous basal disk.

Etymology. Named for Mr. Leonard (Lenny) Brown, co-author of *The Wentletrap Book*, for his efforts in putting together that publication, and for his love of Epitoniidae.

***Amaea splendida* (de Boury, 1913)**
Figs. 16, 17

Material examined. **Coral Sea**: CORAIL 2: sta. DW20, 20°39'S, 161°01'E, 88 m, 1 dd.
New Caledonia. LAGON: sta. 373, 22°28'S, 167°11'E, 52-57 m, 1 dd. - Sta. 374, 22°30'S, 167°09'E, 70-72 m, 1 dd.
Philippines. MUSORSTOM 2: sta. CP6, 13°56'N, 120°21'E, 136-152 m, 1 dd.
MUSORSTOM 1: sta. CP24, 14°01'N, 120°18'E, 189-209 m, 1 dd.
Vanuatu. MUSORSTOM 8: sta. DW976, 19°25'S, 169°27'E, 160-182 m, 7 dd (Fig. 16, 25 mm).

Distribution. Japan to the Coral Sea, in the SW Pacific.

Remarks. This species has a brownish, conical, multispiral protoconch (Fig. 17). Although Weil, Brown and Neville (1999) list it as far south as Australia, Wilson (1993) does not list it as part of the Australian fauna. I have included this taxon to show the relative number of species in a geographical area, as well as their relative abundance within the material studied.

Genus ***Boreoscala*** Kobelt, 1902
Type species: *Scalaria greenlandica* Perry, 1811 (OD)

***Boreoscala ponderosa* n. sp.**
Figs. 23-25

Type material. Holotype MNHN length 51.1 mm, width 19.6 mm; paratype MNHN length 48.5 mm, width 19.0 mm.

Type locality. Loyalty Islands, Lifou, Baie du Santal, 20°37'S, 166° 58' E, 538 m, [CALSUB 1989, pl. 15]

Material examined. **New Caledonia**. CALSUB 1989, pl. 15, 20°37'S, 166° 58' E, in 538 m. 1 dd (holotype).
Loyalty Ridge. MUSORSTOM 6: sta. CP466, 21°05'S, 167°32'E, 540 m, 1 dd (paratype).

Distribution. Southwest Pacific: Loyalty Ridge, 538-540 m (shell only).

Description. Holotype 51.1 mm in length, shell strong, acuminate (width/ length, 0.38). Protoconch missing. Teleoconch of at least 10 slightly convex whorls . Axial sculpture of heavy, moderately erect, reflected costae; costae narrower than interstices, smooth, peaked; peaks creating an impression of shoulders on whorls; 16 costae on penultimate whorl; some costae becoming varices, last two whorls with a varix after every fourth costa. Spiral sculpture of 8 spiral cords; most adapical cord weakest, positioned just before periphery of whorl; cords increasing in strength abapically. Body whorl with well-defined

basal cord starting at adapical end of aperture. Aperture slightly ovate; columellar area narrow adapically, later becoming thicker, creating a lobe at anterior end; outer lip thickened by a varix. Operculum unknown. Shell white.
Paratype very similar to holotype, including the presence of four costae between the labral varix and the next two adapertural varices.

Remarks. *Boreoscala* has been considered a subgenus of *Epitonium* by Clench & Turner (1952: 319) and others, a subgenus of *Gyroscala* by Kilburn (1985), and a full genus by Weil, Brown and Neville (1999). The flattened, coarse spiral cords, and the basal ridge separate this taxon from *Epitonium* and its subgenera. Although closer to *Gyroscala* because of the presence of a basal ridge, *Boreoscala* has well-defined flattened spiral cords, wide axial costae, and rather dull surface. Moreover, *Boreoscala* lacks color, and is basically a cold water taxon, inhabiting deeper water in temperate areas. *Gyroscala* usually has some color in its shell, has a rather glossy shell, and inhabits shallow water in tropical and temperate areas.
Boreoscala ponderosa, n. sp., is closest to an undescribed New Zealand species that has been collected in deep water in Papanui Canyon, Dunedin, South Island, and which has been compared to *Boreoscala zelebori* (Weil, Brown and Neville, 1999:129). However, this species attains a smaller size, and has less numerous axial costae. Only *Boreoscala greenlandica* (Perry, 1811), from the northern Atlantic and Pacific, reaches the size of *B. ponderosa*, but the former is narrower (width/ length, 0.36), has less numerous axial costae, and usually has flat, non-peaked axial costae. Clench & Turner (1952: 322) have described a form of *B. greenlandica* (*B. g. lovenii*) from Browns Bank, off Cape Sable, Nova Scotia, Canada, which has peaked, reflected costae.

Etymology. Latin, *ponderosus* (adj., meaning weighty), with reference to the heavy shell.

Genus ***Cirsotrema*** Mörch, 1852
Type species: *Scalaria varicosa* Lamarck, 1812 (OD)

Subgenus ***Cirsotrema*** **s.s.**

Cirsotrema (Cirsotrema) excelsum **n. sp.**
Figs. 32-34

Type material. Holotype MNHN length 18.4 mm, width 7.2 mm.

Type locality. Indonesia, Kai Islands, 05°17'S, 132°41'E, 212- 221 m [KARUBAR, sta. DW15].

Material examined. Known only from the type material.

Distribution. Kai Islands, Indonesia, 212-221 m (shell only).

Description. Holotype 18.4 mm in length, solid, turreted (width / length, 0.38). Protoconch missing. Teleoconch of 11 whorls, whorls abapically convex, adapically shouldered. Axial sculpture of erect costae, formed by a series of packed lamellae, becoming flutted, expanded, and abaperturally reflected at outer margin; narrower than interspaces, peaked adapically, creating a concave shoulder; 16 costae on penultimate whorl. Interspaces shiny, almost smooth, showing a few, low, inconspicuous spiral cords. Basal ridge positioned close to umbilical area; axial costae crossing ridge, creating a fenestrated pattern. Aperture subcircular, almost surrounded by a heavy labral costa. Umbilicus closed. Operculum unknown. Shell white.

Remarks. The turreted shell with strongly peaked costae, and the lack of a basal disk can only be confused with *Cirsotrema rugosum* (Kuroda & Ito, 1961) (Fig. 31). The new taxon can be separated from the latter by its much smaller size; more intricate structure of axial costae, which in *C. rugosum* is composed of a single lamella; almost smooth interspaces; and near-umbilical position of basal ridge.

Etymology. Latin *excelsus* (adj., meaning lofty, distinguished), referring to the magnificent shape and sculpture of the species.

Cirsotrema (Cirsotrema) plexis **Dall, 1925**
Fig. 66

Material examined. MUSORSTOM 1: sta. 61, 14°01'N, 120°17.5E, 184-202 m, 1 dd (Fig. 66, 43.4 mm in length).
Fiji. BORDAU 1: sta. DW 1488, 19°01'S, 178°25'W, 500-516 m, 2 dd.
Indonesia. KARUBAR: sta. DW18, 05°18'S, 133°01'E, 205-212 m, 3 dd. -Sta. DW44, 07°52'S, 132°48'E, 291-295 m, 2 dd - Sta. DW49, 08°00'S, 132°59'E, 206-210 m, 1 dd.
Loyalty Ridge. SMIB 5: sta. DW87, 22°19'S, 168°41'E, 370 m, 1 dd.
New Caledonia. BATHUS 2: sta. DW720, 22°52'S, 167°16'E, 530-541 m, 1 dd. -Sta. DW721, 22°54'S, 167°17'E, 525-547 m, 5 dd.
BATHUS 4: sta. DW918, 18°49'S, 163°16'E, 613-647 m, 4 dd.
MUSORSTOM 4: sta CP158, 18°49'S, 163°15'E, 625 m, 1 dd.
SMIB 3: sta. DW29, 22°47'S, 167°12'E, 405 m, 1 dd.
SMIB 8: sta. DW170-172, 23°41'S, 168°00'E-168°01'E, 230-290 m 1 dd. -Sta. DW190, 23°18'S, 168°05'E, 305-310 m, 3 dd.
Wallis & Futuna, SW Pacific. MUSORSTOM 7: sta. DW626, 11°54'S, 179°32'W, 597-600 m,1 dd.

Tonga. BORDAU 2: sta. CP1545, 21°17'S, 175°17'W, 444-447 m, 2 dd.

Distribution. Japan to Indonesia.

Remarks. This species is among the most common of the dredged material examined. The largest specimen (Fig. 66) measures 43.4 mm. It was dredged from 184-647 m, shells only. It was known only from Japanese and Philippine waters until this new material came to light.

Cirsotrema (Cirsotrema) rugosum
(Kuroda & Ito, 1961)
Fig. 31

Material examined. **Tonga**: BORDAU 2, sta. CH1596, 19°06'S, 174°18'W, 371-437 m,1 lv.

Distribution. Philippines and Tonga.

Remarks. Specimens of *Cirsotrema rugosum* have been regularly collected in deep water in the Philippines for many years. The collection of a live, adult specimen in Tonga greatly expands the geographical range of this species. It measures 56.6 mm in length.

Subgenus ***Dannevigena*** Iredale, 1936
Type species: *Dannevigena martyr* Iredale, 1936 (OD)

***Cirsotrema (Dannevigena) richeri* n. sp.**
Figs. 35-37

Type material. Holotype MNHN length 32.0 mm, width 11.4 mm; 5 paratypes MNHN; 1 paratype SBMNH 348102.

Type locality. New Caledonia, off southern coast, 22° 52'S, 167°16'E, 530-541 m [BATHUS 2, sta. DW720].

Material examined. **New Caledonia**. BATHUS 2: sta. DW720, 22° 52'S, 167°16'E, 530-541 m, 1 lv (holotype, Figs. 35-37), 2 dd (1 paratype, MNHN).- Sta. DW721, 22°54'S, 167°17'E, 1 dd (paratype, SBMNH).
SMIB 2: sta. DW12, 22°53'S, 167°14'E, 445-460 m, 1 dd (paratype, MNHN).
SMIB 3: sta. DW21, 22°59'S, 167°19'E, 525 m,1 lv (paratype, MNHN).- Sta. DW22, 23°03'S, 167°19'E, 503 m, 1 lv (paratype, MNHN).
SMIB 8: sta. DW197-199, 22°51'S, 167°12'E, 408-436 m, 3 dd (1 paratype, MNHN)

Distribution. New Caledonia, alive at 525-541 m.

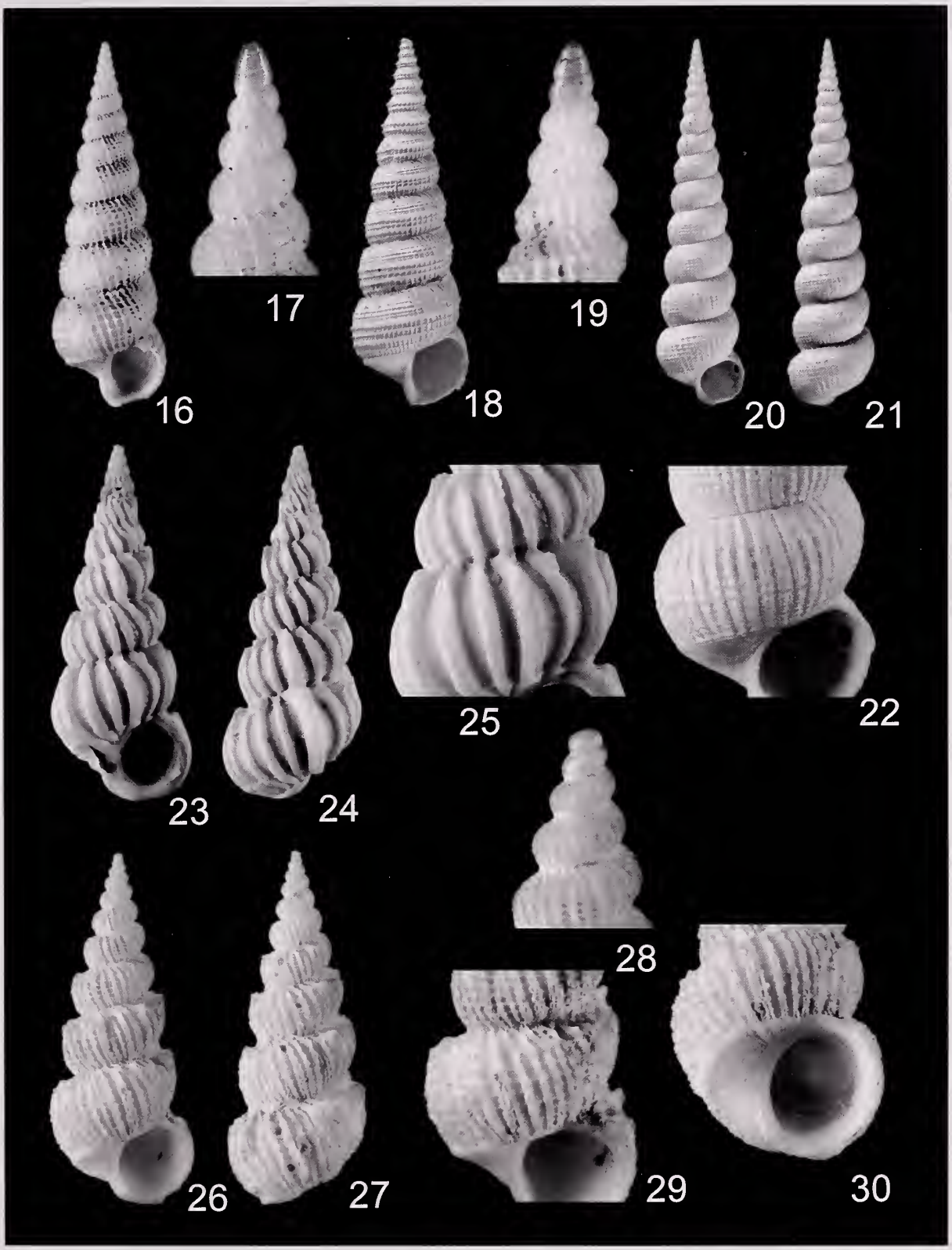
Description. Holotype 32.0 mm in length; solid, turreted (width/ length, 0.36). Protoconch missing. Telcoconch of 10.5 whorls; whorls almost flat, shouldered. Axial costae thick, of varying width, most narrower than interspaces , others wider, somewhat varicoid; costae formed by a series of axial lamellae packed together, creating frilled, reflected costae, peaked adapically; 20 on penultimate whorl; last two with one varix each. Spiral sculpture of two or three low spiral cords; interspaces, including surface of spiral cords, crowded with spiral thread, thread partially going up axial costae abaperturally. Basal disk absent, a residual basal ridge barely insinuated by a sharp basal flattening of body whorl. Umbilicus closed. Aperture subcircular, with an erect lip all around, creating a false umbilicus; outer lip buttressed behind by a thick, double varix. Operculum black. Shell off-white.

Adult paratypes are very similar in shell characters to holotype. All have at least one varix on last whorl, usually placed about four costae behind the labral varix, very near the dorsum. Not all specimens show varices on penultimate whorl. Juveniles and presumed subadults lack varices. Paratypes lack a false umbilicus.

Remarks. The subgenus *Dannevigena* is taxonomically similar to *Cirsotrema* s.s. in the peculiar lamellar structure of the axial costae. Taking into consideration that *Cirsotrema*, unlike other supraspecific taxa, seems to be a natural group within the family, I have chosen to treat *Dannevigena* as a subgenus of *Cirsotrema*, rather than as a full genus, agreeing with Weil, Brown & Neville (1999) in their assesment.

Figures 16-30

16-17: *Amaea splendida* (de Boury, 1913). Vanuatu, 19°25'S, 169°27'E, 70-72 m [MUSORSTOM 8: sta. DW976], length 25 mm. **18-19**: *Amaea gazeoides* Kuroda & Habe, 1950: Fig. 18 – Indonesia, 08°41'S, 131°47'E, 410-413 m, [KARUBAR sta. CP70], length 39.1 mm. **19**: Protoconch. New Caledonia, 20°35'S, 164°58'E, 410-430 m, [BATHUS 1 sta. CP695]. **20-22**: *Amaea elegantula* n. sp. Loyalty Ridge, New Caledonia, 23°54'S, 169°48' E, 695-702 m [BATHUS 3, sta. DW787], width 9 mm. **23-25**: *Boreoscala ponderosa* n. sp. - New Caledonia, west Lifou, south Baie Santal, 20°37'S, 166° 51' E, in 538 m [CALSUB 1989]. Holotype (MNHN) length 51.1 mm, width 19.6 mm. **26-30**: *Cirsotrema (Discoscala) herosae* n. sp. Tonga, NW Tongatapu, 21°02'S, 175°19'W, 351-356 m [BORDAU 2 sta. DW1567]. Holotype (MNHN) length 19.1 mm, width 7.4 mm. **28**: Protoconch **29**: Detail of axial costae **30**: Basal disk.


16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

Cirsotrema (Dannevigena) richeri, n. sp., is similar to *C. (D.) martyr* (Iredale, 1936). It differs mainly in the more uneven construction of the axial costae, particularly in later whorls; the clearly defined spiral threads found in the axial interspaces; the presence of varices; and the structure of the base of the last whorl, which in *C. (D) martyr* becomes a basal disk formed by welding of axial costae below periphery of body whorl.

Etymology. Named for Dr Bertrand Richer de Forges (Institut de Recherche pour le Développement, Nouméa), the indefatigable senior scientist of most of the exploration cruises in the South-West Pacific treated in this study.

Subgenus ***Discoscala*** Sacco 1890
Type species: *Scala scaberrima* Michelotti, 1840. (OD)

***Cirsotrema (Discoscala) herosae* n. sp.**
Figs. 26-30

Type material. Holotype MNHN length 19.1 mm, width 7.4 mm, 1 paratype SBMNH 348103, 1 paratype MNHN.

Type locality. Tonga, NW Tongatapu, 21°02'S, 175°19'W, 351-356 m [BORDAU 2 sta. DW1567].

Material examined. **Fiji**. MUSORSTOM 10: sta. CP1349, 17°31.1'S, 178°38.8'E, 244-252 m, 1 dd.- Sta DW1381, 18°17.8'S, 177°54.4'E, 275-430 m, 1 dd -Sta. CP1390, 18°18.6'S, 178°05'E, 234-361 m, 2 dd.
New Caledonia. BATHUS 1: sta. DW706, 21°42'S, 166°34'E, 247-252 m, 1 dd.
BATHUS 2: sta DW739, 22°35'S, 166°27'E, 465-525 m, 1 dd (paratype MNHN).- Sta DW757, 22°20'S, 166°13'E, 330 m, 2 dd.
Tonga (Tongatapu). BORDAU 2: sta. CP1510, 21°05'S, 175°23'W, 461-497 m, 1 dd. – Sta. DW1567, 21°02'S, 175°19'W, 351-356 m, 1 dd (holotype, Figs, 26-27). - Sta. DW1634, 21°45'S, 175°20'W, 321-322 m, 1 dd (paratype SBMNH).

Distribution. SW Pacific; Fiji, Tonga and New Caledonia, 234-525 m (shell only).

Description. Holotype 19.1 mm in length, thin but solid, turreted (width/ length, 0.39). Protoconch somewhat eroded, of about 1.25 white, bulbous whorls (Fig. 28). Teleoconch of about 9.5 whorls; whorls convex abapically, adapically shouldered. Axial sculpture of laminated costae, usually composed of two or three welded lamellae, ruffled at outer edge (Fig. 29), slightly reflected at both edges; about 31 on penultimate whorl; peaked abapically, creating a slightly concave shoulder. Spiral sculpture of 8 or 9 rather thick cords, with randomly placed secondary threads also present; spiral sculpture partially going up either side of costae. Basal disk strong (Fig. 30), well delineated by a heavy ridge; sculptured with thin, paired axial cords and crowded, undulating spiral threads. Umbilicus closed. Aperture subcircular. Lip simple. Columella short, arched. Operculum unknown. Shell white.

Paratypes are similar to holotype. Largest specimen measures 20.1 mm. Although all specimens have a somewhat immature look to them because of their rather thin aperture, specimens from Fiji, New Caledonia, and Tonga look alike, which seems to indicate that this feature is characteristic of adult specimens.

Remarks. This species is similar to those *Cirsotrema* species with ruffled varices. It is most similar to *C. fimbriatulum* (Masahito, Kuroda & Habe, 1971) in general shape and the structure of the axial costae. However, the latter species lacks the basal disk of *C. herosae*. *Cirsotrema (Discoscala) edgari* (de Boury, 1912) does have a prominent disk, but its structure is composed of erect axial lamellae and less conspicuous spiral threads. Moreover, *C. edgari* has simple, thin axial lamellae instead of the compound, ruffled costae of the new taxon. *C. fimbriatulum* and C. *edgari* are much larger in size. Its paucispiral protoconch indicates a restricted geographical range.

Etymology. Named for Mrs. Virginie Héros, of the National Museum of Natural History, Paris, France, in appreciation for making so many malacologists from all over the world, including myself, feeling welcome while working in MNHN.

Genus ***Claviscala*** de Boury, 1909
Type species: *Scalaria richardi* Dautzenberg & de Boury, 1897 (OD)

***Claviscala pellisanserina* n. sp.**
Figs. 38-39

Type material. Holotype MNHN length 36.5 mm, width 7.8 mm; 2 paratypes MNHN; 1 paratype SBMNH 348101.

Type locality. Philippines, 10°01'N, 120°19'E, 196-204 m [MUSORSTOM 3, sta. CP99].

Material examined. Philippines. MUSORSTOM 2: sta. CP70, 14°00'N, 120°18'E, 191 m, 1 dd (paratype; MNHN). – Sta. CP72, 14°00'N, 120°18'E, 182-197 m, 1 dd (paratype; SBMNH).
MUSORSTOM 3: sta. CP99, 14°01'N, 120°19'E, 196-204 m, 1 dd (holotype, Figs. 38-39).– Sta. CP112, 14°00'N, 120°38'E, 187-199 m, 1 dd (paratype).

Distribution. Philippine Islands, 182-204 m (shell only).

Description. Holotype 36.5 mm in length, light but solid, orthoconic (width / length 0.21). Teleoconch of 16.5 whorls; whorls evenly convex. Axial sculpture of smooth, round costae on first 5 whorls; costae becoming progressively nodulose on later whorls; costae as wide as interspaces, about 30 on penultimate whorl. Spiral sculpture beginning on sixth whorl, increasing in intensity on later whorls, creating conspicuous nodules as they cross axial costae, giving surface of shell a fenestrate pattern. Top of axial costae and spiral cords glossy; interspaces opaque. Body whorl with conspicuous, almost smooth basal disk, delineated adapically by a slightly undulating basal ridge, ridge showing on earlier whorls as a pre-sutural cord. Aperture ovate-quadrate; outer lip simple. Operculum unknown. First four whorls white, increasing in pigmentation to a solid tan color; lighter inside aperture.

Largest paratype (sta. CP112, 47.1 mm in length) shows a low, round varix on 17th whorl; second largest (sta. CP70, 46.7 mm in length) also shows same type of varix on 15th whorl.

Remarks. Although the paratype from sta. CP70 shows a varix on fifteenth whorl, it has about two more teleoconch whorls missing than paratype with varix on seventeenth; therefore, it seems that the production of a varix on, or near, the seventeenth whorl is characteristic for the species. Its heavily nodulose sculpture differentiates it from other *Claviscala*. *C. nodulosa* Nakayama, 2000, is smaller, has a lesser number of whorls and axial costae; has weaker spiral sculpture and nodules; and a different sculpture on basal disk.

Etymology. Latin *pellis* and *anser* (nouns, meaning skin and goose, respectively), referring to the granular appearance of the surface of the shell: « goose bumps,» or «goose skin.»

***Claviscala solar* Nakayama, 1995**
Fig. 49

Material examined. **Fiji**. MUSORSTOM 10: sta. CP1325, 17°16.4'S, 177°49.8'E, 282-322 m, 1 dd.

Distribution. Japan and Fiji.

Remarks. This taxon has been recorded only from Japanese waters. The Fijian specimen indicates a much wider geographical range. It measures 45 mm in length. Dr. Philippe Bouchet (pers. comm.) suggests that perhaps this species may belong in *Gregorioiscala*.

***Claviscala vivienneae* n. sp.**
Figs. 40-41

Type material. Holotype MNHN length 40.3 mm, width 10.2 mm; 1 paratype (PPPO-LIPI).
Type locality. Tanimbar Islands, Indonesia, 08°03'S, 131°48'E, 1244-1266 m [KARUBAR, sta. CP52].

Material examined. Known only from the type material.

Distribution. Off Tanimbar Islands, Indonesia, 1244-1256 m, shells only.

Description. Holotype 40.3 mm in length, light but solid, orthoconic (width / length 0.25). Protoconch missing. Teleoconch of 13 whorls; whorls tabulated, separated by deep sutures. Axial structure of wide, somewhat sharp costae; costae weaker on shoulders (Fig. 40); 27 on penultimate whorl. Varicoid costae absent. Spiral structure of prominent spiral cords; cords crossing over axial costae without creating nodules, becoming undulated as they do so; about 10 cords per whorl, beginning near periphery of shoulder. Spiral and axial scratches covering whorls, more so on interspaces, creating a pitted appearance. Body whorl with prominent, smooth basal disk; disk defined adapically by a strong basal ridge; ridge delineating presutural edge on teleoconch whorls. Aperture ovate-quadrate. Lip simple. Operculum unknown. Shell white.

Remarks. The two type specimens have a rather worn surface, and presumably have been empty for a rather long time. Fresher specimens may show more detail and color than the type specimens. This species can only be confused with *Claviscala pellisanserina* n. sp., from which it differs in lacking prominent nodules, having deeper sutures, tabulated whorls and a smooth basal disk.

Etymology. Named for the late Mrs. Vivienne Smith, an Epitoniidae lover, a good friend, and a great lady.

Genus *Cylindriscala* de Boury, 1909
Type species: *Scala fulgens* de Boury, 1909 (OD) (= *Cylindriscala acus* Watson, 1883)

***Cylindriscala humerosa* (Schepman, 1909)**
Fig. 50

Type locality. East Banda Sea, in 1570 m.

Material examined. **Loyalty Ridge**. MUSORSTOM 6: sta. CP438, 20°23'S, 166°20'E, 780 m, 1 dd. (Fig. 50).
New Caledonia. MUSORSTOM 4: sta. DW219, 23°02'S, 167°33'E, 750 m, 1 dd.

Marquesas Archipelago. MUSORSTOM 9: sta. DR1255, 9°38'S, 139°48'W, 416-440 m, 1 dd.

Distribution. East Banda Sea and the Loyalty Ridge.

Remarks. The holotype of this species measures 15 mm, has 11 whorls, and was collected in the east Banda Sea in 1570 m. The specimens from the Loyalty Ridge, New Caledonia, and the Marquesas Archipelago considerably expand its known geographical distribution. The Loyalty Ridge specimen (Fig. 50) is twice as large as the holotype. It has 17 whorls and measures 30.0 mm in length.

***Cylindricala paradoxa* n. sp.**
Figs. 42-45

Type material. Holotype MNHN length 28.6 mm, width 6.5 mm.

Type locality. Philippines, 13°47'N, 120°30'E, 640-668 m [MUSORSTOM 3, sta. CP106].

Distribution. Philippine Islands, 640-668 (shell only).

Description. Holotype 28.6 mm in length, rather thin, orthoconic (width / length 0.23). Protoconch missing. Teleoconch of 14 whorls, separated by deep sutures; periphery of whorls almost straight; sharply, narrowly shouldered near sutures. Axial sculpture of narrow costae; costae narrower than interspaces (Fig. 45); 10 to12 costae on earlier whorls, increasing to 27 on penultimate whorl; costae rounded, but well-defined on teleoconch whorls, becoming less pronounced on last 1.5 whorls (Fig. 44). Spiral sculpture of well-defined cords, about 12 per whorl; cords crossing over costae, creating small nodules; numerous axial scratches crossing spiral cords but not creating pitting. Body whorl with axial sculpture terminating at level of posterior end of aperture; spiral sculpture continuing with diminishing strength. Base of body whorl convex (Fig. 44). Basal ridge and basal disk absent. Aperture elongate-ovate. Lip simple. Operculum unknown. Shell yellowish-white; costae lighter in color.

Remarks. The tabulated whorls, nodular axial costae, and spiral cords approximate this taxon to *Cylindriscala hmmerosa* (Schepman, 1909) (Fig. 50), *C. sibogae* Schepman, 1909), *C. enamelis* (Kuroda in Nakayama, 1995), and *C. nitida* (Kuroda & Ito, 1961). However, these species have a basal ridge and/or a basal disk, which creates a flattening of the base of the body whorl and a sub-quadrate aperture. *C. paradoxa* lacks either of these features, and its aperture is elongate-ovate.

Etymology. Greek *paradoxos* (adj., meaning strange, contrary to expectations), referring to the lack of expected features for the genus *Cylindriscala*.

Genus ***Epitoninm*** Röding, 1798
Type species: *Turbo scalaris* Linnaeus, 1758 (SD, Suter, 1913)
Subgenus ***Epitoninm* s.s.**

Epitoninm (Epitonium) marmoratnm
(Sowerby, 1844)
Fig. 67

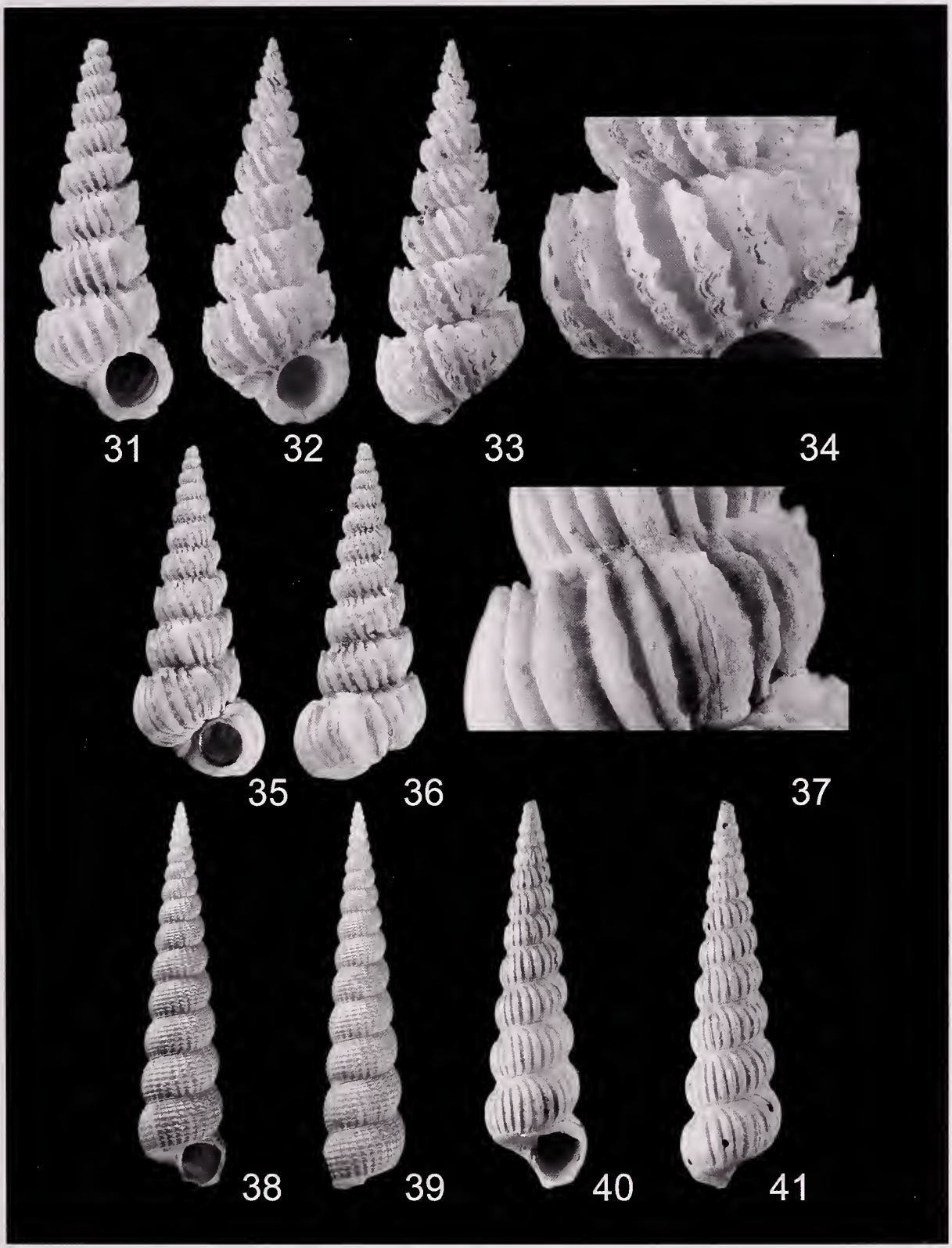
Material examined. **New Caledonia**. LAGON: sta. 340, Grand Récif Sud, 22°48'S, 166°47'E, 27 m, 1 dd. (Fig. 67), length 18. 0 mm.

Distribution. In spite of its type locality being established as «India», this species seems to be restricted to the SW Pacific, from the Solomon Islands (Weil et al, 1999) and New Caledonia to Cairns, northern Queensland, Australia (Wilson, 1993).

Remarks. Only one broken specimen was found in the material studied. I have included this taxon to show the relative number of species in a geographical area, as well as their relative abundance within the material studied.

Figures 31-41

31: *Cirsotrema rugosum* (Kuroda & Ito, 1961). Tonga, 19°06'S, 174°18'W, 371-437 m, [BORDAU 2, sta. CH1596], length 56.6 mm. **32-34**: *Cirsotrema (Cirsotrema) excelsum* n. sp. Indonesia, Kai Islands, 05°17'S, 132°41'E, 212-221 m [KARUBAR, sta. DW15]. Holotype (MNHN). Length 18.4 mm, width, 7.2 mm. **35-37**: *Cirsotrema (Dannevigena) richeri* n. sp. New Caledonia, off southern coast, 22° 52'S, 167°16'E, 530-541 m [BATHUS 2, sta. DW720]. Holotype (MNHN) length 32.0 mm, width 11.4 mm. **38-39**: *Claviscala pellisanserina* n. sp. Philippines, 10°01'N, 120°19'E, 196-204 m [MUSORSTOM 3, sta. CP99]. Holotype (MNHN) length 36.5 mm; width 7.8 mm. **40-41**: *Claviscala vivienneae* n. sp. Tanimbar Islands, Indonesia, 08°03'S, 131°48'E, 1244-1256 m [KARUBAR sta. CP52]. Holotype (MNHN) length 40.3 mm, width 10.2 mm.


31
32
33
34
35
36
37
38
39
40
41

Epitonium (Epitonium) pallasi **(Kiener, 1838)**
Fig. 65

Material examined. **Fiji**. MUSORSTOM 10: sta CP1331, 17°02.4'S, 178°01.8'E, 694-703 m, 5 dd.- Sta CP1371, 18°12.4'S, 178°32.8'E, 135-151 m, 1 dd.
BORDAU 1: sta CP1407, 16°40'S, 179°39'E, 499-527 m, 1 dd.
Indonesia. KARUBAR: -Sta DW08, 05°20'S, 132°31'E, 358-360 m, 1 dd. -sta CC56, 08°16'S, 131°59'E, 549-552 m, 1 dd. - Sta CP70, 08°41'S, 131°47'E, 410-413 m, 2 dd. - Sta CP72, 08°36'S, 131°33'E, 676-699 m, 2 dd. -Sta CP75, 08°46'S, 131°36'E, 451-452 m, 3 dd.
CORINDON-MAKASSAR: sta CH276, 01°55'S, 119°13'E, 395-450 m, 1 dd.
Philippines. MUSORSTOM 2: sta CP2, 14°01'N, 120°17'E, 184-186 m, 1 dd. - Sta CP64, 14°01'N, 120°19'E, 191-195 m, 1 dd.
MUSORSTOM 3: CP122, 12°20'N, 121°42'E, 673-675 m, 4 dd (Fig. 65). - Sta CP128, 11°50'N, 121°42'E, 815-821 m, 1 dd.

Distribution. Indo-West Pacific.

Remarks. Together with *Amaea gazeoides, Epitonium (Parviscala) bevdeynzerae*, and *Cirsotrema (C.) plexis,* this was among the most common epitoniids found in the material studied. I have included this taxon to show the relative number of species in a geographical area, as well as their relative abundance within the material studied.

Subgenus ***Hirtoscala*** Monterosato, 1890
Type species: *Scalaria cantrainei* Weinkauff, 1866 (SD, de Boury, 1891)

***Epitonium (Histoscala) deschampsi* n. sp.**
Figs. 57- 58

Type material. Holotype MNHN length 26.4 mm, width 15 mm.

Type locality. Southern New Caledonia, 23°00'S, 167°24'E, 480-560 m [SMIB 4 sta. DW58].

Material examined. Known only from the type material.

Distribution. South New Caledonia, at 480-560 m (shell only).

Description. Holotype 26.4 mm in length, unusually solid, broadly pyramidal (width/ length 0.57). Protoconch missing. Teleoconch of 5.5 whorls; whorls convex, adapically shouldered. Axial sculpture of thick, solid, non-reflected costae, some slightly peaked; almost all costae continuous with costae from previous whorl, costae as wide as interspaces. Spiral sculpture absent. Umbilicus closed, covered by a heavy callus. Aperture subcircular, thickened by labral costa. Operculum unknown. Shell white.

Remarks. The holotype is a rather poor specimen. The better preserved costae are peaked at shoulder, and I presume that a better specimen would show this feature on all its costae. *Epitonium deschampsi* is uncharacterisatically heavy for a *Hirtoscala*. However, the smooth interspaces, closed suture and umbilicus, and the peaked costae has led me to place it in this subgenus. This species is similar to *Epitonium (Lamelliscala) maestratii*, n. sp. (Figs. 63-64). The new taxon differs from the latter in lacking an umbilicus; and in having a more solid shell, a body whorl proportionately higher (total length of specimen vs height of last whorl, 1.67 vs. 1.81), and slightly wider costae.

Etymology. Named for Mr. Guy Deschamps, a volunteer at MNHN, who has sorted numerous bottom samples for micromolluscs.

Subgenus ***Hyaloscala*** de Boury, 1890
Type species: *Scala clathratula* Kanmacher, 1797 (OD)

***Epitonium (Hyaloscala) stigmaticum* (Pilsbry, 1911)**
Fig. 62

Material examined. **Marquesas Archipelago**. MUSORSTOM 9: sta. CP1239, 09°42.2'S, 139°03.6'W, 89-95 m, 1 dd. – Sta. DW1224, 9°44.6'S, 138°51.1'W, 115-120 m, 6 dd (Fig. 62, length 25.6 mm),
New Caledonia. LAGON: sta. 528, 19°31'S, 163°30'E, 47 m, 1 dd. -Sta. 874, 20°37'S, 164°53'E, 40 m, 1 dd. –Sta. 1099, 19°47'S, 163°46'E, 38 m, 1 dd. - Sta. 1177, 19°20'S, 163°25'E, 59 m, 1 dd. - Sta. 1183, 19°27'S, 163°19'E, 58 m, 1 dd. - Sta. 1201, 19°36'S, 163°36'E, 33 m, 2 dd.

Distribution. Central Japan to northern Queensland.

Remarks. This is a widespread species. I have included this taxon to show the relative number of species in a geographical area, as well as their relative abundance within the material studied.

Subgenus *Lamelliscala* de Boury, 1909
Type species: *Scalaria fasciata* Sowerby, 1844 (OD)

***Epitonium (Lamelliscala) maestratii* n. sp.**
Figs. 63-64

Type material. Holotype MNHN length 21.3 mm, width 12.2 mm.

Type locality. North New Caledonia. 18°56'S, 163°05'E, 777-820 m [BATHUS 4, sta. CP913].

Material examined. Known only from the type material.

Distribution. North New Caledonia, 777-820 m (shell only).

Description. Holotype 21.3 mm in length, solid, broadly pyramidal (width / length, 0.57). Protoconch missing. Teleoconch of 6.5 whorls; whorls convex, adapically shouldered. Axial sculpture of thick, solid, not reflected, peaked costae; costae narrower than interspaces, thinner and slightly sinouous at shoulder; most costae continuous from preceding whorl; 20 on penultimate whorl. Spiral sculpture absent. Umbilicus narrow, peripherally delineated by a modest umbilical rib created by the fusion of slight peaks of axial costae. Aperture circular, surrounded by a thick lip; lip slightly auriculate anteriorly. Operculum unknown. Shell dull white.

Remarks. The closed suture and narrow umbilicus exclude this taxon from *Epitonium* s.s. It can be separated from other *Lamelliscala* by the combination of thick, non-reflected costae, broadly pyramidal shape, and large size.

Etymology. Named for Mr. Philippe Maestrati, of the Muséum national d'Histoire naturelle, Paris, in appreciation for his skilled work at sorting out and curating vast amounts of expedition mollusc material in MNHN.

Subgenus ***Parviscala*** de Boury, 1887
Type species: *Scalaria algeriana* Weinkauff, 1866 (OD)

***Epitonium (Parviscala) bevdeynzerae* García, 2001**
Figs. 59-61

Material examined. **Fiji**. MUSORSTOM 10: sta. CP1331, 17°02.4'S, 178°01.8'E, 694-703 m, 1 dd.
BORDAU 1: sta. DW1477, 20°58'S, 178°45'E, 390-405 m, 1 lv (Fig. 60).
Loyalty Ridge. MUSORSTOM 6: sta. DW459, 21°01'S, 167°31'E, 425 m, 4 dd.
New Caledonia. BATHUS 1: sta. DE705, 21°02'S, 165°38'E, 350-400 m, 1 dd.
BATHUS 3: sta. DW790, 23°49'S, 169°48'E, 685-715 m, 1 dd.
BATHUS 4: sta. DW917, 18°47'S163°14'E, 397-400 m, 1 dd.
CALSUB: Pl.15, 20°37'S, 166°58'E, 538 m, 1 dd.
PALEO-SURPRISE: sta. DW1391, 18°29.8'S, 163°02.8'E, 365 m, 1 dd.
VAUBAN 1978-79: sta. 14, 22°16'S, 167°17'E, 465-495 m, 1 dd.
Tonga. BORDAU 2: sta. CP1641, 21°09'S, 175°22'W, 395 m, 1 dd.
SW Pacific, Wallis Island. MUSORSTOM 7: sta. DW 610,13°21'S, 176°09'W, 286 m, 1 dd.
New Caledonia (BATHUS 2) or **Vanuatu** (MUSORSTOM 8)- accidental mixing, 1 dd (Figs. 59, 61).

Distribution. Philippines Islands to SW Pacific.

Remarks. This species has previously been known only from the Philippines. In this new material it was collected alive at 309-405 m, and shell only at 350-715 m. *E.(P.) bevdeynzerae* resembles *Mazescala koyamai* Nakayama, 1995; however, according to the description, the latter resembles the type species of *Mezescala*, *M. thrasys* Iredale, 1936, which has «almost smooth» interspaces (Iredale, 1936), and a protoconch of 1.5- 2.0 whorls. *E. bevdeynzerae* has obvious spiral sculpture in the interspaces, and a protoconch of about 4.25 whorls (Fig. 60). The multispiral protoconch accounts for the long pelagic survival and widespread distribution of the species. The largest specimen, from sta. DW1477, measures 38 mm.

***Epitonium (Parviscala) juanitae* n. sp.**
Figs. 55-56

Type material. Holotype MNHN length 24.6 mm, width 11.7 mm.

Type locality. Fiji, 16°02'S, 179°30'W, 557-558 m [BORDAU 1, sta. CP1409].

Material examined. **Fiji**. BORDAU 1: sta. CP1409, 16°02'S, 179°30'W, 557-558 m, (holotype, Figs. 55-56).
Loyalty Basin. BIOGEOCAL: sta. CP290, 20°37'S, 167°03'E, 760-920 m. 1 dd.

Distribution. Fiji and the Loyalty Basin, at 557- 920 m, shells only.

Description. Holotype 24.6 mm in length, light but solid, glassy, widely pyramidal (width / length 0.47). Protoconch missing. Teleoconch of 10 whorls; whorls convex, adapically shouldered. Axial sculpture of thin, slightly reflected costae; costae peaked at shoulders; about 26 on penultimate whorl. Spiral sculpture of low, wide interstitial cords; cords starting near anterior edge of shoulder; about 10 on penultimate whorl; cords not going up sides of costae. Aperture sub-circular. Outer lip widened by labral costa; inner lip slightly erect, somewhat expanded at umbilical area. Umbilicus closed. Operculum unknown. Body of shell pale amber; costae white. Inside of aperture amber; edge white.

Remarks. The spiral cords, peaked costae , and lack of umbilicus place this taxon in the same grouping as the two preceding species. However, their large size

separates them from other *Parviscala* , The widely pyramidal shape of *E. (P.) juanitae* conclusively separates this species from *E.(P.) beydeynzerae* García, 2001, which also has many more axial costae, and from *E.(P.) kastoroae*, n. sp., which also has highly peaked axial costae.

Etymology. Named for Mrs. Juanita Cacioppo, of Baton Rouge, Louisiana, for her dedication to shell collecting for many decades.

***Epitonium (Parviscala) kastoroae* n. sp.**
Figs. 53-54

Type material. Holotype MNHN length 28.6 mm, width 10.8 mm; 1 paratype MNHN.

Type locality. Philippines, 12°20'N, 121°42'E, 673-675 m [MUSORTSTOM 3, sta. CP122].

Material examined. **Philippines**. MUSORSTOM 3: sta. CP106, 13°47'N, 120°30'E, 640-668 m, 1 dd. (paratype)- Sta. CP122, 12°20'N, 121°42'E, 673-675 m, 1 dd (holotype, Figs. 53-54).
Indonesia. KARUBAR: sta. CP20, 05°15'S, 132°59'E, 769-809 m, 1 dd. – Sta. CP75, 08°46'S, 131°36'E, 451-452 m, 1 dd.

Distribution. Philippine Islands and Indonesia, at 451 - 809 m (shells only).

Description. Holotype 28.6 mm in length, thin but solid, pyramidal (width/ length 0.38). Protoconch missing. Teleoconch of about 10.5 whorls, whorls convex abapically, shouldered adapically. Axial sculpture of thin, reflected costae, highly peaked adapically, creating an excavated shoulder; costae narrower than interspaces, about 23 on penultimate whorl. Spiral sculpture of crowded, well-defined, heavy cords; cords going up costae abaperturally. Aperture subcircular; lip expanded. Umbilicus closed. Shell white.

Paratypes similar to the holotype; the specimens from Indonesia are slightly narrower (width/ length 0.34) than those from the Philippines.

Remarks. The large size, highly peaked axial costae, and prominent spiral cords separate this species from other *Parviscala*. It resembles the Japanese species *E. (P.) ensculptum* (Sowerby, 1903), which has peaked costae and strong spiral cords. However, this species has more highly peaked costae; grows only to about 20 mm, in contrast to almost 30 mm for *E. kastoroae*; and has about half the number of axial costae.

Etymology. Named for Ms Widana Kastoro (Institute of Oceanology, LIPI, Jakarta), who was one of the malacologists during the 1991 KARUBAR expedition on board R/V *Baruna Jaya* 1.

Genus ***Gregorioiscala*** Cossman, 1912
Type species: *Scalaria romettensis* de Gregorio, 1890 (by monotypy; Miocene of S. Italy)

***Gregorioiscala nevillei* n. sp.**
Figs. 46-48

Type material. Holotype MNHN length 46.0 mm, width 11.8 mm.

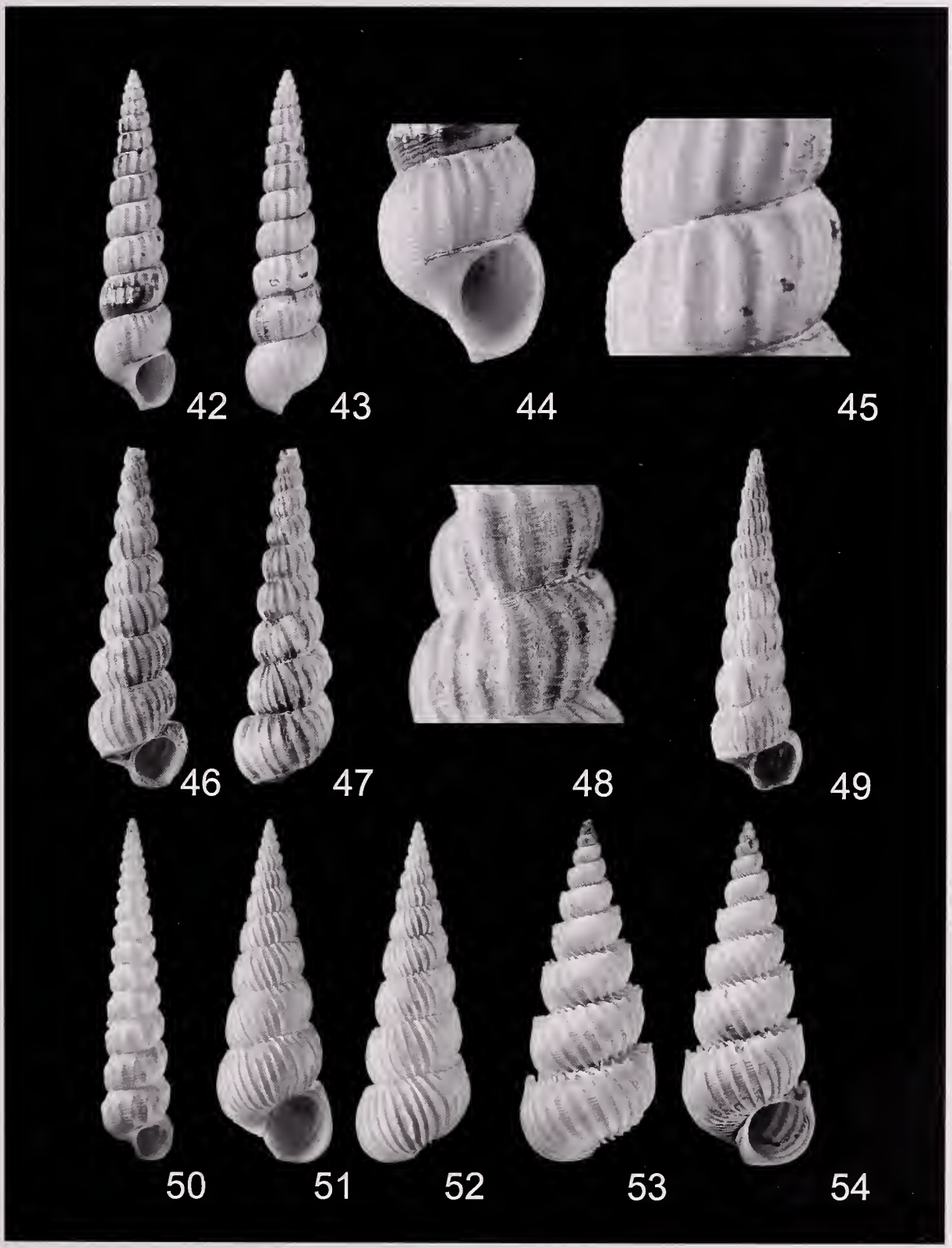
Type locality. Off northern Madagascar, 12°34.0'S, 148°15.0'E, 395 m, A. Crosnier coll., 1972.

Material examined. Known only from the type material.

Distribution. Off northern Madagascar, 395 §shell only).

Figures 42-54

42-45: *Cylindriscala paradoxa* n. sp. Philippines, 13°47'N, 120°30'E, 640-668 m [MUSORSTOM 3 sta. CP106]. Holotype (MNHN) length 28.6 mm, width 6.5 mm. **46-48**: *Gregorioiscala nevillei* n. sp. Off northern Madagascar, 12°34.0'S, 148°15.0'E, 395 m. Holotype (MNHN) length 46.0 mm, width 11.8 mm. **49**: *Claviscala solar* Nakayama, 1995. Fiji. 17°16.4'S, 77°49.8'E, 282-322 m, [MUSORTSTOM 10: sta. CP1325], length 45 mm. **50**: *Cylindriscala humerosa* (Schepman, 1909) Loyalty Ridge, 20°23'S, 166°20'E, 780 m,. [MUSORSTOM 6: sta. CP438], length 30 mm. **51-52**: *Gyroscala mikeleei* n. sp Indonesia, Tanimbar Islands, 08°36'S, 131°33'E, 676-699 m [KARUBAR sta., CP72]. Holotype (MNHN) length 47.3 mm, width 15.4 mm. **53-54**: *Epitonium (Parviscala) kastoroae* n. sp. Philippines, 12°20'N, 121°42'E, 673-675 m. [MUSORTSTOM 3, sta. CP122]. Holotype (MNHN) length 28.6 mm, width 10.8 mm.


42
43
44
45
46
47
48
49
50
51
52
53
54

Description. Holotype 46.0 mm in length, light but solid, orthoconic (width / length, 0.26). Protoconch missing. Teleoconch of 9.5 whorls; whorls almost straight at periphery, becoming very convex abapically and adapically. Suture deep. Axial sculpture of thick, round costae; costae narrower than interspaces, some becoming varicoid; 20 on penultimate whorl; fine, crowded axial threads covering whorls, more obvious near sutural area. Spiral sculpture of conspicuous cords; cords crossing over axial costae; about 20 on penultimate whorl, creating pitted surface when crossing axial threads. Basal disk conspicuous, delineated adapically by a heavy spiral cord; disk sculptured with heavy spiral cords crossed by fine axial threads. Aperture ovate-quadrate. Lip erect; outer lip re-enforced by heavy varix. Operculum unknown. Shell presumably whitish.

Remarks. Although some *Claviscala* have a pitted surface, the significantly pitted surface of this species places it closer to *Gregorioiscala*, and shows the close relationship between the latter and *Opalia*. *Opalia garciai* Kilburn, 1994, has the general appearance of this taxon, but the former is narrower and has varices on teleoconch whorls. I presume that fresher examples of the new taxon will show that the species does posses an intritacalx.

Etymology. Named for Mr. Bruce Neville, co-author of *The Wentletrap Book*, for his efforts in putting together that publication, and for his love of Epitoniidae.

Genus ***Gyroscala*** de Boury, 1887
Type species: *Scalaria commutata* Monterosato, 1877 (OD) (= *Scalaria lamellosa* Lamarck, 1822)

***Gyroscala mikeleei* n. sp.**
Figs. 51- 52

Type material. Holotype MNHN length 47.3 mm, width 15.4 mm; 1 paratype MNHN; 1 paratype PPPO-L1PI.

Type **locality**. Indonesia, Tanimbar Islands, 08°36'S, 131°33'E, 676-699 m [KARUBAR sta. CP72].

Material examined. Indonesia. KARUBAR: sta. CP72, 08°36'S, 131°33'E, 676-699 m, 3 dd (holotype, Figs. 51-52) -Sta. CP75, 08°46'S, 131°36'E, 451-452 m, 2 dd (paratypes).
East New Caledonia. BATHUS 1: sta. CP671, 20°51'S, 165°28'E, 450-470 m, 2 dd.

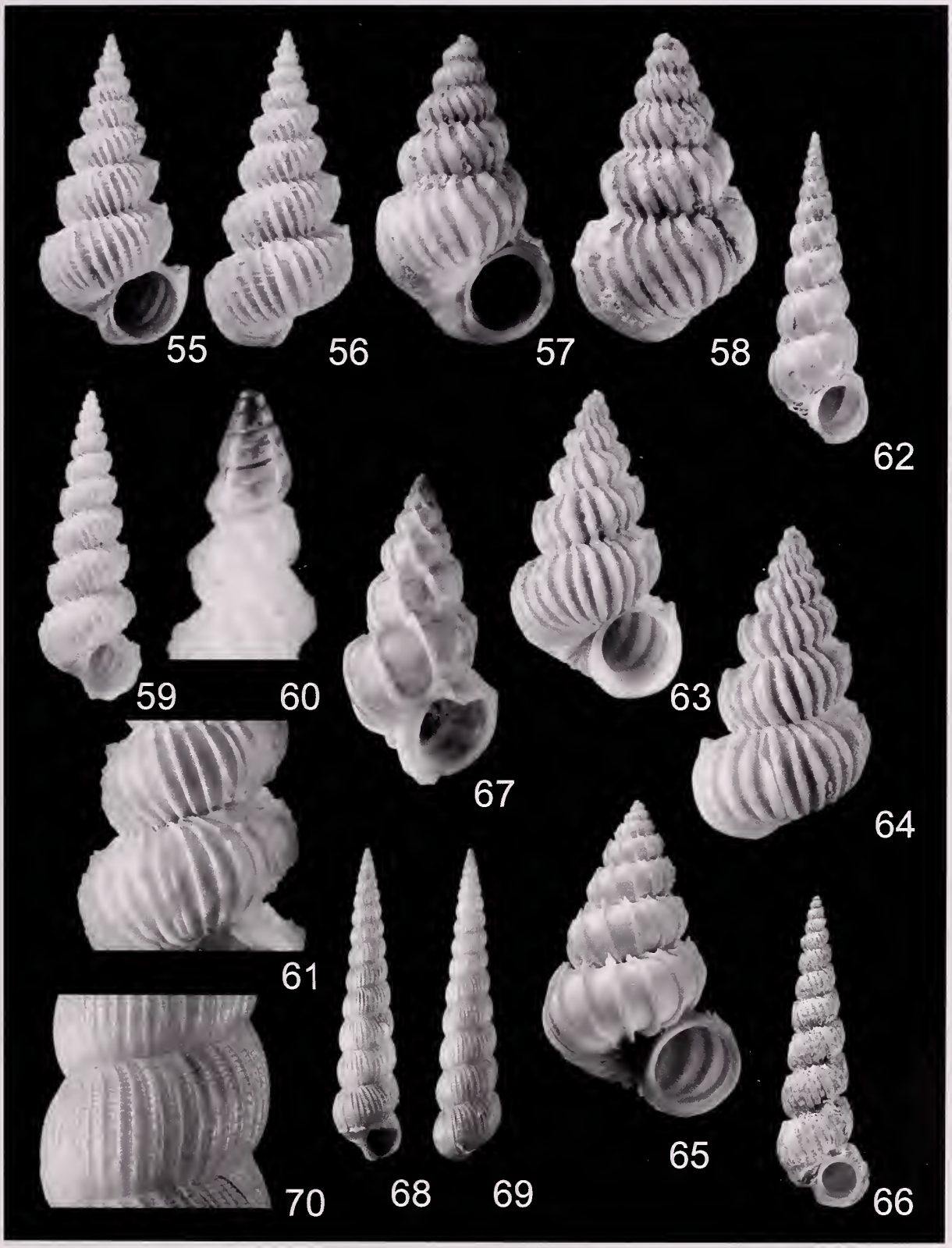
Distribution. Tanimbar Islands, Indonesia, and east New Caledonia, 450-699 m (shells only).

Description. Holotype 47.3 mm in length, shell thin, rather fragile, narrowly pyramidal (width/length 0.33). Protoconch missing. Teleoconch of about 12.5 whorls, whorls slightly convex. Axial sculpture of thin, slightly peaked, low costae, higher adapically, creating a narrow shoulder and a deep suture; costae much narrower than interspaces; about 30 on penultimate whorl. Spiral sculpture of uneven, crowded, low threads, Body whorl with weak basal ridge; axial and spiral sculpture diminishing in strength below ridge. Aperture ovate. Lip simple. Umbilicus closed. Operculum unknown. Shell chalky-white.

Paratypes very similar to holotype; one showing stronger basal ridge than holotype.

Figures. 55-70

55-56: *Epitonium (Parviscala) juanitae* n. sp. Fiji, 16°02'S, 179°30'W, 557-558 m [BOURDAU 1, sta. CP1409]. Holotype (MNHN) length 24.6 mm, width 11.7 mm. **57-58**: *Epitonium (Hirtoscala) deschampsi* n. sp. - South New Caledonia, 23°00'S, 167°24'E, 480-560 m [SMIB 4, sta. DW58]. Holotype (MNHN) length 26.4 mm, width 15 mm. **59, 61**: *Epitonium (Parviscala) bevdeynzerae* García, 2001. New Caledonia (BATHUS 2) or Vanuatu (MUSORSTOM 8) [accidental mixing] length 28.4 mm. **60**: Protoconch. Fiji, 20°58'S, 178°45'E, 390-405 m, [BOURDAU 1 sta. DW1477]. **62**: *Epitonium (Hyaloscala) stigmaticum* (Pilsbry, 1911). Marquesas Archipelago, 9°44.6'S, 138°51.1'W, 151-120 m, [MUSORSTOM 9 sta. DW1224], length 25.6 mm. **63-64**: *Epitonium (Lamelliscala) maestratii* n. sp. North New Caledonia., 18°56'S, 163°05'E, 77-820 m [BATHUS 4: sta. CP913]. Holotype (MNHN) length 21.3 mm, width 12.2 mm. **65**: *Epitonium (Epitonium) pallasi* (Kiener, 1838). Philippines, 12°20'N, 121°22'E, 673-675 m, [MUSORSTOM 3: CP122,], length 40 mm. **66**: *Cirsotrema (Cirsotrema) plexis* Dall, 1925. 14°01'N, 120°17.5E, 184-202 m, [MUSORSTOM sta. 61], length 43.4 mm. **67**: *Epitonium(Epitonium) marmoratum* (Sowerby, 1844) New Caledonia, Grand Récif Sud, 22°48'S, 166°47'E, 27 m, [ORSTOM: sta. 340], length 18.0 mm. **68-70**: *Periapta weili* n. sp. Loyalty Ridge, 21°05'S, 167°32'E, 540 m [MUSORSTOM 6, sta. CP466]. Holotype (MNHN) length 49.5 mm, width 10.5 mm.


55
56
57
58
62
59
60
63
67
64
61
65
70
68
69
66

Remarks. I have tentatively placed this taxon in *Gyroscala* because of its basal ridge, However, the spiral sculpture and non-glossy shell are uncharacteristic of *Gyroscala*. The large size and spiral sculpture separate this species from other *Gyroscala*.

Etymology. Named for Michael D. Lee, of Lafayette, Louisiana, who has been my companion on collecting trips for more than a quarter of a century.

***Gyroscala xenicima* (Melvill & Standen, 1903)**
Figs. 11-12

Material examined. **New Caledonia**. Baie de St. Vincent. LAGON: sta. 215, 21°53'S, 165°50'E, 14 m, 1 dd, length 18 mm).
EXPEDITION MONTROUZIER: sta. 1250, Baie de Touho, 20°46.7' S, 165°13.7' E, 3-6 m, 2 dd (juveniles) (length 7.7 mm, Figs 11, 12).

Distribution. Gulf of Arabia and Singapore (Blake & Oliver, 1982), Transkei (Kilburn, 1985) and New Caledonia.

Remarks. In the description of *G. xenicima* Melvill & Standen indicated the existance of spiral striae in its surface. There are also sparse axial striae, which form large, uneven reticulations when they cross the spiral sculpture. Although this characteristic, as well as the basal ridge, approximate this taxon to *Acrilloscala* Sacco, 1891, typical *Acrilloscala* have a more obvious, closer reticulated pattern, and some of the axial costae tend to become varicoid. I have placed this species in *Gyroscala* in spite of its uncharacteristic sculpture, a trait already seen in *G. mikeleei*. *G. xenicima* is a senior synonym of *Gyroscala turnerae* (Altena, l971), a species found in the western Atlantic (García, in ms).
The New Caledonia records expand the geographical distribution of *G. xenicima* into the SW Pacific.

Genus ***Periapta*** Bouchet & Warén, 1986
Type species: *Scalaria polygyrella* Fischer in Locard, 1897 (OD)

***Periapta weili* n. sp.**
Figs. 68-70

Type material. Holotype MNHN length 49.5 mm, width 10.5 mm.

Type locality. Loyalty Ridge, 21°05'S, 167°32'E, 540 m [MUSORSTOM 6, sta. CP466].

Material examined. Known only from the type material.

Distribution. Loyalty Ridge, SW Pacific, in 540 m (shell only).

Description. Holotype 49.5 mm in length, light but solid, somewhat glossy, orthoconic (width/ length, 0.21). Protoconch missing. Telcoconch of 14.5 whorls; whorls slightly convex. Suture impressed. Axial sculpture of narrow, low, rounded costae; about 31 on penultimate whorl. Spiral structure of numerous cords; cords passing over axial costae creating nodules; about 17 cords on penultimate whorl. Body whorl with axial and spiral sculpture to the level of posterior end of aperture; almost smooth basally, with only traces of earlier sculpture. Basal ridge absent. Aperture oval. Lip simple. Operculum unknown. Shell pale tan on earlier whorls, progressively darkening to tan on last whorl.

Remarks. About half of the body whorl of holotype missing; only sutural connection with earlier whorl remaining, creating the impression of a basal ridge. However the intact portion of the whorl shows no trace of basal ridge. This species can be readily separated from *Claviscala* by the lack of a basal ridge. It is closest to *Pariapta luxus* (Okutani, 1964). However, the latter has a white shell and about four times as many axial costae.

Etymology. Named for Mr. Art Weil, co-author of *The Wentletrap Book*, for his efforts in putting together that publication, and for his love of Epitoniidae.

Acknowledgments

My deepest thanks to Dr. Philippe Bouchet for allowing me to study part of the large collection of Epitoniidae housed at MNHN, for providing the background material from the expeditions treated in this study, and for making essential suggestions on the manuscript. I also thank him, Mr. Philippe Maestrati, and Mrs. Virginie Héros for their help and hospitality while I was visiting the museum. Mrs. Héros also helped to clarify some problems with the sections on «Material examined»; and Mr. Maestrati did the magnificent photography for the plates. Dr. Richard Kilburn (NM), Dr. Harry G. Lee, of Jacksonville, Florida, Dr. Emily Vokes, professor Emerita at Tulane University, and Mr. Roland Houart also read the manuscript and made important suggestions. Drs. Darryl Felder and Suzanne Fredricq, allowed me office space and the use of necessary equipment at the University of Louisiana at Lafayette; Dr. Gary Rosenberg, (ANSP) provided needed literature; and Ms. Mariana Scott translated Thiele from the German.

REFERENCES

Blake, A.F. & Oliver, P.G. 1982. The Melvill-Tomlin collection. Part 12. Epitoniacea (Epitoniidae). *Handlists of the molluscan collections in the Dept. Zoology, Nat. Mus. Wales*. [1]: 1-18.

Bouchet, P., & Warén, A. 1986. Revision of the northeast Atlantic bathyal and abyssal Aclididae, Eulimidae, Epitoniidae (Mollusca: Gastropoda), *Bollettino Malacologico*, Suplemento 2, 576 pp.

Bouchet, P. (ed.). 1994. Résultats des Campagnes MUSORSTOM, volume 14. *Mémoires du Muséum National d'Histoire Naturelle*, 167: 1-654.

Bouchet, P. & B. Marshall (eds). 2001. Tropical Deep-Sea Benthos, volume 22. *Mémoires du Muséum National d'Histoire Naturelle*, 185: 1-406.

Bouchet, P., Lozouet, P., Maestrati, P., Héros, V. 2002. Assessing the magnitude of species richness in tropical marine environments: exceptionally high numbers of molluscs at a New Caledonia site. *Biological Journal of the Linnean Society*, 75: 421-436.

Clench, W. J., & Turner, R.D. 1952. The genera *Epitonium* (Part II), *Depressiscala*, *Cylindriscala*, *Nystiella* and *Solutiscala* in the western Atlantic. *Johnsonia* 2(31): 319-327.

Cossmann, A. E. M.1912. *Essais de paléoconchologie comparée*. 9. Cossmann, Paris. 215 pp.

Crosnier, A. & P. Bouchet (eds). 1991. Résultats des Campagnes MUSORSTOM, volume 7. *Mémoires du Muséum National d'Histoire Naturelle*, ser. A, 150: 1-259.

Crosnier, A., B. Richer De Forges & P. Bouchet. 1997. La campagne KARUBAR en Indonésie, au large des iles Kai et Tanimbar. *In*: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 16. *Mémoires du Muséum National d'Histoire Naturelle*, 172: 9-26.

Forest, J. 1981. Résultats des campagnes MUSORSTOM. I – Philippines (18-28 mars 1976). Report and general comments. *Mémoires ORSTOM*, 91: 9-50.

Forest, J. 1986. The MUSORSTOM II Expedition (1980). Report and list of stations. *Mémoires du Muséum National d'Histoire Naturelle*, ser. A, 133: 7-30.

Forest, J. 1989. Report on the MUSORSTOM 3 Expedition to the Philippines (May 21st – June 7th 1985). *In*: J. Forest (ed.), Résultats des Campagnes MUSORSTOM, volume 4. *Mémoires du Muséum National d'Histoire Naturelle*, sér. A, 143: 9-23.

García, E. F. 2000. Description of a very distinct *Cirsotrema* (Gastropoda: Epitoniidae) from New Caledonia. *Novapex* 1(3-4): 105-107.

García, E. F. 2001. Three new deep-water epitoniid (Mollusca: Gastropoda) species from the southern Philippines. *Novapex* 2(3): 109-113.

Iredale, T. 1936. Australian molluscan notes. No. 2. *Records of the Australian Museum* 19: 294-304, pl.XXII.

Kilburn, R. N.1985. The family Epitoniidae (Mollusca: Gastropoda) in southern Africa and Mozambique. *Annals of the Natal Museum* 27(1): 239-337.

Kilburn, R. N.1994. Description of a remarkable new species of *Opalia* (Gastropoda: Epitoniidae) from the Philippines. *Basteria* 58: 49-51.

Melvill, J. C., & Standen, R. 1903. The genus *Scala* (Klein) Humphey, as represented in the Persian Gulf, Gulf of Oman, and North Arabian Sea, with the descriptions of new species. *Journal of Conchology* 10: 340-351.

Nakayama, T. 1995. Five new epitoniid species from the offshore waters of Kii Peninsula, Japan. *Venus* 54(4): 259-267.

Nakayama, T. 2000. Descriptions of a new subgenus, fourteen new species, and three substituted names of epitoniids from Japan, (Gastropoda: Epitoniidae) *Venus* 59(4): 277-292.

Richer de Forges, B. 1990. Explorations for bathyal fauna in the New Caledonian economic zone.). In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 6. *Mémoires du Muséum National d'Histoire Naturelle*, ser. A, 145: 9-54.

Richer De Forges, B. 1991. Les fonds meubles des lagons de Nouvelle-Calédonie: généralités et échantillonnage par dragages. *In*: B. Richer de Forges (ed.), Le benthos des fonds meubles des lagons de Nouvelle-Calédonie, volume 1: 7-148. Etudes et Thèses, ORSTOM, Paris.

Richer de Forges, B. 1993. Campagnes d'exploration de la faune bathyale faites depuis mai 1989 dans la zone économique de la Nouvelle-Calédonie. Listes des stations. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 10. *Mémoires du Muséum National d'Histoire Naturelle*, 156: 27-32.

Richer de Forges, B. & C. Chevillon. 1996. Les campagnes d'échantilonnage du benthos bathyal en Nouvelle-Calédonie, en 1993 et 1994 (BATHUS 1 à 4, SMIB 8 et HALIPRO 1). In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 15. *Mémoires du Muséum National d'Histoire Naturelle*, 168: 33-53.

Richer de Forges, B. & J.L. Menou. 1993. La campagne MUSORSTOM 7 dans la zone économique des iles Wallis et Futuna. Compte rendu et liste des stations. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 10. *Mémoires du Muséum National d'Histoire Naturelle*, 156: 9-25.

Richer de Forges, B., E. Faliex & J.L. Menou. 1996. La campagne MUSORSTOM 8 dans l'archipel de Vanuatu. Compte rendu et liste des stations. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 15. *Mémoires du Muséum National d'Histoire Naturelle*, 168: 9-32.

Richer de Forges, B., J. Poupin & P. Laboute. 1999. La campagne MUSORSTOM 9 dans l'archipel des iles Marquises (Polynésie française). Compte rendu et liste des stations. In: A. Crosnier (ed.),

Résultats des Campagnes MUSORSTOM, volume 20. *Mémoires du Muséum National d'Histoire Naturelle*, 180: 9-29.

Richer de Forges, B., P. Bouchet, B. Dayrat, A. Warén & J.S. Philippe. 2000b. La campagne BORDAU 1 sur la ride de Lau (iles Fidji). Compte rendu et liste des stations. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 21. *Mémoires du Muséum National d'Histoire Naturelle*, 184: 25-38.

Richer de Forges, B., P. Newell, M. Schlacher-Hoenlinger, T. Schlacher, D. Nating, F. Cesa & P. Bouchet. 2000b. La campagne MUSORSTOM 10 dans l'archipel des iles Fidji. Compte rendu et liste des stations. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 21. *Mémoires du Muséum National d'Histoire Naturelle*, 184: 9-23.

Robertson, R. 1994. Protoconch size variation along depth gradients in a planktotrophic *Epitonium*. *The Nautilus* 107(4); 107-112.

Roux, M. 1994. The CALSUB cruise on the bathyal slopes off New Caledonia. In: A. Crosnier (ed.), Résultats des Campagnes MUSORSTOM, volume 12. *Mémoires du Muséum National d'Histoire Naturelle*, 161: 9-47.

Schepman, M. M. 1909. *The prosobranchia of the Siboga Expedition*. Part II. E. J. Brill, Publishers.

Weil, A., Brown, L., & Neville, B. 1999. *The wentletrap book*. Evolver, Rome, 244 pp.

Wilson, Barry. 1993. *Australian marine shells. 1* Odyssey Publishing, Kallaroo,408 pp.