The marine microgastropods from the Northern coast of Papua New Guinea (Mollusca: Gastropoda) III. Family Columbellidae (Subfamily Pyreninae), with description of two new species*

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ABSTRACT: The following species, which belong to the Pyreninae (Fam: Columbellidae), are recorded from the Northern coast of Papua New Guinea and are redescribed here: Zafra hervieri (Pace), Z. minuscula (Gould), Z. troglodytes (Souverbie), Z. brevissima (Hervier), Seminella peasei (von Martens & Langkavel), Pyreneola abyssicola (Brazier), Mitrella galaxias (Reeve), M. loyaltensis (Hervier), M. molecularis (Duclos) and Zafroma nebulosa (Gould). The following species are described as new: Zafra ulinganensis nov.sp. and Z. semiclastriata nov.sp.

RESUME: Les espèces suivantes, qui font partie de la sous-famille des Pyreninae (Fam: Columbellidae), sont signalées de la côte Nord de Papouasie Nouvelle-Guinée et sont redécrites ici: Zafra hervieri (Pace), Z. minuscula (Gould), Z. troglodytes (Souverbie), Z. brevissima (Hervier), Seminella peasei (von Martens & Langkavel), Pyreneola abyssicola (Brazier), Mitrella galaxias (Reeve), M. loyaltensis (Hervier), M. molecularis (Duclos) et Zafroma nebulosa (Gould). Deux espèces nouvelles sont décrites: Zafra ulinganensis nov.sp. et Z. semiclastriata nov.sp.

1. INTRODUCTION AND METHODS

The present paper is the third in a series dealing with the microgastropods from the Northern coast of Papua New Guinea. For a general introduction, methods and a list of the sampling sites, see Sleurs (1984, 1985).

Abbreviations

ad. Adult specimen
A.M. Australian Museum, Sydney

*Leopold III Biological Station, Laing Island, Contribution no. 71.
2. SYSTEMATICS

Family: Columbellidae Swainson, 1840
Subfamily: Pyrcninae Suter, 1913

Genus Zaffra A. Adams, 1860

Zaffra A. Adams, 1860: 331. Type species: Zaffra mitriformis A. Adams, 1860; by monotypy.

Remarks. Thiele (1924) and Wenz (1941) consider Seminella Peasee, 1868 a junior subjective synonym of Zaffra. As pointed out by Reider (1980), the type-species of Seminella is Cithara varia Peasee, 1860. This species differs from Z. mitriformis, the type-species of Zaffra, in having a much narrower aperture. The remaining shell characters, however, are typical of Zaffra, suggesting that both genera are closely similar. However, I consider them two distinct genera, until more data about the nature of their affinity is known.

Zaffra hervieri (Pace, 1902) (Figs 1-3; Pl. A, 3, 4, 6; Pl. C, 1-3; Pl. D, 3)

Columella peasei Hervier (non v. Martens, 1871), 1900: p. 368, Pl. 4, Figs 9a, 9b.

Columella hervieri Pace, 1902: p. 420.

Description. Shell minute, elongate-ovate. Protoconch: conic, of about 3 strongly convex whorls; suture moderately impressed; penultimate and last whorl with a microscopic median spiral thread; protoconch clearly demarcated from teleoconch by a sinus.

Teleoconch: of about 3 plano-convex to strongly convex whorls; whorls sculptured with prominent, rounded axial ribs, the interspaces smooth, about as broad as the ribs or slightly broader; number of axial ribs rather variable; axial ribs on body whorl vanishing below the adapertural spiral grooves of the shell base; one weak subsutural groove intersecting the adapical part of the axial ribs, forming a subsutural row of low nodules; spiral grooves on the last whorl usually numbering 12; suture well marked, moderately to strongly impressed.

Aperture: narrow, peristome continuous; outer lip weakly thickened externally; inside with one strong thickening just below the subsutural sinus; thickening sometimes divided into 2 small denticles; columella with some weak plications, the latter corresponding with the spiral cords on the shell base; columellar callus thin; subsutural sinus moderately deep; anterior canal short.

Colour: variable; shell usually white, with a suprasutural, amber coloured, spiral band on the spire and with a median and basal, amber coloured band, on the last whorl; spiral bands on spire and on last whorl, bordered by two parallel rows of dark brown, spirally arranged, interrupted lines; protoconch white (morph a).
Table 1. Shell data of *Zafra hervieri*.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L₃ (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on last whorl</th>
<th>No. of whorls</th>
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<td>14</td>
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<tr>
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<td>16</td>
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<tr>
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<td>12</td>
<td>3</td>
<td>a</td>
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<td>13</td>
<td>3</td>
<td>a</td>
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<tr>
<td>2.51</td>
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<td>18</td>
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<td>9</td>
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<tr>
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<td>1.28</td>
<td>0.98</td>
<td>12</td>
<td>3</td>
<td>c</td>
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Shell sometimes chestnut brown with white, hexagonal or quadrangular spots, forming a tesselated pattern; protoconch chestnut brown (morph b). Some specimens yellowish, with a double row of proscline and opisthoclone, spirally arranged, brown lines; protoconch pale brown (morph c).

Radula: each radial row consisting of a subquadrangular median tooth, flanked at each side by one tricuspid lateral tooth; two uppermost cusps of the latter sharp, the lowest triangular, blunt.

**Material.** Type material: *Columbella hervieri* Pace; 3 syntypes in B.M.N.H., Lifu (Reg. no. 1899.3.6.29-31).


**Remarks.** This species was erroneously identified by Hervier (1900) as *Columbella peasi* Martins & Langkavel, 1871; therefore Pace (1902) proposed a new name, *Columbella hervieri*.

*Zafra hervieri* (Pace) is a polymorphic species with respect to both the shell form and the colour pattern. Hervier (1900) described the following varieties, all from Lifu, to separate the different morphs: *Columbella peasi* var. *lemiscata*, which is the predominant morph with the amber coloured spiral band, *C. peasi* var. *cinnamomea*, which is the tesselated morph and *C. peasi* var. *infaluta* which has a yellowish shell. The extreme morphs of the three nominate varieties are immediately recognizable by their strongly different colour pattern, however a few specimens exhibit intermediate characters between the different morphs. Some specimens from New Caledonia have shells in which the early whorls have the typical colour pattern of another morph. The syntypes of *Columbella hervieri* represent the nominate variety *C. peasi* var. *infaluta*.

*Z. hervieri* is similar to *Z. debilis* Hedley, 1915, from Hope I., in having a strong thickening just below the sinus, but differs in being less elongate fusiform and in having a different colour pattern, which is yellowish brown with a submedian white band on the early whorls and a median white band on the last whorl, in *Z. debilis*.

*Z. rufopiperata* E.A. Smith, 1884, from the Amirantes, is very similar to *Z. hervieri*, but differs in being uniformly yellowish coloured; apart from colour, there do not appear to be any significant differences between the two nominal species, but because we have only seen one syntype of *C. rufopiperata*, we consider them distinct species up to present time.

*Z. hervieri* superficially resembles *Z. troglodytes* (Souverbie), from Lifu, in shape and colour pattern, but differs primarily in lacking the denticles on the anterior part of the inside of the outer lip and in lacking the strong median angulation on the two last whorls of the protoconch; the whorls of the teleoconch are moderately shouldered in *Z. troglodytes*.

**Zafra minuscula** (Gould, 1860) (Fig. 4; Pl. B.2; Pl. D.1)

?*Columbella atomeilla* Reeve (non Duclos, 1840), 1858, Pl. 20, Fig. 108.

*Columbella (Anachis) minuscula* Gould, 1860, p. 334; Gould, 1862, p. 131; Kobelt, 1897, p. 307; Johnson, 1964, p. 110, Pl. 8, Fig. 2.

?*Columbella pumila* Dunker, 1859, p. 224; Dunker, 1861, p. 6, Pl. 1, Fig. 4; Dunker, 1882, p. 54.

*Columbella pumila* Souverbie in Souverbie & Montrouzier, 1863, p. 281, Pl. 12, Fig. 4.

*Columbella regulus* Souverbie in Souverbie & Montrouzier, 1864, p. 41; Brazier, 1879, p. 189; Hervier, 1900, p. 337.

*Columbella (Anachis) goollandi* Brazier, 1874, p. 671, Pl. 83, Figs 15, 16; Brazier, 1877, p. 229.

*Columbella (Anachis) regulus* Brazier, 1877, p. 228.
pars *Columbella atrata*, Tryon (non Gould, 1860), 1883, p. 169, Pl. 30, Fig. 12. *Columbella gowlandii*, Tryon, 1883, p. 170, Pl. 57, Fig. 21. *Columbella (Seminella) atrata*, Kobelt (non Gould, 1860), 1897, p. 219, Fig. 5. *Columbella (Anachis) punila*, Kobelt, 1897, p. 258, Pl. 34, Figs 13-14. *Zafra regular*, Hedley, 1915, p. 740, Pl. 83, Fig. 17; Cerohorsky, 1972, p. 138, Pl. 47, Fig. 1. *Columbella (Seminella) gowlandii*, Dautzenberg, 1929, p. 419. *Columbella (Seminella) regulas*, Dautzenberg, 1929, p. 419. *Zafra punila*, Habe, 1975, p. 86, Pl. 28, Fig. 5.

Description. Shell small, solid, elongate-fusiform. Protoconch: conical, of about 3 convex whors; suture moderately impressed; last 2 whors with 2 weak subsutural threads; below the spiral threads, very short prosoclone, spirally arranged, markings; protoconch clearly demarcated from teleconch by a deep, narrow sinus.

Teleconch: of about 4, plano-convex, whors; suture narrowly channelled; sculpture of closely-spaced, rounded, axial ribs, with equal, smooth, interspaces; last quarter of last whorl mostly lacking the axial ribs; one, moderately strong, spiral groove just below the suture, intersecting the uppermost part of the axial ribs, giving the adapical part of the whors a margined appearance; base of last whorl with about 8 spiral grooves; axial ribs on last whorl vanishing towards the base.

Aperture: narrow, peristome continuous; outer lip not thickened; inside with 4 to 6 denticles, the anterior ones mostly indistinct; inner lip thin, with some weak plications, corresponding with the spiral cords on the base.

Colour: variable; usually uniformly chestnut brown coloured; shell sometimes yellowish with one chestnut brown spiral band on the spire whors and with 2 bands on the last whorl.

Radula: each radular row consisting of a subrectangular median tooth, flanked at each side by one sigmoid tricuspid tooth; 2 distal cusps of the latter sharp, proximal projection subtriangular.

Material. Type material: *Columbella gowlandii* Brazier: 1 syntype in B.M.N.H., Eclipse I. (Reg. no. 75.5.28.1).


Remarks. *Zafra minuscus* (Gould) is a dimorphic species with respect to the colour pattern; the lectotype of *Columbella (Anachis) minuscus* Gould, represents the uniformly dark brown coloured morph; *C. gowlandii* Brazier represents the morph with the yellowish shell and with a narrow, dark brown, spiral band on the whors. In nature, hybrids between both morphs exist.

![Image of Z. minuscus radula](image-url)
Columbella pumila Dunker is very probably a synonym of C. minuscule, but this needs to be confirmed. If C. pumila Dunker may prove conspecific with C. minuscule, the former becomes both a subjective senior synonym and a senior homonym of Columbella pumila Souverbie; the latter is without any doubt conspecific with C. minuscule; Souverbie (1864) proposed the replacement name C. regula for C. pumila Souverbie.

Z. minuscule differs from Columbella atrata Gould, 1860 from Hong Kong in having more closely-spaced and less prominent axial ribs and in having a less swollen last whorl.

Zafra troglodytes (Souverbie, 1866) (Figs 5, 6; Pl. C, 4; Pl. D, 7)
Columbella troglodytes Souverbie in Souverbie & Montrouzier, 1866, p. 145, Pl. 6, Fig. 4; Tryon, 1883, p. 165, Pl. 56, Fig. 89; Hervier, 1900, p. 374.
Citharopsis ornata Pease, 1868a, p. 97, Pl. 11, Fig. 19.
Columbella (Anachis) troglodytes, Taiparone-Canefri, 1877, p. 279.
Columbella garretii Tryon, 1883, p. 166, Pl. 56, Fig. 95.
Columbella (Anachis) sinensis Sowerby G.B., 1894, p. 154, Pl. 12, Fig. 5.
?Columbella (Seminella) garretii, Kobelt, 1897, p. 223, Pl. 30, Fig. 13.
Columbella succinea Hervier, 1900, p. 375, Pl. 14, Fig. 5.
Columbella obesa Hervier, 1900, p. 376, Pl. 14, Fig. 6.
?Columbella (Seminella) selaphora Melvill & Standen, 1901, p. 406, Pl. 26, Fig. 7.
Zafra troglodytes, Tomlin, 1926, p. 293; Cernohorsky, 1972, p. 138, Pl. 41, Fig. 8.
Columbella (Seminella) troglodytes, Dautzenberg, 1929, p. 419; Dautzenberg & Bouge, 1933, p. 226.
Columbella (Seminella) garretii, Dautzenberg & Bouge, 1933, p. 219.
Anachis sinensis, Yen, 1942, p. 228, Pl. 22, Fig. 153.
Zafra sinensis, Maes, 1967, p. 134; Habe, 1975, p. 86, Pl. 28, Fig. 9.

<p>| Table 3. Shell data of Zafra troglodytes. |
|-----------------|-----|-----|-----------------|--------------|</p>
<table>
<thead>
<tr>
<th>T (mm)</th>
<th>L (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on last whorl</th>
<th>No. of whorls</th>
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<tr>
<td>2.75</td>
<td>1.41</td>
<td>1.28</td>
<td>15</td>
<td>3.25</td>
</tr>
</tbody>
</table>

Figures 5-6. Z. troglodytes: 5. Front view of shell, W of Hansa Point, PNG; scale 1 mm; 6. Radula (three median and three lateral teeth), Komuna Point, PNG; scale 0.01 mm.

Description. Shell small, elongate conical.

Protoconch: of three and a half whors; nuclear whorl finely granulated; remaining whors strongly angulate, with a sharp, median carina and with weak granules throughout; suture impressed; protoconch clearly demarcated from teleoconch.

Teleoconch: of three and a half to 4, slightly convex, whors; suture narrowly channelled; whors with prominent, rounded, axial ribs (14-16 on last whorl); interspaces smooth, moderately deep, equal or slightly narrower than axial; one spiral groove, just below the suture, intersecting the subsutural part of the axial ribs, forming a subsutural row of low nodules; last whorl slightly to moderately contracted near the base; base with about 8 strong spiral cords; axial ribs on last whorl vanishing on abapical third.

Aperture: narrow; outer lip slightly thickened externally, inside with 5 to 9 denticles; inner lip thin, columella almost straight, with some plications, corresponding with the spiral sculpture on the shell base; posterior sinus shallow; anterior canal short.
Colour: protococonch opaque white; telecoconch subpellucid, greyish; early whorls with one broad, amber coloured, spiral band on the submedian part of the whorls and with reddish brown markings just above the spiral band; last whorl with one median and one submedian amber coloured band; reddish brown markings above the median spiral band and on the shell base.

Radula: each radular row consisting of a subquadrangular median tooth, flanked at each side by one tricuspid lateral tooth; the uppermost cusp of the latter sharp, the median hooked, the lowest one subtriangular.

Material. Type material: *Anachis ornata* Pease: 9 syntypes in M.C.Z. (Reg. no. 49994), Tahiti; *Columbella sinensis* Sowerby: 3 syntypes in B.M.N.H. (Reg. no. 95.4.29, 143-5), Hong Kong; *Columbella (Seminella) selasphora* Melvill & Standen, holotype in B.M.N.H. (Reg. no. 1901, 12.9.39), Karachi.


Remarks. We did not examine the type material of *Zafra troglodytes* (Sowerby), but both the original description and illustration of the species agree very well with the PNG specimens and cannot be applied to any other known species.

*Z. troglodytes* shows considerable geographic and intrapopulation variation. The predominant morph encountered in PNG, is indistinguishable from the typical *Z. troglodytes* from Lifu. In some specimens from PNG, the last whorl is strongly inflated and the brown markings are lacking; this morph strongly resembles *Columbella obesula* Hervier. Some specimens from PNG and from Lifu, however, exhibit intermediate characters between the typical *Z. troglodytes* and *C. obesula*; accordingly both species are considered subjective synonyms.

*Columbella succinea* Hervier from Lifu is an intermediate morph between *Z. troglodytes* and *C. obesula*, having a semitransparent shell with spirally arranged, opaque white spots, just below the suture; because of the intermediate characters, I consider *C. obesula* also a subjective synonym of *Z. troglodytes*.

In *C. troglodytes* var. *fulvastra* Hervier, from Lifu, the axial ribs are more numerous and less prominent than in the typical *Z. troglodytes*, the subsutural groove is lacking, the suture is not channelled and the shell is brown coloured with white spots just below the suture; because of its markedly different shell characters and colour pattern, *C. troglodytes* var. *fulvastra* must be considered a distinct species. The specimens, recorded from Easter Island by Rehder (1880) as *Seminella cf. ornata* (Pease, 1868) are probably conspecific with this species.

The syntypes of *Columbella sinensis* Sowerby from Hong Kong, have a somewhat less channelled suture and a shorter spire than *Z. troglodytes*, but are otherwise indistinguishable from the latter species and accordingly I consider *C. sinensis* a junior subjective synonym of *Z. troglodytes*.

The syntypes of *Citharopsis ornata* Pease from Tahiti are indistinguishable from the predominant morph encountered in PNG, and is therefore considered a subjective junior synonym of *Z. troglodytes*.

The holotype of *Columbella (Seminella) selasphora* Melvill & Standen (in B.M.N.H.) from Karachi closely resembles *Z. troglodytes*, but is unfortunately an immature specimen. In the Dautzenberg collection are 7 specimens labelled 'Columbella selasphora, Karachi', which agree well with the syntype; they differ from *Z. troglodytes* in the axial ribs on the last whorl vanishing below the periphery and in the last quarter of the last whorl being smooth; the colour pattern is similar to *Z. troglodytes*, apart from some zigzag markings on the last quarter of the last whorl, which are absent in *Z. troglodytes*.

*Pyrene vercoi* Thiele from Nias I. seems to be very similar to *Z. troglodytes*, but we did not examine the type material, and the original description and illustration are too vague to permit recognition of the species.

*Z. troglodytes* is superficially similar to *Columbella habajimana* Pilsbry, 1904 from Bonin I., but differs in having more prominent axial ribs, in having more attenuated shell extremities, in the sutures being narrowly channelled and in having a narrower aperture; furthermore, *C. habajimana* lacks the subsutural spiral groove on the whorls of the telecoconch and the carina on the whorls of the protoconch.

*Z. troglodytes* is superficially similar to *Z. hervier* Pace, but differs in colour pattern and in apertural characters (see under *Z. hervier*).

*Zafra ulinganensis* nov. spec. (Fig. 7; Pl. A. 1; Pl. B. 4; Pl. D. 9)

*Derivatio nominis.* Named after Ulingan Harbour, the type locality.

*Type-locality.* Ulingan Harbour (4°30'S, 145°26'E), Madang Province, Papua New Guinea; reef flat, inside the bay, in the intertidal zone (station PNG81/475).

*Holotype.* Adult shell with soft parts (IG 26.373/414), K.B.I.N.

*Paratypes.* 1 adult shell with soft parts (PNG81/475) and 3 juvenile shells with soft parts (PNG81/475) in K.B.I.N. (IG 26.373/415); 1 adult shell with soft parts (PNG81/475) in A.M.
Figure 7. *Z. ulinganensis* nov.sp.: radula (three median and two lateral teeth), Uilingan Harbour, PNG. Scale 0,01 mm.


Scale bars: 1, 3, 4, 5, 6: 1 mm; 2: 0,5 mm.


Scale bars: 1 mm.


Scale bars: 1 mm.


Scale bars: 0,02 mm. 1, 2, 3, 4, 6, 7, 9, 11: bar A; 4, 8, 10: bar B.
Table 4. Shell data of Zafra ulingensis nov.sp.

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<th>Lₜ (mm)</th>
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</table>

Diagnosis. Shell small, broadly conical, with one broad spiral band on the spire whorls and with two bands on the last whorl.

Description. Shell small, broadly conical.

Protoconch: of two and a half whorls; nucleus and first whord smooth, last one and a quarter whord with a weak median carina and with very weak granules throughout; suture moderately impressed.

Teleoconch: of about 4, almost flat-sided, moderately shouldered whords; suture shallow; sculpture of moderately strong, well rounded, axial ribs, with equal, smooth interspaces; one spiral groove, just below the suture, intersecting the submutual part of the axial ribs, forming a submural row of low nodules; last whord moderately broad, slightly contracted at the base; base of last whord with about 8 prominent spiral cords, the posterior ones intersecting the abapical part of the axial ribs.

Aperture: narrow, outer lip thin, inside with about 6 weak denticles, the posterior ones more prominent than the anterior ones; anterior canal very short, weakly twisted dorsally; inner lip thin, with about 5 plications, corresponding with the spiral cords on the shell base.

Colour: protoconch and first whord of teleoconch chestnut-brown; subsequent whords of spire with adapical one third yellowish and abapical two thirds chestnut-brown; last whord yellowish, with one, moderately broad chestnut-brown spiral band just above the periphery, and with one additional, somewhat narrower, spiral band just above the spiral cords on the shell base; 4 zigzag axial bands, running from the narrow spiral band to the anterior end of the shell.

Radula: each radular row consisting of a subquadrangular median tooth, flanked at each side by one tricuspid lateral tooth; uppermost cusp of the latter sharp, the median weakly hooked, and the lowest cusp sharp and moderately hooked downwards.
Material. Type material (PNG81/475); PNG81/529: 1 ad. (Id: 1/0).

Distribution. Northern Coast of Papua New Guinea.

Remarks. Zafra ulinganensis nov.sp. is similar to Z. troglodytes Souverbie, but differs principally in colour pattern and in the whorls of the protoconch being not angular.

Z. ulinganensis nov.sp. is of similar colour pattern to Columella pygmaea Sowerby, from St. Helena, from which it differs in being much smaller and in having a proportionally wider aperture.

Z. ulinganensis nov.sp. is very similar to Z. semicartiata nov.sp. and is contrasted under that species.

Zafra semicartiata nov.sp. (Fig. 8; Pl. C, 7; Pl. D, 6)

Derivatio nominis. Referring to the clathrate sculpture on the apical half of the last whorl.

Type-locality. Suaru Bay (4°22'S, 145°6'E), Madang Province, Papua New Guinea; reef flat at the underside of coral boulders (station PNG81/223).

Holotype. Adult shell with soft parts (IG 26.373/412), K.B.I.N.

Paratypes. 11 adult shells with soft parts (PNG81/223) and 7 juvenile shells with soft parts (PNG81/223) in K.B.I.N. (IG 26.373/413); 1 adult shell with soft parts (PNG81/223) in A.M.

Diagnosis. Small species with a clathrate sculpture on the apical half of the last whorl.

Description. Shell small, almost biconical.

Protoconch: conical; of 2 1/2 convex whors, the last one weakly angulate, with a weak carina on the adapical 1/3; whors with irregular, microscopic pustules; suture moderately impressed; protoconch demarcated from teleoconch by a deep sinus.

Teleoconch: of about three and a half, almost flat-sided, weakly shouldered whors; last whorl moderately globular, suture shallow, slightly undulate; sculpture of prominent, rounded axial ribs, with equal or slightly narrower, deep and smooth interspaces; one weak spiral groove, just below the suture, intersecting the adapical part of the axial ribs; anterior half of last whorl with strong spiral grooves, the adapical ones widely spaced, intersecting the adapical part of the axial ribs, forming a clathrate sculpture; spiral grooves becoming narrower and more closely-spaced near the anterior end of the shell.

Aperture: narrow; outer lip thickened externally, inside with 5 to 7 strong teeth, the posterior ones more prominent than the anterior ones; posterior sinus moderately deep; inner lip thin, with about 4 denticles; columella straight; anterior canal very short, hardly twisted dorsally.

Colour: protoconch brown; teleoconch with brown coloured interspaces be-

Table 5. Shell data of Zafra semicartiata nov.sp.

<table>
<thead>
<tr>
<th></th>
<th>L (mm)</th>
<th>L' (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on last whorl</th>
<th>No. of whors</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.39</td>
<td>1.32</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>Paratypes</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.M.</td>
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<td>1.32</td>
<td>1.28</td>
<td>18</td>
<td>3</td>
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<tr>
<td>K.B.I.N.</td>
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<tr>
<td>(IG 26.373/413)</td>
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<td>1.35</td>
<td>1.33</td>
<td>17</td>
<td>3.25</td>
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<td>17 juv.</td>
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<td>1.16</td>
<td>17 juv.</td>
<td>3</td>
</tr>
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<td>2.52</td>
<td>1.21</td>
<td>1.22</td>
<td>16</td>
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</tr>
<tr>
<td></td>
<td>2.52</td>
<td>1.18</td>
<td>1.19</td>
<td>16 juv.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2.49</td>
<td>1.24</td>
<td>1.21</td>
<td>17</td>
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<tr>
<td></td>
<td>2.49</td>
<td>1.25</td>
<td>1.13</td>
<td>17</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 8. Z. semicartiata nov.sp.: radula (three median and one lateral tooth), Suaru Bay, PNG. Scale 0.01 mm.
tween the axial ribs; the axial ribs with white hexagonal spots and brown coloured between the white spots; anterior canal white.

Radula: each radular row consisting of a subrectangular median tooth, flanked at each side by one tricuspid tooth; two uppermost cusps of the latter sharp, the basal one sharp and hooked downwards.

**Material.** The type-material and 1 adult shell with soft parts from PNG81/26; Lifu: 26 specimens (Coll. Dautzenberg, leg. Goubin).

**Distribution.** Northern Coast of Papua New Guinea and Lifu, New Caledonia.

**Remarks.** *Zafra semicatariata* nov.sp. is probably conspecific with *Columella oselmona* Duclos var. *minima* Hervier, from Lifu; Hervier's description agrees very well with our new species and in the Dautzenberg Coll., there are about 20 specimens from Lifu, which are indistinguishable from the PNG specimens; but without seeing the type material of Herier's variety *minima*, we cannot confirm the identification. *C. oselmona* Duclos is similar to *Z. semicatariata* nov.sp. in colour pattern, but differs in having a more elongate spine and in being much larger than *Z. semicatariata* nov.sp. (7.2 mm vs. less than 3 mm).

*Z. semicatariata* nov.sp. is similar to *Columella brevissima* Hervier in colour pattern, but differs in protoconch facies and in lacking the spiral sculpture on the spire whors and on the adacipal half of the last whorl.

*Z. semicatariata* nov.sp. differs from *Z. ulinganensis* nov.sp. in colour pattern and in having a cleftate sculpture on the adacipal half of the last whorl.

**Zafra brevissima** (Hervier, 1900) (Figs 9, 10; Pl. C, 5; Pl. D, 5)

*Columella brevissima* Hervier, 1900, p. 372, Pl. 14, Fig. 10.

**Description.** Shell small, biconical.

Protoconch: narrowly conical, of two and a half strongly convex whors; suture strongly impressed; last whorl with a strong median carina; protoconch demarcated from teleoconch by a weak sinus.

Teleoconch: of about 4, planoconvex whors; last whorl subglobose; whors moderately shouldered, suture impressed; sculpture of strong, rounded axial ribs, varying from 16 to 18 on the last whorl, crossed by somewhat less prominent, flat-topped spiral ribs; intersections between axial and spiral ribs nodular; last whorl with about 10 spiral ribs on adacipal two thirds and with about 8 spiral cords on adacipal one third; axial ribs on last whorl evanescent on adacipal one third; subsutural row of nodules on last whorl more prominent than the remaining ones; spiral ribs on early whors of teleoconch varying from 3 to 4.

Aperture: narrow; outer lip hardly thickened externally, thickened within with about 5 denticles; columella almost straight; inner lip thin; anterior canal very short, weakly twisted dorsally; posterior sinus shallow.

Colour: protoconch chestnut-brown; teleoconch chestnut-brown with pale brown axial ribs; one narrow, white subsutural spiral band on the last whorl; tip of anterior canal white.

Figures 9-10. *Z. brevissima*: 9. Front view of shell, Tobinam Point, PNG; scale 1 mm; 10. Radula (two median and two lateral teeth), Tobinam Point, PNG; scale 0.01 mm.

Radula: each radular row consisting of a subquadrangular median tooth, flanked at each side by one tricuspid lateral tooth; two uppermost cusps of the latter sharp, the basal one subtriangular.

**Material.** PNG-material: PNG81/400: 1 juv. (l/d:1/0), 8 ad. (l/d:8/0); PNG81/418: 1 juv. (l/d:1/0); PNG81/421: 1 juv. (l/d:0/1), 3 ad. (l/d:3/0); PNG81/474: 4 ad. (l/d:4/0); PNG81/478: 2 ad. (l/d:2/0).

**Distribution.** New Caledonia (type-locality of *Columella brevissima*; Coll. Dautzenberg, leg. Goubin), Northern Coast of Papua New Guinea.

**Remarks.** *Zafra brevissima* is superficially similar to *Z. semicatariata* nov.sp. and is contrasted under that species.

*Z. brevissima* is similar to *Columella clathrata* Brazier, 1877, but differs in having a more elongated shell, in having a less contracted shell base and in protoconch facies.

*Hedley* (1913) proposed a new subgenus *Zafra* (*Retzaafra*) for *Pyrene gemmiformis*. *Zafra* *mirtiformis* *A.Adams*, the type
Table 6. Shell data of *Zafra brevissima*.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>Lbars (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on last whorl</th>
<th>No. of whorls</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.06</td>
<td>1.56</td>
<td>1.44</td>
<td>17</td>
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<td>2.81</td>
<td>1.47</td>
<td>1.30</td>
<td>17</td>
<td>3.5</td>
</tr>
</tbody>
</table>

species of the genus *Zafra*, in having a clathrate sculpture on the whorls of the teleoconch; the remaining shell features are otherwise typical of *Zafra* s.s., so that the differences in shell sculpture does not seem sufficient to warrant the recognition of *Reitza* as a distinct subgenus.

**Genus Seminella Pease, 1868**

*Seminella* Pease, 1868: p. 233. Type species: *Cithara varia* Pease, 1860; by monotypy.

**Remarks.** *Seminella* is very similar to *Zafra* A.Adam, 1860 and is contrasted under that genus.

*Seminella peasei* (von Martens & Langkavel, 1871) (Fig. 11; Pl. B, 3; Pl. D, 11) ?Columbella atomella Duclos, 1840, Pl. 11, Figs 5, 6. *Columbella virginea* Gould (non Duclos, 1846), 1860, p. 335; Gould, 1862, p. 131; Tryon, 1883, p. 160; Johnson, 1864, p. 168, Pl. 8, Fig. 16; Kay, 1979, p. 270, Fig. 93 O (non fig. 93 D as indicated); *Cithara varia* Pease (non Sowerby, 1832), 1860, p. 147; Carpenter, 1865, p. 516; Pease, 1867, p. 233; Kay, 1963, p. 33, Pl. 10, Fig. 13. *Citharopsis gracilis* Pease (non C.B.Adam, 1852), 1868a, p. 97, Pl. 11, Fig. 20. *Columbella (Anachis) nana* Dunker (non Duclos, 1846), 1871, p. 157. *Columbella (Seminella) peasei* Martens & Langkavel, 1871, p. 23, Pl. 1, Fig. 17; Kobelt, 1897, p. 240, Pl. 32, Figs 12, 13; Hervier, 1900, p. 368. *Zafra purpurea* H.Adam, 1875, p. 206, Pl. 23, Fig. 3. *Columbella peasei*, Tryon, 1883, p. 166. *Columbella gracilis*, Tryon, 1883, p. 167, Pl. 56, Fig. 94 (non Fig. 95 as erroneously indicated). ?Columbella nana*, Tryon, 1883, p. 172. ?Columbella (Seminella) nana*, Kobelt, 1897, p. 328.

Figure 11. *Seminella peasei*: radial (one median and one lateral tooth), Laijg L, PNG. Scale 0.01 mm.

Table 7. Shell data of *Seminella peasei*.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>Lbars (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on penultimate whorl</th>
<th>No. of whorls</th>
</tr>
</thead>
<tbody>
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<td>3.10</td>
<td>1.32</td>
<td>1.38</td>
<td>18</td>
<td>3</td>
</tr>
</tbody>
</table>


**Description.** Shell minute, elongate, biconical.

Protoconch: of three and a half whors; initial whorl with microscopic pustules; remaining whors with a strong median carina and with two subutural spiral rows of moderately strong, sharp granules; narrow, sometimes interrupted, inequally spaced, axial threads, running from carina to the abapical suture; protoconch clearly demarcated from teleoconch by a deep sinus.

Teleoconch: of about three and a half, weakly convex whors, sculptured with prominent, rounded axial ribs, with equal to somewhat narrower interspaces; one strong spiral groove just below the suture, intersecting the adapical part of axial ribs, forming strong nodules and giving the whors a margined appearance; remaining part of the whors with very weak to moderately strong, closely-
spaced, spiral grooves; last whorl with about 10 moderately strong spiral cords on the abapical third; axial ribs on last whorl vanishing on the abapical third; suture narrowly channelled.

Aperture: very narrow, moderately high; outer lip weakly thickened externally, within with about 10 weak denticles; columella almost straight, with one strong oblique groove; anterior canal very short, weakly twisted dorsally; posterior sinus shallow.

Colour: variable; predominant form with a semitransparent shell with opaque white spots or with chestnut brown spiral lines.

Radula: each radular row consisting of a subrectangular rachidian tooth, flanked at each side by one tricuspid lateral tooth; uppermost cusp of the latter sharp, weakly hooked; basal cusp subtriangular.

**Material.** Type material: *Columbella atomella* Duclos: 9 syntypes in M.N.H.N. (no information about type-locality); *Cythara varius* Pease: lectotype in B.M.N.H. (Reg. no. 1962782), Hawaii; *Citharopsis gracilis* Pease: syntype in A.N.S.P. (Reg. no. 16921), Tuamotu.

PNG material (live/dead ratio not determined, except where indicated): PNG77/37: 1 ad; PNG77/94: 6 juv, 6 ad; PNG77/95: 2 juv; PNG77/Sed,107: 10 juv, 5 ad; PNG77/120: 2 ad; PNG77/225: 12 juv, 3 ad; PNG77/234: 2 ad; PNG77/260: 1 juv; PNG78/70: 1 ad (l/d=1.0); PNG78/123: 3 juv (l/d=3.0), 3 ad (l/d=3.0); PNG78/131: 1 juv (l/d=1.0), 4 ad (l/d=4.0); PNG78/158: 3 juv (l/d=3.0), 1 ad (l/d=1.0); PNG78/174: 5 juv, 5 ad; PNG78/225: 3 juv (l/d=3.0), 4 ad (l/d=4.0); PNG79/349: 1 juv (l/d=0.1), 6 ad (l/d=0.6); PNG81/410: 1 ad; PNG81/441: 1 ad.


**Remarks.** In the M.N.H.N., Paris, there are nine specimens labelled *'Columbella atomella* Duclos, 1840; syntypes*: one specimen resembles strongly the original figure of *C. atomella*, but it is worn and without protoconch; the PNG specimens are similar to this specimen, but because of the poor condition, the identification remains tentative. The remaining eight syntypes belong to a quite different species.

The specimens from PNG are indistinguishable from the syntype of *Citharopsis gracilis* Pease and from the lectotype of *Cythara varia* Pease; the lectotype of *Columbella virginiae* Gould was figured by Johnson (1964: Pl. 8, Fig. 16) and is also indistinguishable from the PNG specimens.

We have not seen the type material of *Columbella (Seminella) peasei* Martens & Langkavel, but judging from the original description and illustration and because there are actually no strictly similar species in Hawaiian waters, which is the type-locality of *C. peasei*, we have no doubt that the PNG specimens are conspecific with *C. peasei*.

The PNG specimens agree well with the original description and illustration of *Columbella nanisca* Hervier; we did not examine the type material of the latter species, but there seems to be no doubt about its identity; moreover, we have seen many specimens from Lifu, the type-locality of *C. nanisca*, which were identified by Hervier as *'C. nanisca'* (Coll. Dautzenberg) and which are indistinguishable from the PNG specimens.

The PNG specimens agree well with the original description of *Columbella (Anachis) nanisca* Dunker, but because we have not seen the type material of the latter, and because the original description was not accompanied with an illustration of the species, we cannot give any comment on their true identity.

Judging from the original description and illustration, *Zafra purpurea* H.Adam's from the New Hebrides, seems to be conspecific with the PNG specimens, but because we have not seen the type material and because no material from the type-locality was available for this specimen, the inclusion of this species in the synonymy is only tentative.

The syntypes of *Columbella comista* Melvill, 1906, from the Gulf of Oman, are very similar to *S. peasei*, but differ in having less prominent axial ribs and in being porcelaneous white coloured.

*S. peasei* is superficially similar to *Columbella dautzenbergi* Hervier, 1900 in shell form and apertural features, but differs in having axial ribs on the whorls of the teleoconch, instead of being smooth, and in having weak denticles on the inside of the outer lip, which are absent in *C. dautzenbergi*; the latter is a junior subjective synonym of *Columbella (Asteris) laeta* Brazier, 1877 from Darnley Island (Torres Strait).

**Genus Pyreneola Iredale, 1918**

*Pyreneola* Iredale, 1918: p. 31. Type-species: *Columbella abyssicola* Brazier, 1877; by original designation.

**Remarks.** Although the type-species *C. abyssicola* is generally similar to *Zafra miriformis* A.Adam's, the type-species of the genus *Zafra*, the former differs mainly in having a smooth shell surface instead of being axially ribbed. More detailed anatomical studies, however, are required to show if *Pyreneola* can be maintained as a separate genus.

*Pyreneola abyssicola* (Brazier, 1877) (Figs 12, 13; Pl. A, 2; Pl. D, 2)
*Pyreneola (Anylca) abyssicola* Brazier, 1877, p. 232.
*Pyreneola abyssicola*, Tryon, 1883, p. 141, Pl. 51, Fig. 65.
*Pyreneola (Mitrella) semipicta* Sowerby, 1894, p. 154, Pl. 12, Fig. 3.
Columbella (Mitrella) abyssicola, Kobelt, 1897, p. 215, Pl. 29, Fig. 16.
Columbella melvilli Hedley, 1899, p. 463, Fig. 38.
Columbella subphilodicia Hervier, 1900, p. 333, Pl. 13, Fig. 2.
Pyrene abyssicola, Hedley, 1907, p. 509, Pl. 19, Figs. 40-43; Thiele, 1930, p. 583.
?Columbella delineata Thiele, 1925, p. 177, Pl. 31, Fig. 10.
Pyreneola abyssicola, Habe, 1975, p. 87, Pl. 28, Fig. 12.

Description. Shell smooth, semitransparent; almost biconical. Protoconch: broadly conical, of about 3 whorls; nucleus and first postnuclear whorl smooth, remaining whorls with a weak median thread; protoconch well demarcated from teleoconch by a deep sinus. Teleoconch: of about 8, almost flat-sided, smooth whorls; base of last whorl with about 8 spiral cords; suture shallow, not impressed. Aperture: very narrow; outer lip hardly thickened externally; posterior sinus shallow; inside of outer lip with a variable number of teeth (4 to 7), the posterior ones more prominent than the anterior ones; columella weakly convex, with some denticles, corresponding with the spiral cords on the shell base; inner lip thin; anterior canal very short.

Colour: shell yellowish to pale brown, with one subsutural colourless transparent zone and with spirally arranged, brown, arrow-shaped markings below this zone; brown subrectangular markings on the submedian part of the spiral whorls; a double row of brown markings on the last whorl.

Radula: each radular row consisting of a subrectangular median tooth, flanked at each side by one sigmoid tricuspid tooth with the two uppermost cusps sharp, the basal one subtriangular.

Material. Type material: Columbella abyssicola Brazier: 31 'probable syntypes' in A.M. (Reg. no. A80; transferred from the Mac Leay Museum, Sydney, to the A.M. on permanent loan), Darnley Is, Torres Strait (Cheverton Expedition); Columbella melvilli Hedley: holotype in A.M. (Reg. no. C6023) Funafuti Lagoon, Tuvalu; Columbella semipicta Sowerby: 2 syntypes in B.M.N.H. (Reg. no. 95.4.29.137-8), Hong Kong.

PNG-material: PNG77/225: 2 juv. (1/7:7); PNG77/234: 2 juv. (1/7:7); PNG77/245: 55 ad. (1/4:3/2); PNG77/260: 2 juv. (1/4:2/0). 1 ad. (1/0:7); PNG78/150: 1 juv. (1/1:0); PNG78/199: 1 ad. (1/1:0).

Distribution. Darnley I. (type-locality of Columbella abyssicola), Hope I. (Coll. Dautzenberg ex Preston), New Caledonia (type-locality of Columbella subphilodicia), Port Curtis, N.Queensland (Coll. Dautzenberg ex Preston), Funafuti (type-locality of Columbella melvilli), Papua New Guinea (K.B.N.), Amani I., Sagami Bay, Honshu to S.China (Habe, 1975), Hong Kong (type-locality of Columbella semipicta).

Table 8. Shell data of Pyreneola abyssicola.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L₄ (mm)</th>
<th>W (mm)</th>
<th>No. of whorls</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.49</td>
<td>1.80</td>
<td>1.38</td>
<td>7.25</td>
</tr>
<tr>
<td>3.41</td>
<td>1.74</td>
<td>1.38</td>
<td>6.25</td>
</tr>
<tr>
<td>3.40</td>
<td>1.77</td>
<td>1.35</td>
<td>7.25</td>
</tr>
<tr>
<td>3.30</td>
<td>1.77</td>
<td>1.32</td>
<td>6.5</td>
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<tr>
<td>3.29</td>
<td>1.74</td>
<td>1.27</td>
<td>6.5</td>
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<tr>
<td>3.27</td>
<td>1.67</td>
<td>1.28</td>
<td>7.25</td>
</tr>
<tr>
<td>3.27</td>
<td>1.65</td>
<td>1.42</td>
<td>7</td>
</tr>
<tr>
<td>3.26</td>
<td>1.76</td>
<td>1.28</td>
<td>6.25</td>
</tr>
<tr>
<td>3.24</td>
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<td>7</td>
</tr>
<tr>
<td>3.15</td>
<td>1.65</td>
<td>1.24</td>
<td>7</td>
</tr>
<tr>
<td>3.15</td>
<td>1.62</td>
<td>1.25</td>
<td>7</td>
</tr>
</tbody>
</table>
Remarks. The PNG specimens are indistinguishable from the probable syntypes of *Columbella abyssicola* Brazier.

The holotype of *Columbella melivlli* Hedley differs only from the probable syntypes of *P. abyssicola* in having broader axial markings on the whors, but it cannot be sufficiently separated from the typical *P. abyssicola*, and accordingly *C. melivlli* is regarded as a synonym of *P. abyssicola*.

The syntypes of *Columbella semipicta* Sowerby differ only from the probable syntypes of *P. abyssicola* in having more numerous axial markings on the whors, but are otherwise indistinguishable from the latter; the colour pattern of *Columbella subphilodicia* Hervier is very similar to *C. semipicta*.

*Columbella delineata* Thiele, 1925, from the Strait of Malakka seems to be very similar to *C. abyssicola*, but this identification cannot be verified, because we did not examine the type material and because the original description and illustration are too inaccurate for species recognition.

*P. abyssicola* strongly resembles *Columbella shellstonensis* Smith, 1910, from Natal, but differs in being less fusiformly elongate and in having a different colour pattern; in *C. shellstonensis* the whors have a narrow subscutural, brown coloured, spiral band, which is sometimes interrupted, and below this band there are subquadrangular brown spots, which alternate with white spots.

The syntypes of *Columbella* (Mitrella) angasi Brazier, 1871 are similar to the probable syntypes of *P. abyssicola*, but differ in having more convex whors, in having a strongly impressed suture, in lacking the denticles on the inner lip and in the teeth on the inside of the outer lip being more prominent.

The PNG specimens show no dimorphism and the sexual dimorphism, meant by Hedley (1907: p. 510), was probably due to the presence of immature specimens in the examined material.

*Genus Mitrella* Risso, 1826


*Mitrella galaxias* (Reeve, 1859) (Pl. A, 5)

*Columbella eximia* Reeve, 1859, Pl. 35, Fig. 222.

*Columbella galaxias* Reeve, 1859, Pl. 36, Fig. 229a, b.

*Columbella (Mitrella) venulata* Sowerby, 1894, p. 153, Pl. 12, Fig. 4.

Table 9. Shell data of *Mitrella galaxias*.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L₁ (mm)</th>
<th>W (mm)</th>
<th>No. of whors</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9</td>
<td>4.6</td>
<td>2.8</td>
<td>7</td>
</tr>
</tbody>
</table>

*Columbella (Atrialia) galaxias*, Melvill & Standen, 1895, p. 108; Kobelt, 1897, p. 128, Pl. 18, Figs 17, 18.


*Pyrene venulata*, Yen, 1942, p. 227, Pl. 22, Fig. 147.

*Mitrella venulata*, Cemohorsky, 1972, p. 157, Pl. 41, Fig. 7.

Description. Shell fusiformly elongate.

Protoconch: of about 3 smooth whors; first 2 whors depressed, remaining one globose; protoconch clearly demarcated from teleoconch by a sinus.

Teleoconch: of about 7, weakly convex whors; suture not impressed; whors smooth, apart from about 10 oblique spiral cords at the base of the last whorl; last whorl strongly constricted at the base.

Aperture: narrow, outer lip with a narrow, moderately thick, external varix; posterior sinus moderately deep; inside of outer lip with 8 denticles, the anterior ones somewhat more prominent than the posterior ones; inner lip very thin; columella nearly straight and weakly denticulate; anterior canal short, narrow and weakly twisted dorsally.

Colour: protoconch milky-white; teleoconch semitransparent, apart from the two opaque white adical whors; below and above the suture of the remaining whors, irregular white spots; last three whors with interrupted brown spiral lines below the suture.

Radula: not examined.


PNG material: PNG/77/95: 1 ad. (Id/0/1).

Distribution. Papua New Guinea (K.B.I.N.), New Caledonia (Melvill & Standen, 1895; Coll. Dautzenberg), Hong Kong (type-locality of *Columbella (Mitrella) venulata*).

Remarks. The PNG specimen is identical to the holotype of *Columbella galaxias* Reeve.

The holotype of *Columbella (Mitrella) venulata* Sowerby, from Hong Kong, was figured by Yen (1942) and is indistinguishable from the holotype of *C. galaxias*.

The holotype of *Columbella eximia* Reeve (no information about the type-locality) is similar to *C. galaxias*, but differs in being less fusiform, in having a slightly wider aperture and in lacking the brown dark spiral lines. We have seen one specimen from Mauritius, which is rather intermediate between typical *M. galaxias* and *M. eximia*; the latter species may prove to be a synonym of *M. galaxias*, but because we examined too few specimens, the inclusion in the synonymy is only tentative.

*Pyrene sorongensis* van Bruggen, 1956, from Sorong (West Irian) is similar to *M. galaxias*, but differs in lacking the denticles on the outer lip, in having a
different colour pattern and in being markedly larger (length of shell: 13.5 mm vs. 8.0 mm).

*M. galaxias* is superficially similar to *M. loyaltensis* (Hervier) and is contrasted under that species.

**Mitrella loyaltensis** (Hervier, 1900) (Figs 14, 15; Pl. B, 1; Pl. D, 4)
*Columella pusilla* Pease (non Sowerby, 1844), 1863, p. 244; Kay, 1965, p. 78, Pl. 13, Figs 9, 10.
*Columella fusiformis* Pease (non Anton, 1839; non d’Orbigny, 1845), 1868b, p. 122; Martens & Langkavel, 1871, p. 22, Pl. 1, Fig. 14.
*Columella loyaltensis* Hervier, 1900, p. 347, Pl. 13, Fig. 4.
*Columella procollarum* Hervier, 1900, p. 349, Pl. 13, Fig. 5.
*Mitrella fusiformis*, Kay, 1979, p. 268, fig. 94 I (?Fig. H).

**Description.** Shell small, fusiformy elongate, strongly contracted towards the base.

Protoconch: conical, of about four to four and a half smooth whorls; protoconch clearly demarcated from teleoconch by a deep sinus.

Teleoconch: of about four to four and a half flat sided to weakly convex whorls; suture shallow; whorls smooth, apart from about 8 oblique cords on the shell base; last whorl strongly angulate.

Aperture: narrow, peristome continuous; outer lip with a thick, broad varix; inside with 6 to 8 denticles; posterior sinus wide and moderately deep; anterior canal short, narrow and weakly twisted dorsally.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L₁ (mm)</th>
<th>W (mm)</th>
<th>No. of teeth on outer lip</th>
<th>No. of whors</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.59</td>
<td>2.62</td>
<td>1.85</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>4.53</td>
<td>2.62</td>
<td>1.66</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>4.34</td>
<td>2.06</td>
<td>1.69</td>
<td>7</td>
<td>4.5</td>
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<tr>
<td>4.02</td>
<td>1.17</td>
<td>1.66</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

Colour: protoconch opaque white; teleoconch with a subsutural spiral band and with irregular opaque white axial markings below the transparent zone; one spiral row of semicircular opaque markings just above the suture.

Radula: each radular row consisting of a subrectangular median tooth, flanked at each side by one tricuspid lateral tooth; two uppermost cusps of the latter sharp, the lowest one blunt.

**Material.** Type material: *Columella pusilla* Pease: lectotype in B.M.N.H. (Reg. no. 1964302), paratype in B.M.N.H. (Reg. no. 1964303), Kingsmill Island; 7 spec. labelled "Co-Type" in M.C.Z. (Reg. no. 136617), Kingsmill Islands, ex Pease.

PNG material (only adult specimens are included, because immature specimens are indistinguishable from immature specimens of *M. galaxias* Reeve): PNG78/70: 4 ad. (Id:4/0).

**Distribution.** Kingsmill Islands (type-locality of *Columella pusilla*), Hawaii (Kay, 1979), New Caledonia (type-locality of *Mitrella loyaltensis* Hervier and *C. procollarum* Hervier; Coll. Dautzenberg ex Hervier, leg. Guobin, leg. Lambert), Papua New Guinea.

**Remarks.** The lectotype and paralectotype of *Columella pusilla* Pease are larger than the PNG specimens (7 mm vs. 4.6 mm) and have a different colour pattern, but are otherwise indistinguishable from the PNG specimens. In the M.C.Z. is a lot of seven specimens, labelled ‘*Columella pusilla* Pease’ which is conspecific with the specimens in the B.M.N.H. The name *Columella pusilla* Pease, 1863 was preoccupied by *Columella pusilla* Sowerby, 1844; therefore Pease proposed the replacement name *Columella fusiformis* Pease, 1868, which however, was also preoccupied by *Columella fusiformis* Anton, 1839 and *Columella fusiformis* d’Orbigny, 1845. Thus the first available name for this species is *Columella loyaltensis* Hervier, 1900, which has page priority over *C. procollarum* Hervier, 1900 (see below).

The PNG specimens agree well with the original description and illustration of *Columella loyaltensis* Hervier from New Caledonia. We examined much topotypic material, which was identified by Hervier as *C. loyaltensis*; these

![Image 14-15](image-url)

**Figures 14-15. Mitrella loyaltensis:** 14. Side view of shell, Laing 1, PNG; scale 1 mm; 15. Radula (one median and one lateral tooth), Laing 1, PNG; scale 0.01 mm.
specimens differ slightly from PNG specimens in having a somewhat shorter anterior canal and in having a different colour pattern, but the latter seems to be a rather variable character; the remaining characters are identical to the PNG specimens.

The PNG specimens are very similar to the holotype of _Columbella galaxias_ Reeve but differ in their less elongate spire and in being narrower.

The PNG specimens are superficially similar to the syntype of _Columbella plutonida_ Duclos, 1846 (no information about the type-locality) in shell form, but the latter is in such a poor condition that species recognition is almost impossible.

_Mitrella moleculina_ (Duclos, 1840) (Figs 16, 17; Pl. C, 6; Pl. D, 10)

_Columbella moleculina_ Duclos, 1840, Pl. 9, Figs 1, 2; Duclos in Chenu, 1858, Pl. 9, Figs 1, 2.

_Columbella (Amycla) inscripia_ Brazier, 1877, p. 230.

_Pars Columbella moleculina_, Tryon, 1883, p. 117, Pl. 47, Fig. 48 (non Fig. 49).

_Columbella moleculina_, Hervier, 1900, p. 330; Hedley, 1901, p. 124, Pl. 16, Fig. 8; ?E.A. Smith, 1910, p. 193.

_Columbella (Mitrella) moleculina_, Odner, 1917, p. 52, Pl. 2, Figs 48, 49; Dautzenberg, 1932, p. 35; Dautzenberg & Boulig, 1933, p. 221.


_Mitrella moleculina_, Habe, 1975, p. 88, Pl. 28, Fig. 27.

**Description.** Shell solid, fusiform; base truncate.

Protoconch: weakly tilted, of about 3 smooth, strongly convex whorls; last whorl strongly globose; suture deeply impressed.

Teleoconch: of about 4 smooth, flat sided to weakly convex whorls; last whorl inflated, contracted towards the base, with some weak spiral cords at the base; suture faintly impressed.

Table 11. Shell data of _Mitrella moleculina_.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L₁ (mm)</th>
<th>W (mm)</th>
<th>No. of teeth on outer lip</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.32</td>
<td>3.32</td>
<td>2.65</td>
<td>6</td>
</tr>
<tr>
<td>6.28</td>
<td>3.19</td>
<td>2.74</td>
<td>5</td>
</tr>
<tr>
<td>6.19</td>
<td>3.25</td>
<td>2.74</td>
<td>6</td>
</tr>
<tr>
<td>5.96</td>
<td>3.13</td>
<td>2.71</td>
<td>6</td>
</tr>
<tr>
<td>5.87</td>
<td>3.19</td>
<td>2.52</td>
<td>6</td>
</tr>
<tr>
<td>5.74</td>
<td>3.06</td>
<td>2.49</td>
<td>3</td>
</tr>
<tr>
<td>5.55</td>
<td>3.00</td>
<td>2.42</td>
<td>6</td>
</tr>
<tr>
<td>5.04</td>
<td>2.55</td>
<td>2.36</td>
<td>3</td>
</tr>
<tr>
<td>4.21</td>
<td>2.30</td>
<td>1.91</td>
<td>6</td>
</tr>
</tbody>
</table>

_Aperture._ Moderately wide, peristome continuous; outer lip weakly thickened externally, with a broad varix; inside of outer lip with 3 strong posterior teeth and usually with 3 weak anterior denticles, the latter sometimes lacking; inner lip thin; columella with 3 prominent denticles on the outer margin; siphonal canal narrow, very short, weakly bent; siphonal notch deep; posterior canal moderately deep.

_Colour._ Yellowish-white with a network of brown-orange lines; subsutural brown streaks alternating with white dots, and white dots above each brown streak; below these markings a network of brown lines with connected corners.

_Radula._ Each radular row consisting of a subrectangular median tooth, flanked at each side by one tricuspid lateral tooth; the uppermost cusp of the latter long and pointed, the median short, subtriangular and the lowest one slightly longer than the median, but shorter than the uppermost one.

_Material._ Type material: _Columbella moleculina_ Duclos: 6 syntypes in M.N.H.N. (locality unknown); _Columbella inscripia_ Brazier: 8 syntypes in A.M. (on permanent loan from the Mac Leay Museum, Sydney) (Reg. no. A82), Katow, New Guinea.

PNG-material: PNG77/95: 1 juv. (l/d:0/1); PNG77/107: 1 juv. (l/d:0/1); PNG78/123: 1 juv. (l/d:0/1); PNG78/131: 2 juv. (l/d:0/2), 1 ad. (l/d:0/1); PNG78/155: 1 ad. (l/d:0/1); PNG78/174: 1 ad. (l/d:0/1); PNG79/219: 1 juv. (l/d:0/1), 7 ad.

Remarks. Colomboella moleculina Duclos is well characterized by its very distinctive colour pattern. The specimens from PNG agree closely with the syntypes of C. moleculina, though the latter are in a rather poor condition. The shell shape shows some variation: the spire can be more or less elongated and in some specimens the last whorl is less inflated than in others.

The syntypes of Columbella inscripta Brazier from Katow (PNG) are indistinguishable from the syntypes of C. moleculina and accordingly C. inscripta is considered a junior subjective synonym of C. moleculina.

Tryon (1883) considers C. moleculina conspecific with C. denticulata Duclos, 1840; the syntypes of the latter are from Santa Barbara, California, and differ from C. moleculina in having a shallow and weak siphonal notch, less prominent columellar teeth and in having a weak parietal tooth, which is absent in C. moleculina; furthermore the shell colour is pale brown with large submarginal white spots in C. denticulata. We conclude that both species differ sufficiently to allow full specific differentiation.

Smith (1910) recorded C. moleculina from Natal, but without seeing specimens, we cannot confirm this identification.

Genus Zafroa Iredale, 1916.
Zafroa Iredale, 1916: p. 32. Type-species: Columbella isomella Iredale, 1916 (non Duclos, 1858) (=Columbella (Anachis) nebulousa Gould, 1860); by original designation.

Remarks. Iredale (1916) established the genus Zafroa for Colomboella isomella Duclos, which he considers synonym of Triton pusilla Pease, 1861. The type material of the former seems to be lost (PBouchet in litt.) and the original illustration, which was not accompanied by a description, is too poor for species recognition. Thus we propose to consider C. isomella a nomen dubium, and to replace C. isomella as the type-species of Zafroa by T. pusilla, which is junior synonym of Columbella nebulousa Gould, 1860.

Zafroa nebulousa (Gould, 1860) (Figs 18, 19; Pl. B, 5; Pl. D, 8)
Columbella (Anachis) nebulousa Gould, 1860, p. 333; Gould, 1862, p. 130;
Johnson, 1964, p. 115, Pl. 8, Fig. 1.
Tritonium pusillum, Martens & Langkavel, 1871, p. 4.
Columbella striataula, Tryon, 1883, p. 176, Pl. 58, Fig. 39; Hervier, 1900, p. 362.
Columbella (Seminella) striataula, Kobelt, 1897, p. 227, Pl. 31, Fig. 1.
Columbella liovanana Hervier, 1900, p. 358, Pl. 13, Fig. 6.
Columbella isomella, Hervier (non Duclos, 1858), 1900, p. 360.
Columbella isomella, Iredale (non Duclos, 1858), 1916, p. 32.
Mitrella (Zafroa) nebulousa, Cernohorsky, 1972, p. 137, Pl. 41, Fig. 4.
Zafroa liovanana, Habe, 1975, p. 87, Pl. 28, Fig. 17.
Cedaticfer nebulousa, Kay, 1979, p. 261, Fig. 92K.
?Zafroa consobrinella Rehder, 1980, p. 76, Pl. 9, Figs 12, 13.

Description. Shell elongate-ovate.

Protoconch: glassy, elongate conical, of about 4 weakly postulated, convex whorls; protoconch clearly demarcated from teleoconch by a deep sinus.

Teleoconch: of about three and a half, slightly to moderately convex whorls; suture moderately impressed; last whorl contracted towards the base; sculpture consisting of strong, rounded axial ribs, numbering from 13 to 18 on the last whorl, crossed by somewhat less prominent spiral ridges; intersection points...
Table 12. Shell data of Zafrosa nebulaosa.

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>L' (mm)</th>
<th>W (mm)</th>
<th>No. of axial ribs on last whorl</th>
<th>No. of whorls</th>
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<tbody>
<tr>
<td>6.63</td>
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<td>4.82</td>
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<td>1.88</td>
<td>16</td>
<td>3.25</td>
</tr>
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<td>4.59</td>
<td>2.65</td>
<td>1.85</td>
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<td>3.5</td>
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<td>4.40</td>
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<td>4.15</td>
<td>2.30</td>
<td>1.66</td>
<td>19</td>
<td>3</td>
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<td>4.05</td>
<td>2.36</td>
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<td>17</td>
<td>3.25</td>
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<tr>
<td>3.99</td>
<td>2.33</td>
<td>1.66</td>
<td>16</td>
<td>3</td>
</tr>
</tbody>
</table>

Remarks. The PNG specimens are indistinguishable from the lectotype of Columbella (Anachis) nebulaosa Gould, which was figured by Johnson (1964).

The holotype of Triton pusilla Pease is indistinguishable from the lectotype of C. (A.) nebulaosa and according to T. pusilla is considered a subjective junior synonym of C. (A.) nebulaosa.

Iredale (1916) considers Triton pusilla a junior synonym of Columbella isomolla Duclos, 1858; the type material of the latter seems to be lost (in lit. PBouchet). Judging from the original illustration of C. isomolla, which was not accompanied with a description, the latter differs from C. nebulaosa in being more adapically acuminate, in being less elongate and in having a higher aperture. Probably C. isomolla Duclos is conspecific with Columbella pulchella Blainville, 1829, which is a Caribbean species.

Amyclia (Astryris) striatula Dunker, 1871 is tentatively included in the synonymy, pending comparison of the type material. The original description of A. striatula agrees well with the present material, so that this species may be found to be conspecific with C. nebulaosa.

Judging from the original description and illustration and from studying topotypic material, Columbella lifouana Hervier seems to represent only a colour morph of C. nebulaosa.

Zafrosa consobarinella Rehder, 1980, from Easter Island, is very similar to the PNG specimens; we did not examine the type material of the former, but judging from the adequate description and the illustrations of this species, we believe that it is only a local morph of Z. nebulaosa.

Lachnea japonica A. Adams, 1860 is a very similar species, which differs from Z. nebulaosa in being more elongate and in having more convex whorls. The radula of L. japonica was figured by Kuroda & Habe (1954: Fig. 14) and it clearly shows the presence of a quadrangular median tooth; the latter, however, could not be found in PNG specimens, but possibly the central teeth in our radular preparations were covered by the laterals.

ACKNOWLEDGEMENTS

I am most grateful to Professor Dr L Van de Poel and to Dr J Van Goethem for critically reading the manuscript. I thank Professor Dr K Wouters for his assistance with the scanning electron microscopy. I am indebted to the following curators for providing material on loan (in alphabetical order): Dr K. Boss and staff (M.C.Z.), Dr P. Bouchez and staff (M.N.H.N.), Dr G. Davis and staff (A.N.S.P) and Dr W. Ponder and staff (A.M.). I am grateful to Dr J. Taylor and staff for the facilities made available during my stay at the British Museum (Nat. Hist.).
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