

An updated list of the recent *Bolma* species (Gastropoda: Turbinidae) with description of two new species from French Polynesia and New Caledonia

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ABSTRACT. An updated list of the hitherto known species of *Bolma* (Turbinidae, Turbininae) is given. Two species, *Bolma maestratii* spec. nov. from French Polynesia and *Bolma fuscolineata* spec. nov. from New Caledonia are described here as new. Some short comments on *Anadema caelata* (Adams & Adams, 1854) are given.

INTRODUCTION

The genus *Bolma* Risso, 1826 belongs to the Turbinidae, subfamily Turbininae (Hickman & McLean 1990; Bouchet & Rocroi, 2005). They are spread worldwide in tropical and subtropical seas, often in deep water. The shells are characterized by the following features:

The shell is minute to large, relatively thick in most species. The apex is small, glassy, the early 2 teleoconch whorls are even with the apex, forming a small plain. The juvenile shell is umbilicate, bicarinate, often with spines or protrusions on the peripheral edge also in species which have no spines or protrusions as adults. The aperture is oblique, with more or less flaring lip in adult specimens. All species with exception of *Bolma martinae* Kreipl & Alf, 2005 have no umbilicus when adult.

The sculpture is pustulate or scaly (partially with smooth spiral ridges in the subgenus *Senobolma* Okutani, 1964) often with small to very large protrusions at the peripheral edge. The sculpture is highly variable within the species and seems also to differ remarkably by bathyal range. The parietal callus deposits are frequently well developed, covering the umbilicus and often also a wide area of the base. The

operculum has a calcified pad which sometimes is ornamented with pustules.

Recent observations show that some *Bolma* species seem to be extremely variable in their shell characteristics depending on geographical and bathyal range. At first sight, these forms seem distinctive enough to be considered different species as can be seen from specimens of *Bolma guttata* (Adams, 1863) collected by the MNHN at New Caledonia. However intensive sampling suggests that they may be connected by intermediates. Research using molecular characters is ongoing at the Museum national d'Histoire naturelle, Paris to test this hypothesis. The results will be published separately.

Other observations seem to make it possible that some "species" as *Bolma henica* (Watson, 1885) could be aggregates of species which cannot be distinguished by shell characters only. As this is proved for *Astralium "rhodostoma"* (Lamarek, 1822) which is widely distributed in the the tropical West Pacific (Meyer et al., 2004), this cannot be excluded for *Bolma* species.

In their publication "A Revision of the species of *Bolma* Risso, 1826 (Gastropoda, Turbinidae)" Beu & Ponder (1979) listed 19 recent species of *Bolma* as valid:

Name	Author
<i>Bolma andersoni</i>	(E.A. Smith, 1902)
<i>B. aureola</i>	(Hedley, 1907)
<i>B. hartschi</i>	(Dall, 1913)
<i>B. exotica</i>	(Okutani, 1969)
<i>B. girgyllo</i>	(Reeve, 1843)
<i>B. guttata</i>	(Adams, 1863)
<i>B. henica</i>	(Watson, 1885)
<i>B. jaquelineae</i>	(Marché-Marchad, 1957)
<i>B. johnstoni</i>	(Odhner, 1923)
<i>B. kermadecensis</i>	Beu & Ponder, 1979
<i>B. midwayensis</i>	(Habe & Kosuge, 1970)
<i>B. modesta</i>	(Reeve, 1842)
<i>B. persica</i>	(Dall, 1907)
<i>B. recens</i>	(Dell, 1967)
<i>B. rugosa</i>	(Linné, 1758)
<i>B. somaliensis</i>	Beu & Ponder, 1979
<i>B. tamikoana</i>	(Shikama, 1973)
<i>B. tayloriana</i>	(E.A. Smith, 1880)
<i>B. venusta</i>	Okutani, 1964

Table 1. *Bolma* species listed by Beu & Ponder (1979)

During their research on *Bolma* the authors could find one additional species close to this genus from West Africa which was described as *Omphalins (Anadema) caelatus* Adams & Adams, 1854 (Figs 1-9). This species shows all features of *Bolma* but differs by having a wide (false) umbilicus when adult and

therefore is placed in the genus *Anadema*. This species is quite rare and almost always only juvenile specimens are available. Synonyms of this species are *A. macandrewii* (Mörch, 1868) and *A. granuloides* (Nordsieck, 1982).

Since 1979, 9 additional valid species have been described as new (see Table 2).

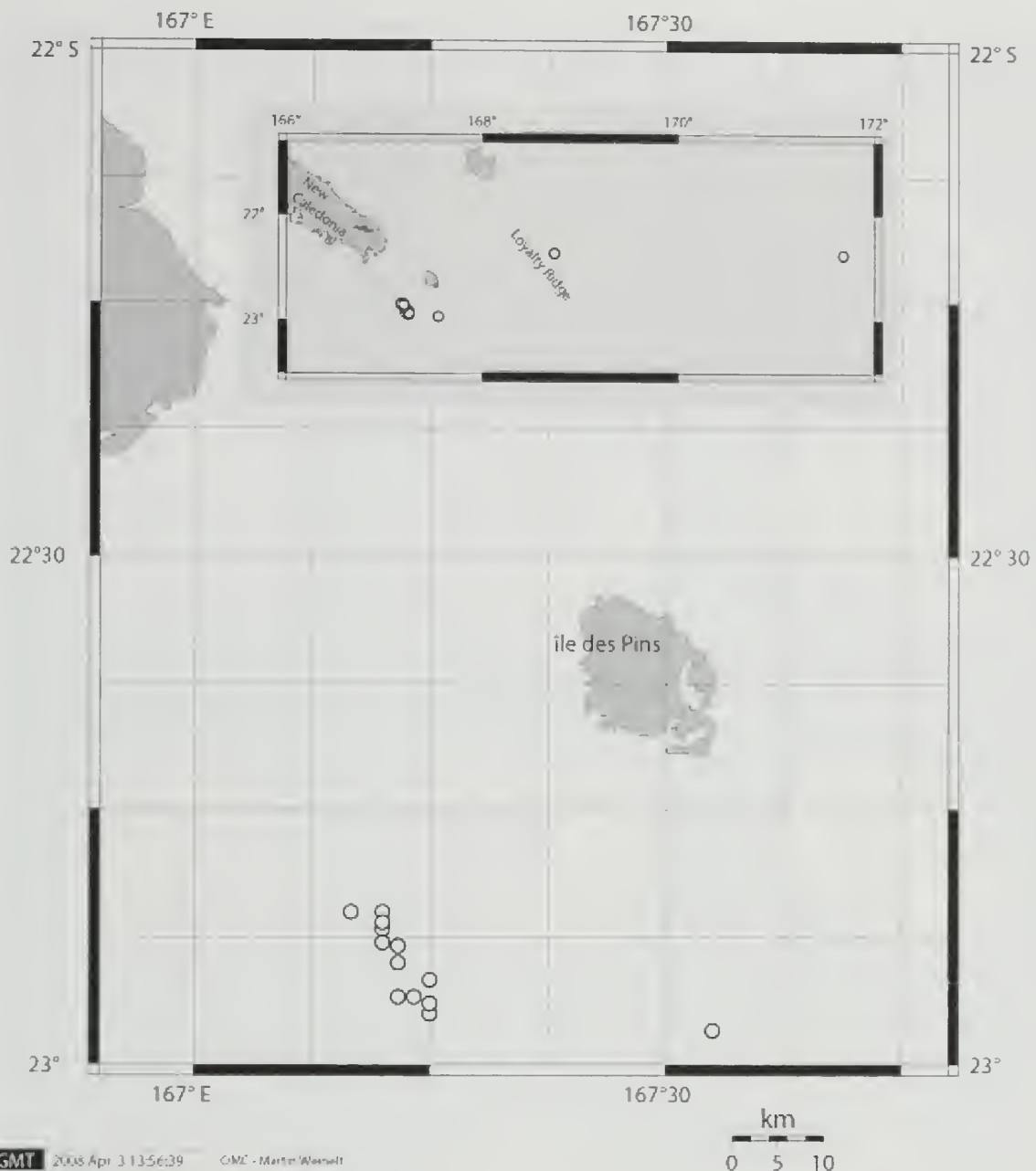
Name	Author(s)	Type-locality
<i>Bolma kitarai</i>	Kosuge, 1986	Japan
<i>B. martinae</i>	Kreipl & Alf, 2005	Papua New Guinea
<i>B. massieri</i>	Bozzetti, 1992	South Africa
<i>B. microconcha</i>	Kosuge, 1985	Philippines
<i>B. minuta</i>	Neubert, 1998	Gulf of Aden
<i>B. minutiradiosa</i>	Kosuge, 1983	Philippines
<i>B. myrica</i>	Okutani, 2001	Japan
<i>B. opaoana</i>	Bouchet & Métivier, 1983	New Caledonia
<i>B. sabinae</i>	Alf & Kreipl, 2004	Madagascar

Table 2. *Bolma* species named after 1979

Bolma sunderlandi Petuch, 1987 which was described from the Caribbean (off Roatan Island, Honduras) is not a *Bolma* but a *Homalopoma (Cantrainea)*. After Beu & Ponder (1979) there exists neither a fossil nor a recent record of *Bolma* from America. On the other side the subgenus *Homalopoma (Cantrainea)* is represented in America [*Homalopoma (Cantrainea)*

panamense (Dall, 1908) from tropical Western America].

The investigation of material from the MNHN, Paris from dredgings in the area of French Polynesia and New Caledonia yielded two new species which are described here.

**Map 1**

Region south-east of New Caledonia, locality of the dredgings of *Bolma fuscolineata* spec. nov.; the inserted map shows the locality of the dredgings of the smaller, smooth morph similar *Bolma fuscolineata* spec. nov. (on Loyalty Ridge and eastwards on New Hebrid Arc).

SYSTEMATICSFamily **TURBINIDAE**Genus *Bolma* Risso, 1826*Bolma maestratii* spec. nov.

Figs 10-12

Type material. Holotype MNHN 20799 (height 19.9 mm width: 17.5 mm).

Type locality. Rimatara, Archipel des Australes, French Polynesia. 22°26.6'S 152°49.3'W. dredged in 1200- 1226 m, N/O "Alis" campagne BENTHAUS. Stn 2021.

Description. Shell small, turbiniform, adults reaching a height of about 20 mm, medium shelled, taller than wide (h/w about 1.14). Protoconch consisting of about 1 whorl, smooth, diameter about 0.3 mm (corroded). Teleoconch of 6 whorls. First whorl flat

the following whorls sloping, convex; slightly stepped beneath the suture, periphery rounded; whole shell covered with very fine, prosocline growth lamellae. Peripheral angle well expressed from the beginning of the teleoconch, first forming a spiral ridge then from the 3rd whorl turning into a row of beads. From 2nd whorl 2 spiral rows of beads are visible, a 3rd row inserts from beginning of the 3rd whorl. 5th whorl sculptured with 4 primary and 4 interstitial rows of strong beads, body whorl with 5 primary and 5 interstitial rows of strong beads, uppermost 2 cords on shoulder slightly stronger than the others; basal angle only marked by a row of prominent beads. Base with 4 rows of prominent primary beads, interstitial rows can be present, on umbilical callus 2 or more additional rows of beads are connected to axial ridges. Suture incised and channelled at first whorls, filled with the 5th row of beads at the body whorl. Columella broadened, smooth and evenly rounded, forming a weak denticle at the base; columellar callus present, thin, covering about 1/6 of the base. Aperture round, outer lip not flaring in adult specimens. Umbilical area covered by a broad callus which fuses with the columellar callus. Basic colour of the whole shell pale pinkish, gemmulae lighter. Columellar callus pale yellow, white near columella. Columella white and nacreous, aperture nacreous within. Operculum not known.

Discussion. *Bolma somaliensis* is the only *Bolma* which also has a yellow columellar callus but it has less rounded whorls, no incised suture and an angulated periphery with small protrusions; *Bolma*

kiharai is quite similar by its form, but is smaller (14.5mm), it differs in having less rows of granules on the whorls (6 on body whorl) which all are of similar size, in having small protrusions of hollow spines at the periphery; *Bolma myrica* is smaller (12.5 mm) and also has hollow spines at the periphery, the basal angle is more expressed, columellar callus is pinkish; *Bolma midwayensis* is larger (up to 28.6 mm) and has more rows of granules on whorls (14) and base (11 - 13), the base is flatter and lighter in colour than the whorls, the basal angle is more expressed.

Range. Only known from the type locality .

Remarks. Only known from the holotype, which is a dead found, adult shell.

Etymology. The species is named after Philippe Maestrati, Museum national d'Histoire naturelle, Paris.

***Bolma fuscolineata* spec. nov.**

Figs 13-23

Synonyms. Bouchet & Métivier (1983) have figured *Bolma fuscolineata* spec. nov. as a juvenile specimen of *Bolma guttata*.

Type material. Holotype MNHN 20797 (height 9.0 mm; width 9.1 mm without spines, 10.1 mm including spines),

Paratypes MNHN 20798: Locality same as the holotype.

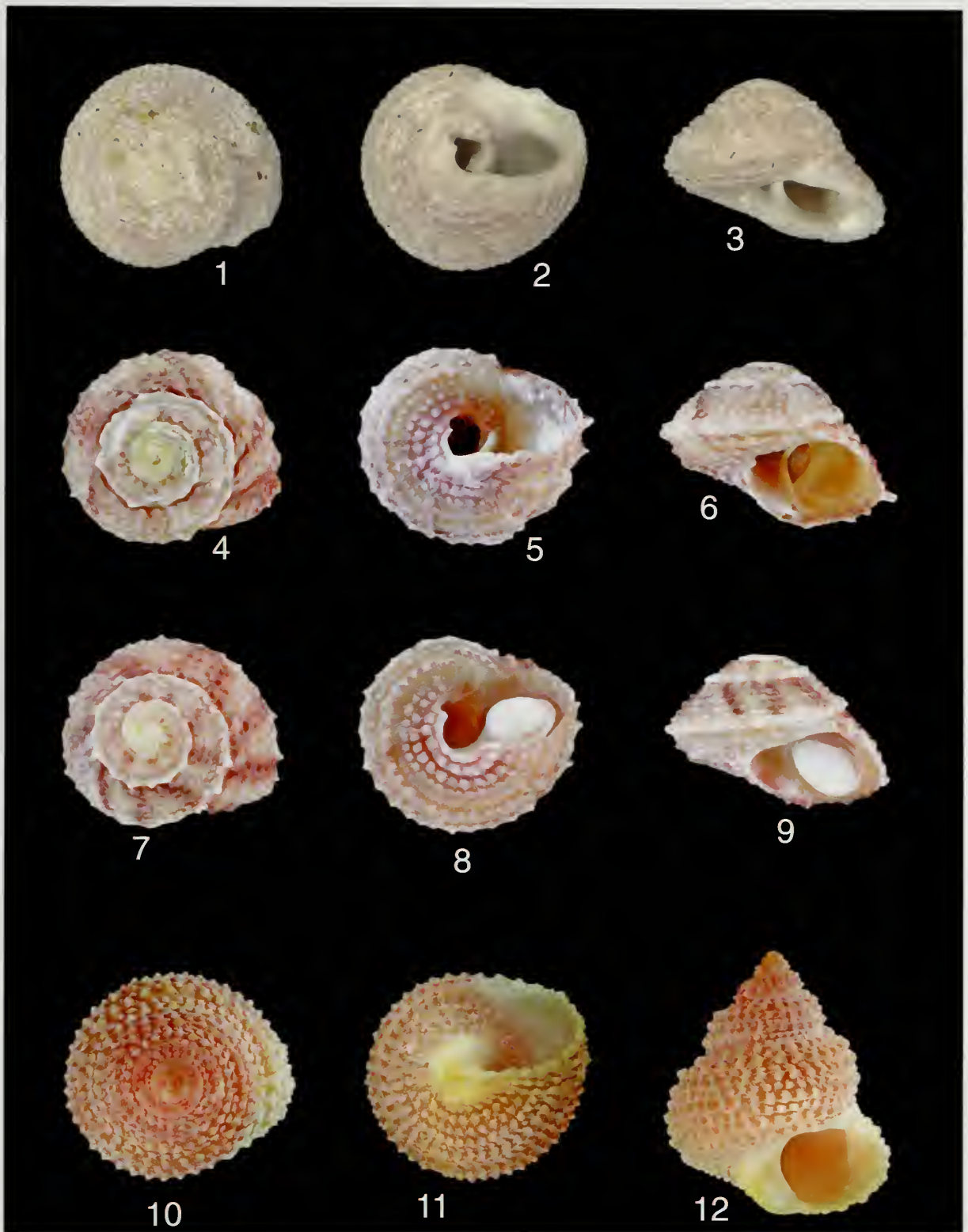
Paratypes	Height [mm]	Width [mm] including spines
1	9.4	9.6
2	7.3	7.5
3	9.0	9.4
4	9.1	9.2
5	8.5	8.9
6	9.0	9.5
7	8.6	9.1
8	8.9	9.4
9	8.6	8.9
10	7.8	8.9

All types were taken from a set of 78 specimens.

Type Locality. New Caledonia, Ile des Pins, Grand Récif Sud. SM1B 8, stations DW 197-199, 22°51/52'S - 167°12/13'E, 408-436 m.

Description. Shell minute, trochiform, adults reaching a height of about 10 mm, thin shelled and light, almost as tall as wide (h/w = 1, without spines). Protoconch white, glassy, about 1 whorl, diameter 0.25 mm. Teleoconch of 5.5 whorls. First 1.5 whorls even with the apex, forming a small plain, following whorls descending, straight-sided, sculptured with fine axial

striae. Peripheral angle well expressed from the beginning of the teleoconch, from the 2nd whorl with nodes which develop into small protrusions (about 15 - 20 on the body whorl). First 1.5 teleoconch whorls showing very fine, irregular axial riblets which turn into distinct axial folds for 1 whorl and then into 2 to 4 rows of beads, the beads closest to suture distinctly larger than the others. Basal angle more or less expressed, marked by a smooth edge. Space between protrusions and basal angle smooth. Base smooth like polished. Suture incised, forming a broad gap



Figures 1 - 12

1 - 9. *Anadema caelata* (Adams & Adams, 1854); 1 - 3. Mogador, Morocco, ex coll. Cuming (Natural History Museum, London), holotype, diameter 16.8 mm, height 11.6 mm; 4 - 9. off Dakhla, Mauritania, trawled at 60m (A. Alf collection, set no. 112133a); 4 - 6. diameter 11.1 mm, height 7.7 mm; 7 - 9. diameter 9.5 mm, height 6.8 mm.

10-12. *Bolma maestratii* spec. nov., Holotype (20799), MNHN Paris

sculptured with lamellae. Columella smooth and evenly rounded, columellar callus small, covering about 10% of the base. Aperture almost round, outer lip expanded in adult specimens. No umbilicus, but a distinct umbilical callus is present which forms a columellar tooth. Basic colour of the entire shell beige, with or without very indistinct broad purplish flames best visible between the protrusions. Base in almost all specimens with irregular, thin, brownish purple axial flames. Columella white and nacreous, aperture nacreous within. Operculum thick, almost round with a small marginal edge. Surface convex smooth to granulose. Colour pure white.

Discussion. The species shows a certain similarity to pale and high spired forms of *Bolma persica* (Dall, 1907), and to pale forms of *Bolma microconcha* Kosuge, 1985. It easily can be separated from these species by its straight sided whorls and especially by its smooth base. The base of the other 2 species is always sculptured with rows of granules. *Bolma exotica* (Okutani, 1969) and *Bolma venusta* (Okutani, 1964) also have a smooth base but a different shape (trochiform), smooth spiral ridges on the lower part of the whorls and do not show any protrusions at the peripheral angle of the body whorl (subgenus *Senobolma*). The coloration of the base is not known from any other *Bolma*-species.

Other material examined

South West île des Pins

SMIB 2, stns DW3, 22°56'S 167°15'E, 412-428 m, 2 shells; DW4, 22°53'S 167°13'E, 410-417 m, 1 shell w/o; DW5, 22°56'S 167°14'E, 398-410 m, 2 shells w/o; DW8, 22°54'S 167°13'E, 435-447 m, 2 shells, 1 w/o; DW16, 22°51'S 167°12'E, 390 m, 1 shell w/o; DW17, 22°55'S 167°15'E, 428-448 m, 2 shells.

SMIB 3, stn DW31, 22°56'S 167°13'E, 383 m, 1 shell w/o.

BATHUS 2, stn DW729, 22°52'S 167°12'E, 400 m, 4 shells, 2 w/o.

NORFOLK 1, stns DW1733, 22°56'S 167°15'E, 427-433 m, 5 shells, 9 w/o; DW1735, 22°52'S, 167°12'E, 415-445 m, 2 shells, 1 w/o; DW1736, 22°51'S, 167°12'E, 383-407 m, 19 shells, 9 w/o; DW1737, 22°52'S, 167°12'E, 343-400 m, 3 shells, 5 w/o; DW1738, 22°51'S, 167°10'E, 340-381 m, 1 shell; DW1739, 22°51'S, 167°12'E, 404-448 m, 3 shells.

MUSORSTOM 4, stn DW222, 22°58'S 167°33'E, 410-440 m, 6 shells

Range. Main specimens come from a very restricted area situated South West of Île des Pins, caught alive in depth between 390-435 meters (see map 1).

Remarks. There is a smaller and smoother morph quite similar to *Bolma fuscolineata* spec. nov. existing in the Coral Sea, Argo Bank (22°48'S 159°24'E at 450

m and 22°10'S 159°26'E at 385-420 m). Two other dredges during Volsmar cruise brought a couple of similar, dead shells (drilled but still operculated), 4 specimens along Loyalty Ridge (stn DW38, 22°22'S, 168°44'E, 380-420 m), and one shell on New Hebrid Arc (Volsmar, stn DW17, 22°23'S, 171°41'E, 260-300 m).

This differs from *Bolma fuscolinata* spec. nov. by the following features:

- smaller shell, adults only up to 5 mm height;
- space between peripheral and basal angle and also base smooth like polished, the angles may carry some smooth beads, on the shoulder 0 to 3 rows of beads;
- space below suture not incised so deeply;
- operculum smooth like polished.

This may be a variant or a subspecies of *Bolma fuscolineata* spec. nov.. More material is needed to show if there are any intermediate forms.

Other *Bolma* species found in the waters round New Caledonia are *B. henica*, *B. opaoana* (endemic), *B. persica* and several forms of *Bolma guttata*.

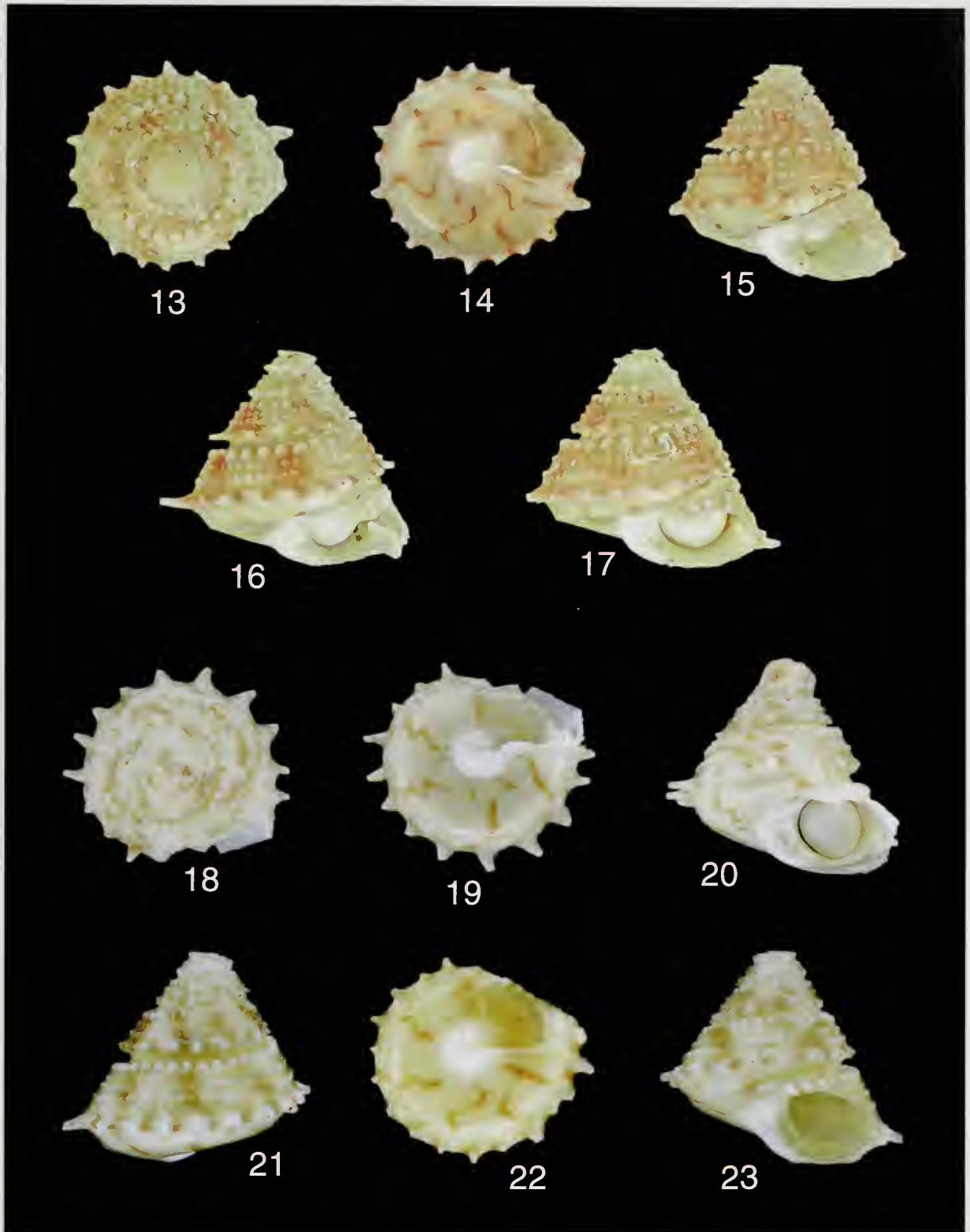
Etymology. *Fuscolineata* (latin) = "brown-lined" refers to the purplish brown axial lines on the base which are quite typical for the species.

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Figures 13 - 23

13 - 23. *Bolma fuscilineata* spec. nov., 13-15. Holotype (20797) MNHN, Paris; 16. Paratype 1 (20798), MNHN, Paris; 17. Paratype 2 (20798), MNHN, Paris; 18 - 23. specimens from the A. Alf collection (set no. 112123a); 18 - 20. diameter 10.8 mm, height 10.0 mm; 21 - 23. diameter 9.8 mm, height 9.0 mm; all specimens from type locality.

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