

# Six new species of marine gastropods from the Red Sea and the Gulf of Aden

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Abstract: Six new species of marine gastropods from the Red Sea and the Gulf of Aden are described: *Bolma minuta* (Turbinidae), *Agathodonta meteorae* (Trochidae), *Pedicularia granulata* (Pediculariidae), *Murex megapex* (Muricidae), *Zafra marisrubris* and *Zafra farasanensis* (Columbellidae).

## ستة أنواع جديدة من معديات الأرجل من البحر الأحمر وخليج عدن

ايك نيوبرت

خلاصة: في هذه الدراسة، تم وصف الأنواع الستة من معديات الأرجل من البحر الأحمر وخليج عدن. كذلك تم مناقشة علاقة هذه الأنواع الجديدة مع أنواع أخرى.

## INTRODUCTION

The marine life of the Red Sea and the waters surrounding the Arabian Peninsula has continued to attract the interest of biologists from various disciplines over the last ten years, illustrated by the increasing number of publications. A comprehensive environmental review was published by EDWARDS & HEAD (1987) and a thorough analysis of the ecology of the region was prepared by SHEPPARD et al. (1992). Molluscs play an important role in these tropical seas. They are a highly diversified group of marine invertebrates and are present in every marine habitat from the littoral zone to the abyssal depths. In mussel beds they make a significant contribution to the local biomass, and in reef communities the gastropods occur in high numbers.

Moderate progress has been made over the last few years adding to our knowledge of molluscan species, their ecology and distribution. Major contributions include the monographic works of OLIVER (1992) on the bivalves of the Red Sea and the compilation of BOSCH et al. (1995) on the seashells of Eastern Arabia. It must be stressed, however, that in many fields reliable information is still absent. There is no recent, comprehensive guide to the gastropods of the Red Sea for example. The malacofauna of the Gulf of Aden and adjacent areas along the east African coast is also insufficiently well known. In fact the Indo-Pacific malacofauna is far from being adequately understood. The taxonomic situation of the micro-molluscs in particular is quite unacceptable as they form a major component of the marine ecosystem. It is clear that there is still an overwhelming need for basic work to be carried out at the alphataxonomical level. For this reason, only species from recently revised groups, or groups under current revision, have been described as 'new' in this paper.

Over the last 30 years, a substantial quantity of material from the seas around Arabia has been deposited in the Senckenberg Museum. It has arisen from a number of sources including research vessels, private collectors and following expeditions conducted by the author. As a result, it has been possible for a considerable number of specimens to be identified and new species described. Due to the problems already mentioned, most of the micro-molluscs still remain unidentified but they may serve as a source for future work on the taxonomy and ecology of the molluscs of this region.

## MATERIALS AND METHODS

The majority of the material discussed in this paper was obtained from trawls in the Gulf of Aden, conducted during the research cruise of the "FS Meteor" in 1987. All measurements are given in millimetres. The Senckenberg Museum uses a six figure reference code for all the material in the mollusc collection, with a forward slash followed by a figure to denote the number of individual specimens involved.

### Abbreviations

AD	Aperture diameter
AH	Aperture height
D	Diameter
H	Height
SMF	Senckenberg Museum Frankfurt
LACM	Los Angeles County Museum
W	Number of whorls of the complete shell
Wp	Number of protoconch whorls
Wt	Number of teleoconch whorls

### Family Turbinidae

#### *Bolma minuta* n. sp.

Figs 1-3

Material: Locus typicus and type material: Red Sea: Bab al-Mandab, ME5-Stat. 230 KD1, 12°43.7'N 43°15.0'E, 228-235 m depth, 5.III.1987, "Meteor". Holotype SMF 311515/1, paratypes SMF 311510/18. — Non-type material: Red Sea: Bab al-Mandab, ME5-Stat. 230 KD2, 12°43.5'N 43°14.8'E, 214-237 m depth, 5.III.1987, "Meteor", SMF 311511/1; ME5-Stat. 232 KD, 12°36.8'N 43°15.7'E, 276-296 m depth, 6.III.1987, "Meteor", SMF 311512/2 (juv.); ME5-Stat. 236 KD, northern Djibouti, 12°21.4'N 43°26.9'E, 45 m depth, 6.III.1987, "Meteor", SMF 311513/37 (juv.); ME5-Stat. 241 KD, approx. 30 km S of Perim Island, 12°27.2'N 43°36.9'E – 12°26.9'N 43°37.3'E, 313-321 m depth, 6.III.1987, "Meteor", SMF 311514/4.

Diagnosis: A very small species from the *Bolma guttata* group; whorls with flat sides, a fine gemmulate spiral sculpture and moderately strong prosocline axial threads.

Description: The shell is broadly conical with nearly completely flat whorls. The protoconch is very small and consists of a single whorl. Its surface is ornamented by minute rounded punctations.

The first two teleoconch whorls are flat-topped and pure white in fresh specimens. The suture of the subsequent teleoconch whorls is channelled. The periphery of all whorls bears one row of short, straight, hollow spines. On the body whorl, 14 spines can be found. The ornamentation of the teleoconch whorls consists of two elements: the gemmate spirals and small axial threads. The

number of gemmate cords increases with whorl number and reaches five on the body whorl. Additionally, three to five fine spiral threads fill the area between the gemmate cords. The strongly prosocline axial threads are prominent in the sutural channel. In fresh specimens, they produce a fine reticulate pattern on the teleoconch when crossed by the spiral threads.

The base is polished and dominated by one major peripheral spiral cord. Within this cord, the single beads are white, contrasting with the red interspaces. In the area between the major cord and the spines, a secondary cord of small beads occurs. Towards the columella, up to seven additional cords of small beads could be observed.

The aperture is semicircular with a sharp peristome. The columella is porcellaneous white, and the columellar callus is restricted to a small area in the vicinity. The colour varies from fleshy red to pink. In pale specimens, a few oblique axial flames of deeper red can be found. The operculum is unknown.

Measurements (holotype): H = 11.4; D = 12.1; AH = 6.6; AD = 5.5; W = 6.

Etymology: The specific name is derived from the Latin 'minutus' = small.

Affinities: *Bolma minuta* n. sp. is a member of the *Bolma guttata* group as defined by BEU & PONDER (1979: 4). It closely resembles *B. guttata bathyraphis* (E.A. Smith, 1889) in its general shape, but this latter taxon (as all other subspecies of *B. guttata*) reaches at least twice the shell height of *B. minuta*. Moreover, *B. minuta* differs by having fewer basal cords and peripheral spines and a less channelled suture.

In 1979, BEU & PONDER described *B. somaliensis* from "off the Somali coast, 11°24'-11°29'N, 51°35'-51°36'E, 75-175 m", a location on the Somalian shelf between Ras Gardafui and Ras Hafun. Besides its size (H = 26.04, D = 23.76, W = 6-7, according to BEU & PONDER 1979: 33, figs 4 a-c), this species differs from *B. minuta* in the form of its whorls (more ventricose), the peripheral spines (relatively shorter), the suture (not channelled), and in details of the coloration (white subsutural zone, white gemmules).

## Family Trochidae Subfamily Eucyclinae

### *Agathodonta meteorae* n. sp.

Figs 4-7

Material: Locus typicus and type material: Red Sea: Bab al-Mandab, northern Djibouti, ME5-Stat. 236 KD, 12°21.4'N 43°26.9'E, 45 m depth, 6.III.1987, "Meteor". Holotype SMF 311516/1, paratypes SMF 311517/17 (2 adults, 1 subadult, 14 juv.); 1 paratype LACM catalogue no. 1192. — Non-type material: Red Sea: Bab al-Mandab, ME5-Stat. 230 KD2, 12°43.5'N 43°14.8'E, 214-237 m depth, 5.III.1987, "Meteor", SMF 311518/1.

Diagnosis: A small species of *Agathodonta* Cossmann, 1918, with flat whorls and coarse spiral cords.

Description: The protoconch is glassy and smooth showing extremely small and scattered pits and consists of 1-1.5 whorls. The first teleoconch whorl is rounded but the following whorls are nearly flat. The sculpture is dominated by spiral rows of granules which are regularly crossed by somewhat weaker axial ribs, thus producing small beads. On the first teleoconch whorl only axials may be found. Their interspace is covered by fine spiral threads which disappear on the second whorl where the spirals start. Fully mature shells bear five subsutural spicords on the body whorl. The base is covered by four to five cords. A strongly prosocline striation is present all over the shell. The suture is deeply impressed.

The aperture is oblique and rounded and shows 10-12 denticles on the outer lip with the uppermost of them connected to fine lirae. Minute labial denticles may be intercalated. The columella ends in a heavy ridge with two prominent folds. The upper one is rounded while the

lower one curves downwards and projects somewhat into the aperture. The columellar shield is small, inconspicuous and spreads between the columella and the upper peristomial rim. The operculum is not known.

The shell is pale yellow to light brown. There are fine irregularly arranged axial streaks of red often restricted to one or two gemmules only.

Measurements (holotype): H = 7.5; D = 5.2; AH = 4.25; AD = 3.5; Wp = 1; Wt = 6.

Etymology: This species is called *A. meteorae* in memory of the research vessel "FS Meteor".

Affinities: A subadult paratype specimen (H = 6.85; D = 5.5) is shown in Fig. 7 to illustrate a developmental stage of the columellar dentition. *Agathodonta meteorae* is close to the only other extant species known in this genus, *Agathodonta nortoni* McLean, 1984, which was found on a sandy bottom off Baltazar Island, Marinduque Province, Philippine Islands, at a depth of 296-320 m (McLEAN 1984). *Agathodonta meteorae* was compared to the holotype of *A. nortoni* by J.H. McLean (Los Angeles) who also noted differences between the species: *A. nortoni* is larger and has at least one more spiral cord (up to six) on the body whorl. The apertural lirae are less numerous and the shell is covered by large extended red blotches, a pattern which could not be seen in any of the paratype specimens of *A. meteorae*.

#### Family Pediculariidae

##### *Pedicularia granulata* n. sp.

Figs 8-15

Material: Locus typicus and type material: Red Sea: Bab al-Mandab, northern Djibouti, ME5-Stat. 236 KD, 12°21.4'N 43°26.9'E, 45 m depth, 6.III.1987, "Meteor". Holotype SMF 311519/1, paratypes SMF 311520/67. — Non-type material: Red Sea: Bab al-Mandab, northern Djibouti, ME5-Stat. 232 KD, 12°36.8'N 43°15.7'E, 276-296 m depth, 6.III.1987, "Meteor", SMF 311878/7.

Diagnosis: A medium-sized, white species of *Pedicularia* with coarsely granulated, spiral cords.

Description: The shell is ovoidly elongate, the protoconch is completely concealed by the adult shell. The brown protoconch (described from juveniles) consists of five whorls. It is subdivided in a smooth PI with two whorls, and a PII which is covered by oblique rhombs forming a dense reticulate pattern (cf. LILTVED 1989: fig. 226).

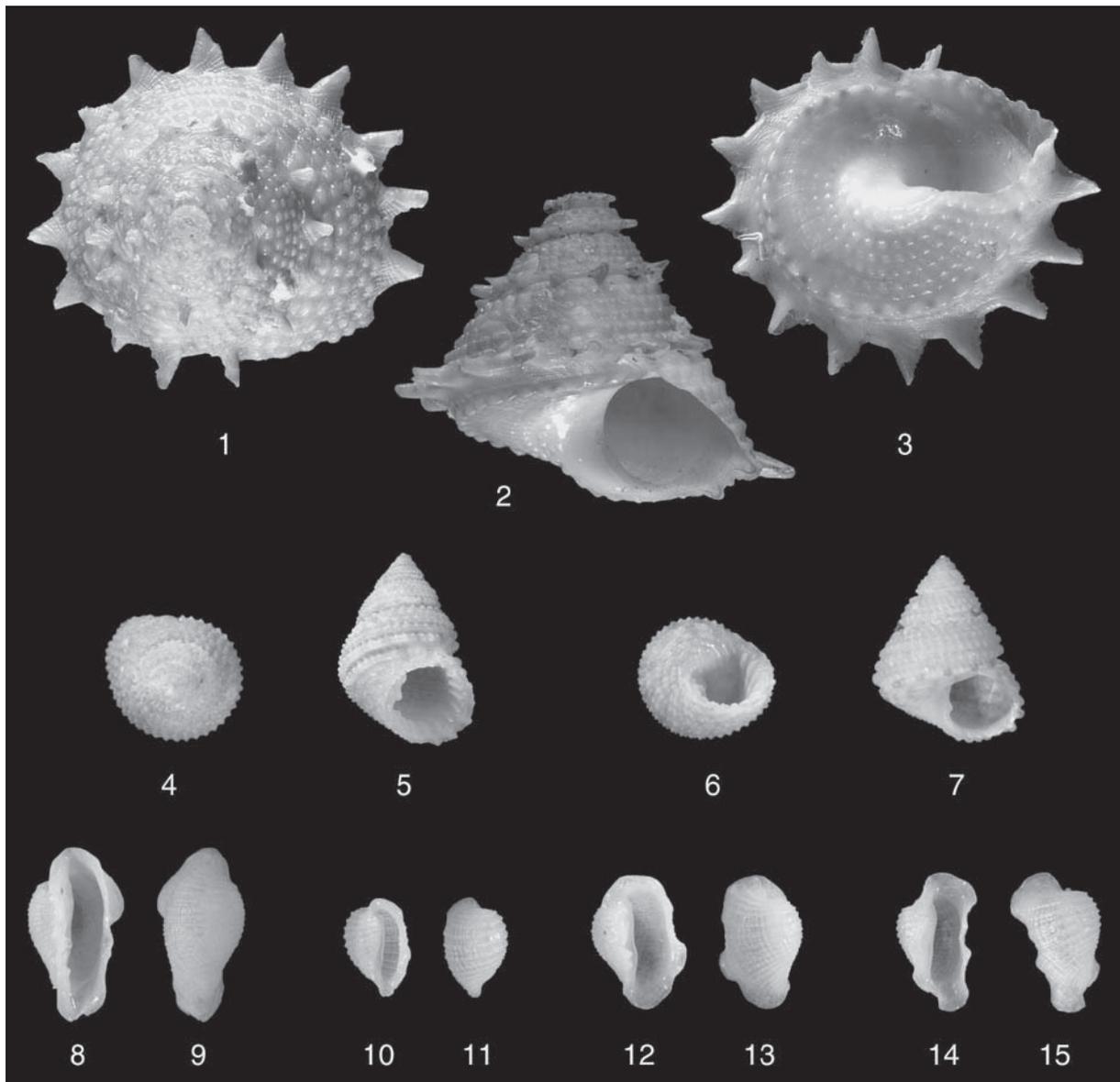
The adult shell is purely white. The aperture is narrowly elongate and always exceeds the spire in length. In almost all specimens, the peristomial rims are connected and sometimes project like a tube. In general, the shape of the peristome is irregularly foliate and it depends on the substrate that the animal was fixed upon. In the upper third of the shell, a wing-like projection often occurs which corresponds to a blunt shoulder. In juveniles, a carinal ridge is present. Often, this character is combined with a thick and heavily denticulate lip. Both features disappear during growth (Figs 10-15).

The median part of the body whorl is covered by up to 25 spiral cords composed of numerous elongate beads. The spirals are intersected by fine growth lines.

Measurements (holotype): H = 6.35; D = 3.4.

Etymology: The specific name is derived from the Latin 'granulata' = with granules, and describes an important detail of the surface sculpture of the shell.

Affinities: SCHILDER (1931) reviewed the genus listing ten extant and one fossil species from the Pliocene of Sicily. In 1971, SCHILDER & SCHILDER gave a more complete catalogue reducing the number of taxa to seven species and several subspecies. Generally *P. granulata* differs from these with regard to its granulated shell surface. Only in *P. elegantissima* Deshayes, 1863, are the major cords somewhat granulated, as described by DESHAYES (1863: 50-51, pl. VI, figs 23-26) and figured by



Figs 1-15: (original size  $\times 5$ ), 1-3: *Bolma minuta* n. sp. 1: Holotype, frontal view. 2: Holotype, apical view. 3: Holotype, ventral view. 4-7: *Agathodonta meteorae* n. sp. 4: Holotype, frontal view. 5: Holotype, apical view. 6: Holotype, ventral view. 7: Subadult paratype, frontal view. 8-15: *Pedicularia granulata* n. sp. 8: Holotype, frontal view. 9: Holotype, dorsal view. 10-15: Growth stages of paratypes: 3.6 mm (10-11), 4.9 mm (12-13), 5.1 mm (14-15).

LILTVED (1989: 148, figs 224-226), but in this species the sculptural elements are much finer than in *P. granulata*. Additionally, *P. elegantissima* is white to purple while *P. granulata* is always white. *Pedicularia pacifica* Pease, 1865 is also purple, the shell has much finer striations, and the aperture is much broader in comparison to *P. granulata* and has an expanded peristome (KAY 1965).

The ontogenetic change of shell shape and apertural dentition is striking (SCHILDER 1931: pl. VI, figs 2, 3 b). SCHMIEDER (1980: 283, fig. 2) illustrates two 'species' of *Pedicularia* which show dentition and 'ovulid' characters very similar to those observed in the type lot of *P. granulata* n. sp. These 'ovulid' forms from California had been described as a separate species (*P. ovuliformis* Berry, 1946), but actually they represent juvenile forms of *P. californica* (Newcomb, 1864).

Remarks: Pediculariidae are known to live as sessile epizoic organisms on hydrocorals. HABE (1976) reported hydrocorals of the family Stylasteridae (*Stylaster profundiporus profundiporus* Broch, 1936; *S. p. crassicaulis* Broch, 1936; *S. dentatus* Broch, 1936; *Distichopora borealis japonica* Broch, 1942; and *Stenohelia echinata* Eguchi, 1968) as host specimens for *P. pacifica*. In South Africa, *P. elegantissima* was found on the stylasterid species *Errina capensis* Hickson, 1912, *Errina* sp., and *Stylaster* sp. by LILTVED (1989). The Mediterranean *P. sicula* Swainson, 1840, lives on *Errina aspera* as reported by ARNAUD & ZIBROWIUS (1979), and *P. californica* was found to live in association with *Stylantheca porphyra* (SCHMIEDER 1980, 1982).

The hydrocoral species found during the cruise of the "Meteor 5" have not yet been investigated. The samples contain a moderately rich coelenterate fauna, probably including a few hydrocoral fragments. Information on the special habitat of *P. granulata* will be published as soon as information on these tentative host species becomes available (Zibrowius and Grasshoff, pers. comm. 1998).

### Family Muricidae

#### *Murex (Murex) megapex* n. sp.

Figs 16-18

Material: Locus typicus and type material: Gulf of Aden: approx. 60 nm SW of Aden, ME5-Stat. 287 KU, 12°16.0'N 44°08.5'E – 12°16.0'N 44°09.5'E, 472-479 m depth, 16.III.1987, "Meteor". Holotype SMF 311509/1, paratype SMF 311510/1 (preserved in alcohol).

Diagnosis: A large, thin-walled species of *Murex* with a large, prominent, cylindrical protoconch.

Description: The white to yellowish-cream shell is very large, and the shell walls are thin in comparison to other species of *Murex*.

The prominent, cylindrical protoconch consists of three well-rounded whorls demarcated by a deep suture. The first whorl starts with a sharp and acutely pointed apex, the second whorl is inflated and its diameter exceeds that of the third whorl. The boundary between the protoconch and teleoconch is marked by a thin laminar varix (Fig. 18).

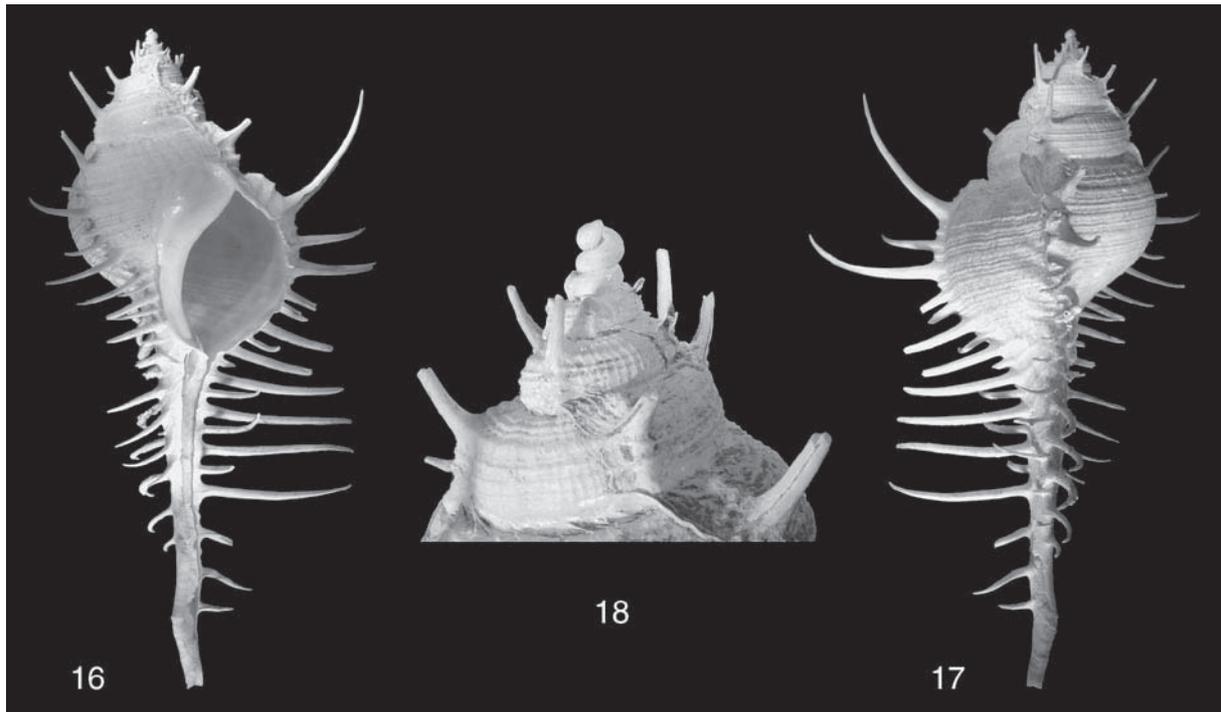
The teleoconch is broadly conical and ornamented by fine spiral threads and three oblique rows of varices. The varices exhibit long spines. The anterior canal is spinose and reaches half the length of the complete shell (90.3 mm in the holotype specimen).

Spiral sculpture: The spiral sculpture of the teleoconch whorls consists of fine and somewhat granulose threads. On the body whorl there are eight major cords which correspond to the spines of the varices. Numerous minor cords are intercalated. On the median teleoconch whorls, a subreticulate pattern is produced by fine axial laminae.

Axial sculpture: There are three blunt varices per whorl. Subsuturally, spines are lacking over a considerable portion of the varix. On the upper whorls, the varices are dominated by a single, primary spine curving up on the shoulder; a small, secondary spine is present starting at the third whorl. On the labial varix, eight spines can be found. Here, the first and the third spine are dominant with a secondary spine intercalated. On the basal part of the varix, the spine sequence is as follows: two tertiary, one secondary, one tertiary, and one secondary.

The anterior canal opens with a narrow slit. There are more than ten spines per varix on the canal, but spines are lacking on its frontal tip. The labral spines are strongly curved adaperturally. A few spinelets occur on the dorsal canal varix. All spines are hollow and open on the tip by a small slit.

The aperture is oblique with a crenulated and somewhat strengthened labial peristome. The highly polished columellar shield spreads over a small area on the body wall. Basally on the columellar side, the peristome forms a thin lamella gently curving towards the anterior canal.



Figs 16-18: (original size  $\times 0.5$ ) *Murex (Murex) megapex* n. sp., holotype. 16: Frontal view. 17: Dorsal view. 18: Protoconch enlarged.

Measurements (holotype): H = 170.9; D = 62.1 (measured without spines); AH = 51.2; AD = 31.6; Wp = 3.5; Wt = 6.75. The protoconch has a diameter of 3.8 mm and a height of 5.2 mm.

Etymology: from the Greek 'mega' = big, large and the Latin 'apex' = tip.

Affinities: The characteristics of this species, in particular the protoconch and the thin shell wall, are quite unique within the genus *Murex*. The species is similar to *Murex troscheli* Lischke, 1868, which reaches a similar size, spinosity of the anterior canal, and spreading of the columellar shield. However it differs from this species having thinner varices, less deep sutures, finer spiral ornamentation and in its protoconch. Moreover, *Murex troscheli* has only been recorded from southern Japan, Indonesia and the Solomon Islands (PONDER & VOKES 1988: 29, figs 73 H, 82 A-C). Other species known from the seas surrounding the Arabian Peninsula can be distinguished using the following contrasting features:

*Murex forskoeblii* Röding, 1798: Smaller; protoconch of 1.75 whorls. Teleoconch more slender, suture deeper; primary shoulder spine and spines on the anterior canal straight (PONDER & VOKES 1988: 33, figs 74 A, 82 D-F).

*Murex carbonnieri* (Jousseaume, 1881): Smaller; protoconch more slender and conical. Spiral cords of teleoconch coloured with an alternating pattern of white and red. Varices thicker, fewer spines on anterior canal. Columellar shield small, if present at all (PONDER & VOKES 1988: 22, figs 75 A-C, 80 G-I).

*Murex tenuirostrum tenuirostrum* Lamarck, 1822: Smaller; protoconch small and slender, conical. Spiral cords with prominent granules. Anterior canal less spinose, always reaching more than half of the length of the complete shell (PONDER & VOKES 1988: 24, figs 73 C, 80 B-C).

*Murex scolopax* Dillwyn, 1816: Usually smaller (but cf. BOSCH et al. 1995: 117); protoconch with a very characteristic flattened ramp subsuturally and often a bluntly angulated shoulder. Spiral

sculpture of teleoconch consists of a few prominent cords with smooth spaces between. Yellow to brown streaks or even flames often occur on the teleoconch (PONDER & VOKES 1988: 49, figs 24 A-C, 76 A-B, 85 E).

*Murex somalicus* Parth, 1990: Somewhat smaller; protoconch smaller, not bulbous. Spire lower, teleoconch whorls smoother and much more massive, only four spiral cords; spines generally shorter, thicker and less numerous (PARTH 1990).

*Murex brevispina brevispina* Lamarck, 1822: Smaller; protoconch smaller, broader, fewer whorls. Teleoconch much more massive, broadly conical with a few short, thick spines (PONDER & VOKES 1988: 60, figs 74 C, 83 A-C).

### Family Columbelloidea

#### *Zafra marisrubris* n. sp.

Figs 19-21

Material: Locus typicus and type material: Sudan: Red Sea, Sha'ab Rumi, reef drop, 11.3 m depth, 8.VI.1996, U. Zajonz & F. Krupp. Holotype SMF 311879/1, paratypes SMF 311880/16. — Non-type material: Egypt: 28 adults, 15 juv., southern Egypt, Port Berenice, Sha'ab Claudio, 19.5 m depth, IV.1996, J. Bender, SMF 311841/43.

Diagnosis: A small *Zafra* species with a bulbous paucispiral protoconch, complete teleoconch ribs and a prominent white spiral band.

Description: The shell is elongate with a slightly turreted spire. The paucispiral protoconch consists of 1.5 smooth and bulbous whorls. Basically, the protoconch is creamy but always shows a reddish hue.

The teleoconch whorls are flat with straight sides, the suture is somewhat indented. The sculpture consists of strong axial ribs which are somewhat thickened subsuturally. Moreover, the ribs are intersected by a very shallow subsutural furrow. On the body whorl, the ribs are continuous reaching the spiral threads of the fasciole. The ribs are equidistant throughout the complete shell. The anterior canal is covered by six to eight spiral cords and is slightly recurved.

The aperture is narrow and slightly S-shaped. The two shallow folds on the columella are deep in the aperture and separated from each other by a small incisure. Opposite them are five to six labral denticles which decrease in size towards the anterior canal. The columellar shield consists of a small, upright, fragile rim.

The basic colour of the teleoconch is red-brown. Subsuturally there is a thin, red, spiral line which is only visible in the axial interspaces. It is followed by a broad, white band. On the body whorl, a second white spiral band may occur on the periphery. The axial interspaces are always darker red than the axial ribs themselves.

Unfortunately, no living animals were collected. Data on the structure of the radula and operculum will be given as soon as material is available.

Measurements (holotype): H = 3.3; D = 1.5; AH = 1.5; AD = 0.46; Wp = 1.5; Wt = 5.

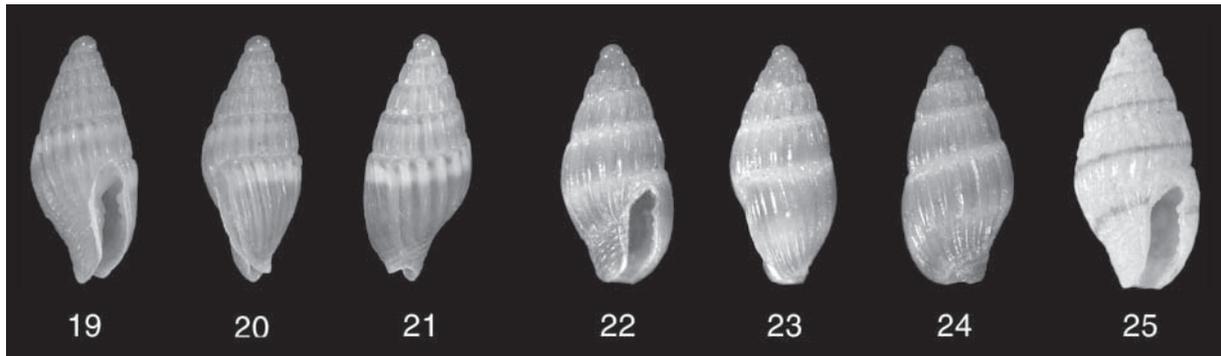
Etymology: The specific name *Z. marisrubris* refers to the occurrence of this species in the Red Sea.

Affinities: Similarities and differences to other closely related species are discussed following the description of *Zafra farasanensis* n. sp.

#### *Zafra farasanensis* n. sp.

Figs 22-26

Material: Locus typicus and type material: Saudi Arabia: Red Sea, Farasan Islands, Sarso, XI/XII.1964, W. Schäfer. Holotype SMF 311716/1, paratypes SMF 311717/8 (4 adults, 4 juv.). — Non-type material: Saudi Arabia: Red Sea, Farasan Islands, Sarso, east island, sediment and sandy shore, 29.XI. and 3.XII.1964, W. Schäfer, SMF 311718/4; Red Sea, Farasan Islands, Sarso, reef, muddy/sandy zone, 1.XII.1964, W. Schäfer, SMF 311719/2; Red Sea, Farasan Islands, Sarso, coarse gravel, 27.XI.1964, W. Schäfer, SMF 311720/4.



Figs 19-25: 19-21: *Zafra marisrubris* n. sp. 19: Holotype, frontal view. 20: Holotype, lateral view. 21: Holotype, dorsal view. 22-25: *Zafra farasanensis* n. sp. 22: Holotype, frontal view. 23: Holotype, lateral view. 24: Holotype, dorsal view. 25: Colour pattern (ex SMF 311720 4).

**Diagnosis:** A small species of *Zafra* with a paucispiral protoconch and a smooth columella.

**Description:** The shell is broadly conical. The paucispiral protoconch consists of 1.5 brown, smooth and rounded whorls.

The teleoconch whorls are slightly curved and covered by a sculpture of coarse axial ribs. These ribs are continuous and not crowded towards the aperture. Subsuturally, a narrow spiral cord is present. The broad anterior canal is straight and covered by six to seven spiral cords.

The aperture is broadly elongate. The columella is smooth, folds are generally lacking. On the outer lip, there are four to five denticles, the anterior ones are small. A thin and fragile columellar shield may be present.

The colour pattern varies considerably. Basically, the specimens are brown and show a narrow, white, spiral band below the suture. Beneath the periphery of the shell, another white band occurs. The lower body whorl and the anterior canal are deep brown. This pattern is shown by the holotype specimen illustrated. Another pattern observed consists of a completely white shell with two fine brown spiral lines, the first above the aperture, the second encircling the anterior canal.

**Measurements (holotype):** H = 3.2; D = 1.5; AH = 1.32; AD = 0.42; Wp = 1.5; Wt = 4.5.

**Etymology:** This species is called *Z. farasanensis* after its type locality, Sarso Island, which forms part of the Farasan archipelago.

**Affinities:** Both new species of *Zafra* described here have a paucispiral protoconch, an attribute that separates them from all other *Zafra* species currently known from the area under discussion. Several characteristics can be used to distinguish between them. The shell of *Z. marisrubris* is nearly biconical, while in *Z. farasanensis* the shell is shaped more broadly. The aperture of *Z. marisrubris* is much narrower and it has two columellar folds, which are missing in *Z. farasanensis*. Subsuturally, a brown spiral band is followed by a white band in *Z. marisrubris*, a pattern which is never found in *Z. farasanensis* where the white spiral starts directly below the suture, and is less pronounced.

Both of these species differ from another separate group of *Zafra* species found in the area, which can be characterised by their particular colour pattern – fine brown axial flames. In the material known to the author, from the seas surrounding the Arabian Peninsula, this group is represented by five species. This colour pattern is well illustrated by BOSCH et al. (1995: 131, fig. 544) for *Z. selasphora* (Melvill & Standen, 1901). Additionally, the species *Zafra comistea* (Melvill, 1906) was found in three localities in the Strait of Bab al-Mandab and northern Djibouti during the cruise of the “Meteor”, but it was not mentioned by DRIVAS & JAY (1997) in their

publication on the Columbelloidea from the Red Sea. It is also known from Réunion (DRIVAS & JAY 1990: 187). *Zafra comistea* (Melville, 1906) has a tumid glassy shell and is never coloured. In the aperture, the labial denticles are very small and situated on an elevated ridge.

### ACKNOWLEDGEMENTS

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### REFERENCES

- ARNAUD, P.M. & ZIBROWIUS, H. 1979. L'association *Pedicularia sicula* – *Errina aspera* en Méditerranée. *Rapports et Communications internationales Mer Méditerranée* 25/26 (4): 125-126.
- BEU, A.G. & PONDER, W.F. 1979. A revision of the species of *Bolma* Risso, 1826 (Gastropoda: Turbinidae). *Records of the Australian Museum* 32 (1): 1-68.
- BOSCH, D.T., DANCE, P., MOOLENBEEK, R.G. & OLIVER, P.G. 1995. *Seashells of Eastern Arabia*. 296 pp. Dubai, Motivate Publishing.
- DESHAYES, M.G.P. 1863. *Catalogue des mollusques de l'île de La Réunion (Bourbon)*. VI + 144 pp. Paris.
- DRIVAS, J. & JAY, M. 1997. On a collection of Columbelloidea from the Red Sea. *Apex* 12 (1): 27-30.
- DRIVAS, J. & JAY, M. 1990. The Columbelloidea of Réunion Island (Mollusca: Gastropoda). *Annals of the Natal Museum* 31: 163-200.
- EDWARDS, A.J. & HEAD, S.M. 1987. *Key environments: Red Sea*. 441 pp. Oxford, Pergamon Press.
- HABE, T. 1976. Stylasterid hydrocorals to which *Pedicularia pacifica* Pease attaches. *Venus* 35 (4): 205.
- KAY, E.A. 1965. Marine molluscs in the Cuming collection, British Museum (Natural History) described by William Harper Pease. *Bulletin of the British Museum (Natural History), Zoology, Supplement* 1: 1-96.
- LILTVED, W.R. 1989. *Cowries and their relatives of Southern Africa*. 208 pp. South Africa, Seacomber Publications.
- MCLEAN, J.H. 1984. *Agathodonta nortoni*, new species: Living member of a Lower Cretaceous trochid genus. *The Nautilus* 98 (3): 121-123.
- OLIVER, G. 1992. *Bivalves of the Red Sea*. 330 pp. Wiesbaden, Verlag Christa Hemmen.
- PARTH, M. 1990. A new Muricid species from Somalia. *La Conchiglia* 22 (256): 40-41.
- PONDER, W.F. & VOKES, E.H. 1988. A revision of the Indo-West Pacific fossil and recent species of *Murex* s. s. and *Haustellum* (Mollusca: Gastropoda: Muricidae). *Records of the Australian Museum, Supplement*: 81-160.
- SCHILDER, F.A. 1931. Revision of the subfamily Pediculariinae. *Journal of Conchology* 19 (6): 165-169.
- SCHILDER, M. & SCHILDER, F.A. 1971. A catalogue of living and fossil cowries. Taxonomy and bibliography of Triviacea and Cypraeaacea (Gastropoda, Prosobranchia). *Institut Royal des Sciences Naturelles de Belgique, Mémoires* (2) 85: 1-246.
- SCHMIEDER, R.W. 1980. Intermediate forms and range extension of *Pedicularia californica* and *Pedicularia ovuliformis*. *The Veliger* 22 (4): 382-384.
- SCHMIEDER, R.W. 1982. Shape irregularity in *Pedicularia californica*. *The Veliger* 24 (3): 272.
- SHEPPARD, C., PRICE, A. & ROBERTS, C. 1992. *Marine ecology of the Arabian region*. 359 pp. London, Academic Press.

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