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## A critical review of Antarctic Conoidea (Neogastropoda)

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## ABSTRACT

The Antarctic Conoidean fauna is critically reviewed based on published data and specimens in the collections of the USNM, IOAN and MNHN. Forty-two species and subspecies of the superfamily Conoidea are recorded as occurring within the Antarctic convergence (excluding the fauna of the Kerguelen Islands) and are attributed to 14 genera and seven families. These include the new taxa: *Antarctospira* gen. nov. (type species – *Leucosyrinx badenpowelli* Dell, 1990); *Drilliola antarctica* n. sp.; *Pleurotomella* (*Pleutoromella*) *tippetti* n. sp.; *Pleurotomella* (*Anomalotomella*) *petiti* n. sp.; *Xanthodaphne pastorinoi* n. sp. *Aforia watsoni* is introduced as a new name for *Pleurotoma* (*Surcula*) *lepta* Watson, 1881, non *Pleurotoma lepta* Edwards, 1861. Lectotype is designated for *Conorbella antarctica* (Strebel, 1908). New combinations include: *Antarctospira badenpowelli* (Dell, 1990), n. comb. (previously assigned to *Leucosyrinx*); *Antarctospira principalis* (Thiele, 1912), n. comb. (previously assigned to *Typhlomangelia*); *Antarctospira mawsoni* (Powell, 1958), n. comb. (previously assigned to *Leucosyrinx*); *Typhlodaphne paratenoceras* (Powell, 1951), n. comb. (previously assigned to *Leucosyrinx*); *Belalora weirichi* (Engl, 2008), comb. nov. (previously assigned to *Oenopota*); *Pleurotomella* (*Anomalotomella*) *innocentia* (Dell, 1990), n. comb. (previously assigned to *Typhlodaphne*); *Pleurotomella* (*Anomalotomella*) *nipri* (Numanami, 1996) (previously assigned to *Typhlodaphne*); *Xanthodaphne raineri* (Engl, 2008), n. comb. (previously assigned to *Pleurotomella*); *Aforia hedleyi* (Dell, 1990) (previously assigned to *Pontiothauma*). The majority of Antarctic conoidean genera and species have radulae consisting of hypodermic marginal teeth. Comparisons of species richness with other well studied faunas revealed a similar relative abundance of conoideans. The low number of conoideans in Antarctic waters is indicative of the general impoverishment of the gastropod fauna in the region. Fourteen percent (2 of 14) conoidean genera that occur in within the Antarctic convergence are endemic to Antarctic waters, as are 82% (34 of 42) of the species. Most genera and many species have very broad bathymetric ranges, some extending from bathyal to hadal depths. Greatest species diversity was at bathyal depths.

## INTRODUCTION

Conoidea (=Toxoglossa) remains one of the less thoroughly studied gastropod taxa within Antarctic waters. This superfamily ranks among the most diverse clades of Neogastropoda (Bouchet *et al.* 2002; Bouchet *et al.* 2009), especially in the tropics. The classification of the superfamily Conoidea has recently been revised extensively based on a molecular phylogeny (Puillandre *et al.* 2011), and now includes 15 families (Bouchet *et al.* 2011). Thirteen of these families had previously been included in a single family, Turridae, which emerged as paraphyletic in phylogenetic analyses. These 13 families are collectively referred to here as “turrids”. Currently, about 460 conoidean genera and subgenera are recognized, 358 belonging to “turrid” families and encompassing more than 4000 named Recent species (Tucker 2004), with many hundreds of species still unnamed (Bouchet *et al.* 2009).

The diversity of “turrids” decreases significantly in high latitudes. Only about 40 species are known to inhabit the waters of the Arctic Ocean (Kantor and Sysoev 2006). The diversity of “turrids” in Antarctic and subantarctic waters is also very low. At present, 38 named species have been recorded from the Southern Ocean (Engl 2012), although new species remain to be discovered and named. Remarkably, the number of presently recognized Arctic and Antarctic turrids is nearly the same.

The majority of the known Antarctic “turrids”, 20 species, was described in publications based on the large Antarctic expeditions of the early 20<sup>th</sup> century (Watson 1886; Strebel 1908; Thiele 1912; Hedley 1916). More species were added later (Powell 1951, 1958; Dell 1990; Engl 2008 a, b) based on the results of subsequent explorations of this fauna. Early authors (e.g., Watson 1886; Strebel 1908) attributed the “turrid” species inhabiting Antarctic waters to previously known broadly distributed genera, thus greatly underestimating the level of endemism of the Antarctic fauna at the genus level. This tendency was reversed by Powell (1951), who introduced several genera and one subgenus to encompass Antarctic and Magellanic “turrids”. Most of Powell's generic names are still commonly used.

Due to the scarcity of specimens, a number of Antarctic species were described based on juvenile, poorly preserved, or even fragmentary specimens, and, in many cases, on dead collected shells, posing difficulties for unambiguously identifying these taxa. Only rarely do original descriptions include such taxonomically important characters as radulae and opercula. The publications of Hain (1990) and Numanami (1996) are exceptionally informative in this regard, as they included SEM images of the radulae of several species of “turrids”.

The Antarctic “turrid” fauna remains virtually unexplored from the molecular phylogenetic perspective. Only a single antarctic species, *Aforia magnifica* (Strebel, 1908) was represented in

the GenBank Database (Oliverio and Modica 2010) at the time of this study. This is not surprising, due to difficulties in obtaining properly preserved material suitable for sequencing from Antarctic waters.

Prior to the present study, there have been no revisions or critical re-assessments of the systematics of Antarctic conoideans. Engl (2012) included important data on type material (including the first photographs of type specimens of many of the species) and designated several lectotypes. His publication dealt primarily with newly collected specimens obtained by German expeditions aboard the RV *Polarstern*. He described three new species of deep-water "turrids" based on this material, and illustrated several unnamed species. This work did not include a complete list of Antarctic Conoidea, nor did it contain synonymies. However it did apportion the included taxa according to the latest classification of Conoidea (Bouchet *et al.* 2011).

Over the past decade, we accumulated observations and new data on Antarctic turrids, based primarily on the very large collection of mollusks assembled by the United States Antarctic Program (USAP) expeditions and housed in the National Museum of Natural History, Smithsonian Institution. Portions of this material had been examined and sorted by R.K. Dell, and served as the basis for his important publication (Dell 1990) on the mollusks of the Ross Sea, which included descriptions of nine new species and subspecies of "turrids".

The present work is a compilation of a critical checklist of Antarctic Conoidea that summarizes the numerous, incremental advances in our knowledge of these animals, and includes updates in generic and familial allocation for many of these species. We deal only with Conoidea found within the Antarctic convergence. The Antarctic Polar Front, or Antarctic Convergence, marks the location where Antarctic surface waters moving northward sink below subantarctic waters. The Polar Front is a region of elevated current speeds and strong horizontal gradients in density, temperature, salinity, and other oceanographic properties (Moore *et al.* 1999) and thus forms a natural biogeographic border.

Magellanic turrids are excluded, except for two species of "*Leucosyrinx*" that are illustrated and referred to a new genus. The border of the Antarctic convergence is not completely resolved in certain regions, and the position of some island groups remains ambiguous. The Kerguelen islands are considered to be on or within the Antarctic Convergence in some studies (Dell 1990: 274; Orsi *et al.* 1995; Belkin and Gordon 1996) but north of the Antarctic Convergence in others (Engl 2012: 14; Moore *et al.* 1999). The conoidean fauna of the Kerguelen islands, consisting mostly of species described by Watson (1881, 1885) from *Challenger* expedition materials, is not treated here (except for species that have been recorded there, but also penetrate into the Antarctic Convergence).

Type specimens for most conoidean taxa are not illustrated, as they were recently illustrated in color (Engl 2012).

We were able to determine COI sequences for several Antarctic conoidean taxa in cases where suitably preserved specimens were present in the collections of the USNM and MNHN. These sequences are reported in this publication and placed in phylogenetic context using appropriate outgroup taxa, including those from the temperate and tropical faunas.

## MATERIALS AND METHODS

This report is based primarily on published data and on conoidean specimens sorted from the material sampled by the USAP vessels RV *Eltanin* (later renamed RV *Islas Orcadas*), RV *Hero*, and others, and housed in the collections of the National Museum of Natural History (USNM). Additional material, sampled by the Russian vessels RV *Ob'*, RV *Akademik Kurchatov* and RV *Dmitri Mendeleev* housed in collections of the P.P. Shirshov Institute of Oceanology of Russian Academy of Sciences (IORAS) were made available through the courtesy of Drs. Andrey Gebruk and Elena Krylova.

Protoconch measurements and whorls number counts follow the protocols of Bouchet and Kantor (2004). Methods for counting protoconch whorls vary (often by 0.5 whorl) and are rarely specified in published accounts. Thus, the values we report may, in some cases, differ from previously published values.

Bathymetric ranges are provided based on published and original data. Bathymetric ranges of live collected specimens are also when possible.

Radulae were removed by gross dissection (dried animals were rehydrated in water), cleaned using diluted bleach (NaOCl), coated with carbon and gold, and examined using a LEO 440 Scanning Electron Microscope (USNM) and TESCAN Vega TS5130MM (A.N. Severtzov institute of Ecology and Evolution).

Specimens for molecular analyses (Table 1) were preserved in 95° alcohol. For COI sequences with voucher material in the collections of USNM, DNA was extracted from 20 mg snippets of foot tissue, amplified and sequenced following protocols published in Harasewych *et al.* (2011). For the remaining sequences, a piece of foot was clipped and DNA was extracted using the 6100 Nucleic Acid Prepstation system (Applied Biosystems, St Aubin, France). A fragment of 658bp of the COI (Cytochrome Oxidase subunit I) gene was amplified following the protocole described in Kantor *et al.* (2012). The PCR products were purified and sequenced by

the Eurofins sequencing facility. Both directions were sequenced to confirm accuracy of each sequence. Sequences were aligned manually.

<Table 1 ABOUT HERE >

To identify appropriate outgroups for the Antarctic species sequenced, we initially performed a quick analysis (Neighbor-Joining with MEGA 5) on a single dataset that included newly obtained COI sequences of Antarctic turrids and COI sequences of conoideans available in GenBank and in our own MNHN database (results not shown). Species of Antarctic turrids clustered into three groups. Three Bayesian analyses were then performed, one for each group of Antarctic turrids combined with COI sequences of turrids identified as being potential sister groups by the Neighbor-joining analysis.

Phylogenetic analyses were performed using MrBayes 3.2.2 (Huelsenbeck *et al.* 2001) on XSEDE implemented on the Cipres Science Gateway (<http://www.phylo.org/portal2/>). The analysis consisting of eight Markov chains each of 1,000,000 generations with a sampling frequency of one tree per thousand generations; the number of swaps was set to 5 and the chain temperature at 0.02. Parameters of the substitution model were estimated during the analysis (6 substitution categories, a gamma-distributed rate variation across sites approximated in four discrete categories and a proportion of invariable sites). A different model of substitution was applied for each codon position of the COI gene. Convergence of each analysis was evaluated using Tracer 1.4.1 (Rambaut and Drummond 2007) to check that ESS values were all greater than 200 (default burning).

Families are arranged according to the phylogeny of Puillandre *et al.* (2011), genera alphabetically within each family. Species within a genus are treated chronologically, beginning with the type species.

Abbreviations:

AL, aperture length; AW, aperture width; BWL, last whorl length; lv, live collected specimen; sh, shell; SL, shell length; SW, shell width.

Institutional abbreviations:

AMS – Australian Museum, Sydney, Australia;

IORAS – P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia;

MNCN – Museo Nacional de Ciencias Naturales; Madrid, Spain;

MNHN – Muséum National d'Histoire Naturelle, Paris, France;

NHMUK – The Natural History Museum, London, United Kingdom;

NIWA – New Zealand Oceanographic Institute, Wellington, New Zealand;  
NMNZ – Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand;  
NSMT – National Science Museum, Japan;  
SAM – South Australian Museum, Adelaide, Australia;  
USNM – National Museum of Natural History, Smithsonian Institution, Washington DC,  
USA;  
ZIN – Zoological Institution, Russian Academy of Sciences, St.-Petersburg, Russian  
Federation;  
ZMB – Museum für Naturkunde, Berlin, Germany;  
ZSM – Zoologische Staatssammlung, München, Germany

## **SYSTEMATICS**

**Class GASTROPODA Cuvier, 1797**

**Order NEOGASTROPODA Wenz, 1938**

**Superfamily CONOIDEA Fleming, 1822**

**Family BORSONIIDAE Bellardi, 1875**

**Genus *Antarctospira* n. gen.**

Type species (original designation): *Leucosyrinx badenpowelli* Dell, 1990.

**Diagnosis:** Shell medium sized to large, attaining 54.4 mm, fusiform, with spire of medium high and short, attenuated siphonal canal. Whorl profile strongly angulated at shoulder. Protoconch paucispiral, bulbous. Teleoconch whorls weakly convex, subsutural ramp shallow. concave. Anal sinus nearly symmetrical, deepest near midpoint of subsutural ramp. Axial sculpture of weak to moderately pronounced, closely spaced ribs, more strongly pronounced on and below the shoulder. Spiral sculpture of strongly to weakly pronounced, distinct, narrow, flat cords, with interspaces narrower than cords. Aperture high, narrow to broadly oval.

Operculum present, but not examined.

Radula of hypodermic, straight marginal teeth, each with a swollen base, narrow and long apical opening of tooth canal, without barbs, blade very reduced, small.

**Remarks:** The type species of this new genus, *Leucosyrinx badenpowelli*, was originally described within *Leucosyrinx* Dall, 1889, a genus presently classified in Pseudomelatomidae (Bouchet *et al.* 2012). This species cannot be included in *Leucosyrinx* because of its different



radula and lack of an odontophore. The radular morphology of this species is more compatible with species of Borsoniidae. As there are no known borsoniid genera that can accommodate "*Leucosyrinx*" *badenpowelli*, a new genus is proposed here. *Antarctospira* differs from *Typhlodaphne* in having a distinctly angulated whorl profile, as well as slightly different hypodermic marginal teeth that lack barbs or blade. Although an operculum is present in the type species, it was not examined, since it was lost in the only preserved specimen (see below).

We attribute five species to *Antarctospira*, despite having information on radular morphology for only two of these species. Three species, the type species, *Typhlomangelia?* *principalis* Thiele, 1912, and *Leucosyrinx mawsoni* Powell, 1958 are from Antarctic waters, while two species, *Leucosyrinx paragenota* Powell, 1951 (type locality – Burdwood Bank, south of Falkland islands, 54°04'S, 61°40'W, 171–169 m) (Fig. 1 L – M) and *Leucosyrinx falklandica* Powell, 1951 (type locality – north of Falkland islands, 53°16'S, 64°12'W, 336–342 m) (Fig. 1 N – O) are subantarctic. As the two subantarctic species have not been illustrated since their description, photographs of their holotypes are included. Both are similar to *Antarctospira badenpowelli*, but differ in having a thicker, more heavily sculpted shell and a smaller protoconch.

**Distribution:** Antarctic and subantarctic waters.

**Etymology:** the name reflects the Antarctic distribution of the genus, while *spira* – is commonly used root in the names of turrid genera.

***Antarctospira badenpowelli* (Dell, 1990), n. comb.**

(Fig. 1 A – F)

*Leucosyrinx badenpowelli* Dell 1990: 224, 227, figs 393, 410; Engl 2012: 184, pl. 75, fig. 2a-c.

**Type locality:** RV *Burton Island*, Deep Freeze III, st. 3, Victoria Land, McMurdo Sound, east of Cape Hallett, 72°08'S, 172°10'E, 433 m.

**Type material:** Holotype USNM 613118, SL 19.9 mm (Fig. 1 A–B); paratypes USNM 860180, SL 21.5 mm (Fig. 1 C); NMNZ M.249869.

**Material examined:** Holotype; Paratype 1, South Shetland islands, RV *Burton Island*, 72°6'S, 172°12'E, 433 m (USNM 860180, 1 lv); Ross Sea, Victoria Land, Cape Adare, RV *Eltanin*, cruise 27, sta. 1870, 71°18'S, 171°30'W, 659–714 m (USNM 896660, 4 lv); Ross Sea, Victoria Land, Cape Adare, RV *Eltanin*, cruise 27, sta. 1870, 71°18'S, 171°30'W, 659–714 m (USNM 896845, 1 lv.).

<FIGURE 1 ABOUT HERE>

**Morphology:** Protoconch ~ 1.5 whorls, large, bulbous, smooth, demarcated from the teleoconch by a distinct varix. Diameter ~ 2.3 mm, height 2.1 mm. Presence of operculum inferred based on clear presence of an opercular disk on the foot of a dried paratype. Rehydrated animal was female. Eyes present, proboscis very short and wide, strongly contracted.

Radula (Fig. 1 D–F) of hypodermic marginal teeth with moderately long ligament and vestigial subradular membrane, maintaining radular orientation in the radular sac. Teeth straight, with medium sized rounded swollen base and lateral basal opening of tooth canal. Apical opening lateral, without barbs but with small blade. Tooth length ~ 330 µm (2.44% of AL).

**Distribution:** Ross Sea, live 237–714 m (Dell 1990, collections of USNM).

*Antarctospira principalis* (Thiele, 1912), n. comb.

(Fig. 1 G–H)

*Typhlomangelia? principalis* Thiele 1912: 215-216, pl. 14, fig. 6-7, textfig. 2 (radula); Aldea *et al.* 2008: 356; Troncoso and Aldea 2008: 1261; Engl 2012: 178-179, pl. 72, fig. 7.

**Type locality:** Gauss-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** Lectotype: ZMB Moll 62984a, designated by Engl (2012), SL 13.7 mm (Fig. 1 G – H). Paralectotypes ZMB 62984, two very small juveniles and fragments of at least three shells (largest 29 mm in length).

**Material examined:** type material.

**Morphology:** Protoconch large, high mamillate, of ~ 2 whorls, eroded in lectotype, diameter and height ~ 2.5 mm. Protoconch of juvenile paralectotype (Fig. 1 I) covered by thin but distinct spiral striae. Operculum unknown. Thiele (1912) illustrated the radula of the paralectotype (Fig. 1 J), showing it to consist of hypodermic marginal teeth with a large base and likely one inconspicuous barb on the tip. Length around 200 µm (5.8% of AL).

**Remarks:** This species was originally described in the genus *Typhlomangelia* G.O.Sars, 1878, and referred to it by subsequent authors. *Typhlomangelia* was first established as a subgenus of *Pleurotoma* to contain a single North Atlantic species, *Pleurotoma nivale* Lovén, 1846. Later, Watson (1881) described several additional species from Japan, the West Indies, and subantarctic waters, attributing them to *Typhlomangelia* without discussion. Sysoev (1996a) described two additional species from the Indian Ocean. As currently understood, *Typhlomangelia* contains 13 species (Gofas 2015), most assigned to the genus on the basis of conchological similarities. The shell of *T. principalis* differs significantly from the type species, which is high-spired and has widely spaced axial ribs that form pronounced knobs along the

shoulder. Thiele (1912) based his assignment of *principalis* to *Typhlomangelia* on the general similarity of its radula to that of the type species *T. nivale* (radula illustrated by Sars 1878, pl. 9, fig. 106). However, *T. principalis* more closely resembles *Antarctospira badenpowelli* in shell shape and radular morphology. It differs in having a slightly coarser sculpture, fewer axial folds, and a more angulated profile of the upper teleoconch whorls than *A. badenpowelli*. The radular teeth of *A. principalis* (Fig. 1 J) differ from those of *A. badenpowelli* in their proportionally larger size (5.8% AL vs. 2.4% AL), but this may be due to the small size (5 mm) of the specimen from which Thiele obtained the radula. The lectotype and paralectotype of *A. principalis* are both very young specimens. However, shell fragments in the original type series (Thiele did not designate a type, therefore all the specimens were syntypes prior to Engl's (2012) lectotype designation) were estimated to have come from specimens 38 mm (Engl 2012: 179) to 40 mm (Thiele 1912: 216) in size. There have been several reports of this species in the literature (eg. Aldea *et al.* 2008; Troncoso & Aldea 2008), but the lack of illustrations makes these reports difficult to evaluate.

**Distribution:** Davis Sea, Bellingshausen Sea, 310–1400 m (Aldea *et al.* 2008, unconfirmed record).

***Antarctospira mawsoni* (Powell, 1958), n. comb.**

(Fig. 1 K)

*Leucosyrinx mawsoni* Powell 1958: 201-202, pl. 3, fig. 4; Engl 2012: 184, pl. 75, fig. 4 (holotype).

*Typhlomangelia? principalis*. – Egorova 1982: 50, figs 64, 209, 210 (not of Thiele 1912).

**Type locality:** off Mackenzie Sea, 66°48'S, 71°24'E, 456 m (B.A.N.Z.A.R.E. sta. 30).

**Type material:** Holotype: SAM (D 15509), SL 37.75 mm.

**Material examined:** no material available.

**Morphology:** Protoconch unknown. The operculum is small, oval with a terminal nucleus (Egorova 1982: fig. 210, as *Typhlomangelia? principalis*). Radula (Egorova 1982: fig. 64) of nearly straight hypodermic teeth without barbs or blade and with large swollen base and large basal opening.

**Remarks:** The species description was based on a dead-collected, worn holotype and an additional small shell, both studied by Powell. Neither animal nor radula are known.

Egorova (1982) described and illustrated by a line drawing a specimen from the Davis Sea that she identified as *Typhlomangelia? principalis*. Her drawing is similar to the holotype of

*Antarctospira mawsoni*. She noted that the species attains 54.4 mm in length. The radula is similar to that of *A. badenpowellii* and *A. principalis*.

*Antarctospira mawsoni* may prove to be a junior synonym of *A. principalis*.

**Distribution:** from Enderby Land to Mackenzie Sea [now Mackenzie Bay, western Avery Ice Shelf, MacRobertson Land], 193–456 m (Powell 1958).

### **Genus *Belaturricula* Powell, 1951**

*Belaturricula* Powell 1951: 170. Type species (original designation): *Bela turrita* Strebel, 1908; Recent, Antarctica.

**Diagnosis:** Shell large, attaining 100 mm, fusiform, with high spire, narrowly ovate last whorl and short, spout-like siphonal canal. Protoconch paucispiral, large, smooth. Teleoconch whorls weakly convex, subsutural ramp shallow concave, or absent. Anal sinus subsutural, very shallow. Axial sculpture limited to growth lines and, in some species, indistinct, irregularly spaced axial ribs. Spiral sculpture of narrow to moderately wide, dense spiral cords covering entire shell. Aperture of medium height, narrow, oval.

Operculum present, small, with terminal nucleus.

Radula of slightly curved, hypodermic marginal teeth with small rounded bases and two distinct, medium sized apical barbs.

**Remarks:** As the radula of *Belaturricula* was unknown at the time, Powell (1966: 34) assigned this genus to the subfamily Turriculinae (=Cochlespirinae), which are known to possess duplex marginal teeth (Bouchet *et al.* 2011). Dell (1990: figs 430, 431) subsequently illustrated the radulae of *Belaturricula turrita multispiralis* and *B. antarctica* (= *B. gaini*), showing them to consist of hypodermic marginal teeth with distal barbs, yet retained Powell's subfamilial attribution. Later, *Belaturricula* was attributed to Mangeliinae (Sysoev *in* Taylor *et al.* 1993), to Conidae (Clathurellinae) (Kantor and Harasewych 1999), and provisionally to Borsoniidae (Bouchet *et al.* 2011).

The newly acquired COI sequences for the three species of Antarctic *Belaturricula* indicate that these taxa form a monophyletic clade that is sister group to *Borsonia* sp. and more distantly related to *Bathytoma* spp. (Fig. 2), a placement that is congruent with anatomical data.

<FIGURE 2 ABOUT HERE>

Powell (1969: 362) provisionally reaffirmed earlier attributions (Powell 1951: 170; 1966: 34) of the deep-water Philippine species *Pleurotoma (Surcula) dissimilis* Watson, 1886 to *Belaturricula* based solely on shell morphology, as neither protoconch nor radula were known for this species. No new data on the species were acquired since.

*Belaturricula* is quite similar to the genus *Abyssothauma* Sysoev, 1996, which includes a single species *Moniliopsis psilarosis* Barnard, 1963 from deep water (3155–3255 m), off Cape Point, South Africa. Sysoev (1996b: 24) noted the resemblance of the new genus to *Belaturricula* and additionally to *Ponthiothauma ergata*, now transferred to *Belaturricula*. The differences include the presence of more pronounced axial ribs on upper whorls in *A. psilarosis* and absence of barbs on the radular teeth (Barnard 1963: 422).

**Distribution:** Off South Africa, Philippines, and Antarctica, in 70–1646 m. Of the four recognized species, one ranges from South Africa to the Philippines [*B. dissimilis* (Watson, 1881)], the remaining three, including one subspecies, are limited to the waters off Antarctica.

***Belaturricula turrita turrita* (Strebel, 1908)**

(Fig. 3 A-C)

*Bela turrita* Strebel 1908: 18, pl. 3, fig. 32 a-c.

*Belaturricula turrita*. – Powell 1951: 170; Carcelles 1953; Powell 1966: pl. 8, fig. 5; Powell 1969: 362 [23-448], pl. 274, fig. 1; Zelaya 2005: 128, fig. 51; Dell 1990: 228, fig. 399; Castellanos and Landoni 1993: 4, pl. 3, fig. 20.

**Type locality:** Shag Rock Bank, 53°34'S, 43°23'W, 160 m, Swedischen Südpolar-Expedition, sta. 17.

**Type material:** Holotype: SMNH Type-1340 (Fig. 3 A-C, illustrated for the first time), SL 60.0 mm. The label identifies the specimen as a syntype. However, there is no evidence that other specimens were ever present in the type series. Strebel (1908: 18) referred only to a single specimen that exactly matches the present specimen in size. We therefore treat this specimen as the holotype.

**Material examined:** South Georgia Island, RV *Islas Orcadas*, cruise 575, sta. 16, 53°38'24"S, 38°1'12"W, 130–133 m (USNM 894455, 5 sh); South Georgia Island, RV *Islas Orcadas*, cruise 575, sta. 10, 53°48'S, 37°27'W, 165–234 m (USNM 894458, 2 lv); South Georgia Island, RV *Islas Orcadas*, cruise 575, sta. 9, 53°43'12"S, 37°30'36"W, 271–313 m (USNM 894473, 1 sh); South Georgia Island, RV *Islas Orcadas*, cruise 575, sta. 13, 53°44'24"S, 37°59'24"W, 128–137 m, (USNM 894481, 1 sh); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 97, 54°00'S, 36°6'W, 151–158 m (USNM 896980, 1 lv); South Georgia Island,

RV *Professor Siedlecki*, cruise 86-01, sta. 97, 53°36'S, 38°6'W, 159–169 m (USNM 896983, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 90, 54°12'S, 36°12'W, 242–262 m (USNM 896996, 3 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 98, 54°00'S, 36°18'W, 166–197 m (USNM 897401, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 44, 54°30'S, 37°24'W, 152–162 m (USNM 897404, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 44, 54°54'S, 35°48'W, 127–140 m (USNM 897413, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 60, 55°24'S, 35°24'W, 207–218 m (USNM 897414, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 67, 55°00'S, 35°30'W, 117–122 m (USNM 897428, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 107, 53°42'S, 37°00'W, 226–249 m (USNM 897440, 3 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 119, 53°54'S, 38°42'W, 162–168 m (USNM 897447, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 93, 54°00'S, 35°36'W, 170–194 m (USNM 897454, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 111, 53°54'S, 37°30'W, 104–112 m (USNM 897460, 4 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 124, 54°06'S, 36°18'W, 170–187 m (USNM 897474, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 17, 54°00'S, 39°12'W, 328–412 m (USNM 897500, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 23, 54°06'S, 38°42'W, 197–207 m (USNM 897501, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 35, 54°42'S, 38°24'W, 178–185 m (USNM 897512, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 105, 53°42'S, 36°48'W, 161–192 m USNM 897516, (7 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 105, 54°06'S, 38°24'W, 197–207 m (USNM 897522, 4 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 37, 54°18'S, 37°54'W, 158–194 m (USNM 897535, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 84, 54°30'S, 35°36'W, 231–249 m (3 USNM 897541, lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 57, 55°06'S, 35°54'W, 152–178 m (USNM 897547, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 87, 54°18'S, 35°36'W, 238–247 m (USNM 897559, 2 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 21, 53°54'S, 38°36'W, 193–195 m (USNM 897580, 1 lv).

**Morphology:** Protoconch bulbous, smooth, paucispiral; operculum and radula unknown.

**Remarks:** The nominotypical subspecies appears to be endemic to South Georgia and Shag Rocks. It differs from the more widely ranging subspecies *B. turrita multispiralis* (see below) in having fewer, weaker spiral cords.

**Distribution:** South Georgia and Shag Rocks, 97–412 m, live 104–412 m (Dell 1990; USNM material).

<FIGURE 3 ABOUT HERE>

***Belaturricula turrita multispiralis* Dell, 1990**

(Fig. 3 D-E)

*Belaturricula turrita multispiralis* Dell 1990: 228, figs 400, 430 (radula); Engl 2012: 177-178, pl. 72, figs 2a-2b.

**Type locality:** Bransfield Strait, Antarctic Peninsula, 63°14'S, 58°45'W, 73 m, RV *Eltanin* st. 436.

**Type material:** Holotype: USNM 860139 (Fig. 3 D), SL 75.6 mm, paratypes USNM 860140 (type locality), USNM 860178, NMNZ (M.256618, type locality).

**Material examined:** type material; off South Shetland islands, RV *Eltanin*, cruise 6, sta. 445, 62°00'S, 59°06'W, 101 m (USNM 860178, 1 sh, paratype); Bransfield Strait, Antarctic Peninsula, RV *Eltanin*, cruise 6, sta. 436, 63°14'S, 58°45'W, 73 m (USNM 870307, 1 lv); Antarctic Peninsula, Argentine islands, Penola Strait, RV *Hero*, cruise 824, sta. 13-1, 65°13'48"S, 64°12'W, 310–360 m (USNM 894477, 2 sh); N of tip of Antarctic Peninsula, K. Halanych, sta. 21, 63°09'S, 57°07'12"W, 146–192 m (USNM 1099807, 1 lv); N of tip of Antarctic Peninsula, K. Halanych, sta. 21, 63°09'S, 57°07'12"W, 146–192 m (USNM 1121893, 1 lv, sequenced); N of tip of Antarctic Peninsula, K. Halanych, sta. 21, 63°09'S, 57°07'12"W, 146–192 m (USNM 1121960, 1 lv); N of tip of Antarctic Peninsula, K. Halanych, sta. 21, 63°09'S, 57°07'12"W, 146–192 m (USNM 1122047, 1 lv, sequenced).

**Morphology:** The radula was first illustrated by Dell (1990: fig. 430) as a schematic line drawing of a hypodermic, long marginal tooth with a rounded base and single barb near the tip.

**Remarks:** Partial sequences of the COI gene were determined for two specimens (USNM 1121893 and 1122047). The sequences were nearly identical, differing by a single base pair (of 658 bp), and clearly distinguished them from the other sequenced species of *Belaturricula* – *B. gaini* and *B. ergata* (Fig. 2).

**Distribution:** Antarctic Peninsula, Scotia Sea, South Shetland islands, 73–360 m, live 73–192 m (Dell 1990; USNM material).

***Belaturricula gaini* (Lamy, 1910)**

(Fig. 3 F-G)

*Sipho gaini* Lamy 1910: 319; 1911: 7, pl. 1, figs 7-8.

? *Chlanidota gaini*. – Powell 1951: 142.

*Belaturricula antarctica* Dell 1990: 228-229, figs 401, 431.

*Belaturricula gaini*. – Kantor and Harasewych 1999: 430-432; Engl 2012: 177, pl. 72, fig. 3.

**Type localities:** *Sipho gaini* – off King George Island, South Shetland islands, 420 m; *Belaturricula antarctica* – off South Shetland islands, 62°56.9'S, 60°50.1'W, 154 m, RV *Hero*, sta. 465.

**Type material:** Holotype: *Sipho gaini* – MNHN 27405, SL 32.9 mm; *Belaturricula antarctica* – USNM 860141, SL 67.6 mm (Fig. 3F).

**Material examined:** Holotypes of *Sipho gaini* and *Belaturricula antarctica*; Antarctic Ocean, RV *Eltanin*, cruise 6, sta. 437, 62°48'S, 60°36'W, 267–311 m (USNM 860142, 1 sh, paratype of *Belaturricula antarctica*); Antarctic Peninsula, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1003, 62°40'48"S, 54°43'12"W, 210–220 m (USNM 860143, 1 sh, paratype of *Belaturricula antarctica*); Antarctic Ocean, Scotia Sea, RV *Eltanin*, cruise 12, sta. 1079, 61°24'S, 41°54'W, 593–598 m (USNM 860144, 1 lv, paratype of *Belaturricula antarctica*); Palmer Peninsula, W of Renaud Island, RV *Polar Duke*, 65°36'S, 67°18'W, 200 m (USNM 846187, 1 sh); Palmer Peninsula, W of Renaud Island, RV *Polar Duke*, 65°36'S, 67°18'W, 200 m (USNM 846188, 1 sh); Palmer Peninsula, E of Hugo Island, RV *Polar Duke*, 65°06'S, 65°54'W, 150 m (USNM 846189, 1 sh); Scotia Ridge, SE of South Orkney islands, RV *Eltanin*, cruise 12, sta. 1079, 61°24'S, 41°54'W, 593–598 m (USNM 870624, 1 sh); Scotia Sea, RV *Eltanin*, cruise 12, sta. 1084, 60°24'S, 46°54'W, 298–403 m (USNM 870644, 1 sh); Ross Sea, Victoria Land, South of Coulman Island, RV *Eltanin*, cruise 27, sta. 1885, 74°30'S, 170°12'E, 311–328 m (USNM 870946, 1 sh); Antarctic Peninsula, Palmer Archipelago, Anvers Island, RV *Hero*, cruise 812, sta. 18-1, 64°47'24"S, 64°7'12"W, 68–85 m (USNM 881527, 1 lv); Antarctic Peninsula, Graham Land, Joinville Island, RV *Eltanin*, cruise 12, sta. 1002, 62°42'S, 54°48'E, 265 m (USNM 881974, 1 lv); South Shetland islands, Bransfield Strait, S of Low Island, RV *Eltanin*, cruise 6, sta. 441, 63°24'S, 62°36'E, 156–253 m (USNM 887732, 1 sh); Ross Sea, RV *Hero*, cruise 721, sta. 941, 64°46'48"S, 64°7'12"E, 90 m (USNM 890948, 1 sh); Ross Sea, Victoria Land, Cape Adare, RV *Eltanin*, cruise 27, sta. 1870, 71°18'S, 171°30'E, 659–714 m (USNM 896742, 1 lv); South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 72, 54°54'S, 35°36'W, 84–103 m (USNM 897565, 1 lv); Antarctic Peninsula, Bransfield Strait, RV *Hero*, cruise 833, sta. 21-1, 63°23'24"S, 57°0'36"W, 276–280 m (USNM 897602, 1 lv); South Shetland islands, Low Island, RV *Hero*, cruise 833, sta. 22–4, 63°18'36"S, 61°52'48"W, 228–264 m (USNM 897631, 3 lv); South Shetland islands, Elephant Island, RV *Polarstern*, cruise 2, sta. 8, 61°18'S, 55°48'W, 142–158 m (USNM 901688, 1 lv); South Shetland islands, Elephant Island, RV *Polarstern*, cruise 2, sta. 28, 61°0'S, 55°54'W, 214–219 m (USNM 901689,



1 lv); South Shetland islands, Elephant Island, RV *Polarstern*, cruise 2, sta. 34, 60°54'S, 55°24'W, 281–302 m (USNM 901690, 1 lv); Antarctic Peninsula, Palmer Archipelago, Anvers Island, RV *Hero*, cruise 731, sta. 1802, 64°47'24"S, 64°6'36"W, 107 m (USNM 901858, 1 lv); Antarctic Peninsula, Brabant Island, K. Halanych, sta. 29 (A, B), 64°8'24"S, 62°45'36"W, 156 m (USNM 1121911, 1 lv, sequenced); Antarctic Peninsula, off Trinity Island, K. Halanych, sta. 12, 63°40'8.76"S, 61°10'3"W, 126 m (USNM 1121929, 1 lv sequenced).

**Morphology:** Protoconch large (2.4–2.8 mm diameter), rounded, ~ 1<sup>1</sup>/<sub>3</sub> whorls, eroded in most specimens. Operculum (Kantor and Harasewych 1999: fig. 1d) small (<1/4 aperture length), unguiculate, its nucleus strongly deflected to the right. Radula (Kantor and Harasewych 1999: figs 3 a-e) of long, slender, hypodermic marginal teeth with small rounded bases and two distinct apical barbs, one larger than the other. Distal opening of the tooth canal lateral. Tooth length ~ 810 µm (3.24% of AL). A well-developed ligament maintains the regular arrangement of teeth within the radular sac.

**Remarks:** This species was originally described in the genus *Sipho* and referred to the family Buccinulidae until anatomical studies (Kantor and Harasewych 1999) showed it to be a member of the genus *Belaturricula* and a senior synonym of *Belaturricula antarctica*.

**Distribution:** Antarctic Peninsula, islands of the Scotia Arc, Weddell, and Ross seas, 68–714 m, live 68–714 m (Dell 1990; Engl 2012; USNM material).

### ***Belaturricula ergata* (Hedley, 1916)**

(Fig. 3 H-L)

*Pontiothauma ergata* Hedley 1916: 55, pl. 8, figs 85-87; Powell 1958, p. 204, pl. 3, fig. 7, text figs C. 1-4; Powell 1960: 160 (distribution record); Egorova 1982: 50, figs 63a, b, 204, 205; Hain 1990: 72, pl. 8, figs 6a-d, pl. 27, fig. 2; Dell 1990: figs 418-419 (holotype); Numanami 1996: 224-225, figs 159A- E.

*Belaturricula ergata* – Kantor and Harasewych 1999: 434; Engl 2012: 177, pl. 72, fig. 1.

**Type locality:** Off Shackleton Ice-shelf, Queen Mary Land, Antarctica, 65°20'S, 95°27'E, 439 m.

**Type material:** Holotype: AMS (C.46689), SL 31.8 mm.

**Material examined:** Adélie Land, RV *Aurora Australis*, cruise CEAMARC, sta. 27EV45, 66°01'S, 142°43'E, 421–463 m (MNHN IM-2009-8165, 1 lv); Adélie Land, RV *Aurora Australis*, cruise CEAMARC, sta. 11EV429, 66°34'S, 141°20'E, 170–210 m (MNHN IM-2009-8177, 1 lv); Adélie Land, RV *Aurora Australis*, cruise CEAMARC, sta. 87EV524, 65°29'S, 139°19'E, 397–411 m (MNHN IM-2009-8189, 1 lv.).

**Morphology:** Protoconch (Numanami 1996, fig. 159C) large, ~ 2 slightly convex whorls, diameter 2.8 mm, height 2.6 mm, smooth, glossy white in color. Indistinct protoconch-teleoconch transition marked by appearance of spiral sculpture.

Operculum (Egorova 1982, fig. 205) small, narrow oval, with nucleus strongly deflected to the right.

Radula (Fig. 3 J-L) of very long, slender, hypodermic marginal teeth with small rounded bases and two distinct, medium sized apical barbs. Distal opening of the tooth canal lateral, long, oval. Tooth length ~ 1060  $\mu\text{m}$  (3.5% of AL). A well-developed ligament maintains regular arrangement of teeth within the radular sac.

**Remarks.** This species had previously been referred to *Pontiothauma* E.A. Smith, 1895 (type species: *Pontiothauma mirabile* E.A. Smith, 1895), a member of the Raphitomidae, a family characterized by the lack of an operculum.

The radula of this large species, which reaches 100 mm in size (Engl 2012: 177), was first illustrated by Powell (1958) and Egorova (1982) as line drawings, and later by Hain (1990) and Numanami (1996) using electron micrographs. It is nearly identical to those of other species of *Belaturricula*. COI sequences of three specimens (Fig. 2) further support the transfer of this species to *Belaturricula*.

**Distribution:** Off Antarctica, from the Weddell Sea eastward to the Dumont d'Urville Sea, 73–695 m, live 73–463 m (Numanami 1996: fig. 160, MNHN material).

#### **Genus *Drilliola* Locard, 1897**

*Drilliola* Locard 1897: 214. Type species (by monotypy): *Taranis emendata* Monterosato, 1872; Recent, Mediterranean.

**Diagnosis:** Shell small, attaining 12 mm, claviform, with high spire and elongate-ovate last whorl, terminating in moderately long unnotched or shallowly notched siphonal canal. Protoconch ~ 2 1/2 bicarinate whorls (type species) to conical multispiral with axial ribs. Teleoconch whorls weakly convex, subsutural ramp shallow, concave. Anal sinus moderately deep, U-shaped, with the deepest point slightly above the shoulder. Axial sculpture limited to crisp growth lines. Spiral sculpture of distinct, narrow, widely spaced spiral cords. Aperture moderately high, narrow oval.

Operculum present, small, with terminal nucleus.

Radula of long, slightly curved, hypodermic, pointed marginal teeth with very weak blade.

**Remarks:** This genus is known from the northern and central Atlantic Ocean and the Mediterranean Sea in the Recent fauna, as well as from Cenozoic deposits of northern Europe

and New Zealand (Pacaud and Le Renard 1995; Schnetler and Palm 2008; Spencer *et al.* 2009). The Recent species, *D. emendata* and *D. loprestiana* (Calcara, 1841) differ markedly in shell shape and protoconch morphology (Bouchet and Warén 1980: figs 83, 207 for *D. emendata*, figs 82, 208-209 for *D. loprestiana*), *Drilliola loprestiana* seems more similar to species of *Microdrillia* Casey, 1903. Bouchet and Warén (1980: 32) considered *Microdrillia* to be a synonym of *Drilliola*, but both genera are recognized in current classifications (Bouchet *et al.* 2011).

**Distribution:** The range of this genus in the Recent fauna has been extended from the northern and central Atlantic and Mediterranean Sea to Antarctica with the description of the new species below.

<FIGURE 4 ABOUT HERE >

***Drilliola antarctica* n. sp.**

(Fig. 4)

Turridae species 2 - Engl 2012: 190, pl. 78, fig, 5 a-b

**Type material:** Holotype: USNM 898821, South Shetland islands, Penguin Island, 62°40'1.2"S, 57°48'28.7994"W, USAP, RV *Eltanin*, 662–1120 m.

**Description:** Shell (Figs 4 A,B) small, narrow fusiform, fragile, with elevated spire and wide, attenuated siphonal canal. Protoconch and upper teleoconch whorls eroded. Remaining shell ~ 6 1/2 weakly convex whorls, slightly angulated at the shoulder. Suture shallow, weakly adpressed. subsutural ramp nearly flat. Axial sculpture limited to thin, narrowly spaced, slightly raised growth lines. Spiral sculpture of strong, narrow, raised cords, varying in prominence, separated by broader interspaces. Four narrow, irregularly spaced cords on subsutural ramp, 1 strong cord at shoulder producing an angulated profile for the whorls, 14 cords below shoulder and on siphonal canal, becoming more closely spaced along distal portions of the siphonal canal. Anal sinus wide, deep, nearly symmetrical, with deepest point slightly above shoulder cord.

Last whorl convex, comprising 0.6 of SL. Aperture moderately high, narrow, oval, comprising 0.5 of SL. Outer lip broken, showing spiral cords. Parietal region with narrow but thick callus, completely overlaying spiral sculpture. Columella smooth. Siphonal canal long, widely open, well differentiated from aperture, nearly straight. Shell color chalky white.

Periostracum thin, peeling, olive and smooth. Operculum (Fig. 4 C) large, occupying nearly the entire aperture, narrow, oval, lower region including nucleus, abraded.

**Dimensions:** SL 11.6 mm, BWL 6.9 mm, AL 5.8 mm, SW 4.2 mm.

The dried tissues of the holotype were rehydrated. The body lacks pigmentation. Head well defined, small with short tentacles, eyes absent. Holotype is an adult male, penis very long, thick, spans entire mantle cavity, terminates in medium sized conical seminal papilla, not surrounded by fold. Proboscis straight, venom gland very short but thick, muscular bulb small. Radular sac very long, spanning nearly entire haemocoel. Radula (Fig. 4, D-F) of hypodermic marginal teeth, with short ligament and thin but strong subradular membrane maintaining radular integrity within the radula sac. Teeth long, around 270  $\mu\text{m}$  in length (4.7% of AL), base rounded, small, tooth canal opening long, subterminal. Tip with short cutting edge lacking barbs.

**Remarks.** The shell morphology of this new species is very similar to that of *Drilliola emendata*, the type species of the genus, although the eroded protoconch in the new species does not allow full comparison. The radula of *D. antarctica* is generally similar to that of *D. emendata* as illustrated by Bouchet and Warén (1980: fig. 29), but also resembles the radulae of many other Borsoniidae. Engl (2012: 190) noted the resemblance to this species to *Drilliola emendata* (Monterosato, 1872). Several fossil species from New Zealand are also attributed to *Drilliola* (Beu 2011).

**Distribution:** The species appears to be restricted to the South Shetland and South Orkney islands (Engl 2012).

### **Genus *Typhlodaphne* Powell, 1951**

*Typhlodaphne* Powell 1951: 174. Type species (by original designation): *Bela purissima* Strebel, 1908; Recent, Antarctica.

**Diagnosis:** Shell medium sized, attaining 48 mm, from elongate-ovate to narrowly fusiform, with high spire, narrow to moderately wide ovate last whorl and a wide, attenuated siphonal canal. Protoconch paucispiral, large, smooth, ~2 whorls. Teleoconch whorls weakly to moderately convex, may be weakly angulated at shoulder, subsutural ramp shallow, concave. Anal sinus subsutural, shallow to moderately deep. Axial sculpture limited to growth lines, some thickened and more pronounced, producing appearance of irregularly spaced axial ribs. Spiral sculpture of cords that may be weak or obsolete in some species, covering entire shell. Aperture moderately high, narrow, oval.

Operculum present, small, with terminal nucleus.

Radula of slightly curved hypodermic marginal teeth with small rounded bases and two medium sized apical barbs.

**Remarks:** Recent classifications have included as many as eight species in *Typhlodaphne* (Dell 1990: 239), four from Antarctic and four from subantarctic waters. Most have been transferred to other genera. We currently recognize two Antarctic species within this genus.

In the original description of *Typhlodaphne*, Powell (1951: 174, figs M, 92; N, 119, and N, 130) illustrated the radula, protoconch and operculum of the type species. He included this new genus in the subfamily Daphnellinae (=Raphitomidae A. Bellardi, 1875, *vide* Bouchet *et al.* 2011), "mainly on the evidence of the sinus, which is of a type seemingly exclusive to that subfamily" (Powell 1951: 174). This subfamilial placement was followed by subsequent authors (e.g., Powell 1966; Dell 1990; Numanami 1996). As a recent diagnosis of the Raphitomidae (Bouchet *et al.* 2011: 283) has shown that this family lacks an operculum, the genus *Typhlodaphne* was provisionally transferred to Borsoniidae (Bouchet *et al.* 2011: 278).

In addition to the Antarctic type species (*Bela purrissima* Strebel, 1908), Powell (1951) included in the genus *Typhlodaphne* two Patagonian taxa (*Typhlodaphne strebeli* Powell, 1951; *Thesbia filostriata* Strebel, 1905) as well as one subantarctic species (*Pleurotoma (Thesbia) translucida* Watson, 1881) from the Prince Edward islands. He later (Powell 1966: 129) added two species [*Pleurotoma (Thesbia) corpulenta* Watson, 1881; *Pleurotoma (Thesbia) platamodes* Watson, 1881] from off Kerguelen Island. Dell (1990) included the Patagonian species (*Daphnella payeni* Rochebrune & Mabille, 1885) in *Typhlodaphne*, and described an additional species (*T. innocentia* Dell, 1990) from the Ross Sea.

Numanami (1996: 222) reported *Pleurotoma (Thesbia) translucida* Watson, 1881, from the coast of Antarctica, and transferred this species to *Xanthodaphne* on the basis of its radular morphology [see below as *Xanthodaphne translucida*]. We here transfer *Typhlodaphne innocentia* Dell, 1990, to *Pleurotomella*, on the basis of shell morphology [see below under *Pleurotomella innocentia*].

Based solely on shell morphology, the subantarctic species *P. corpulenta* and *P. platamodes*, and the Patagonian species *D. payeni* most closely resemble *P. translucida*, and likely are also referable to *Xanthodaphne*. The Patagonian species *T. filostriosa* and *T. strebeli* (Fig. 5 K-L) are provisionally retained in *Typhlodaphne* pending additional data on radular morphology or molecular sequences.

**Distribution:** Magellanic, Antarctic, 90–2850 m.

<FIGURE 5 ABOUT HERE >

***Typhlodaphne purissima* (Strebel, 1908)**

(Figs 5 A-J, 6 A-F)

*Bela purissima* Strebel 1908: 17-18, pl. 3, fig. 31 a-d.

*Typhlodaphne purissima*. – Powell 1951: 174, figs M 92,051

62 N 119, N 130; Castellanos and Landoni 1993 (part.): 13, non pl. 3, fig. 29 a-b (=

*Typhlodaphne strebeli* Powell, 1951); Zelaya 2005: 128, fig. 54.

**Type locality:** Shag Rock Bank, 53°34'S, 43°23'W, 160 m, Swedischen Südpolar-Expedition, sta. 17.

**Type material:** Syntypes: three syntypes, SMNH Type-1061 (Fig. 5 A-F). Two live collected specimens, one dead broken shell.

**Material examined:** off South Georgia Island, RV *Isla Orcada*, cruise 575, sta. 14, 53°40'36.12"S, 37°57'11.88"W, 144–150 m (USNM 881714, 1 sh); off South Georgia Island, RV *Eltanin*, cruise 22, sta. 1535, 53°54'S, 37°36'W, 97–101 m (USNM 886051, 6 lv); off South Georgia Island, RV *Isla Orcada*, cruise 575, sta. 17, 53°36'S, 38°3'W, 122–124 m (USNM 894454, 4 sh); off South Georgia Island, RV *Professor Siedlecki*, cruise 86-01, sta. 58, 53°16'12"S, 35°43'12"W, 180–186 m (USNM 897551, 1 lv); off South Georgia Island, RV *Eltanin*, cruise 9, sta. 686, 54°59'S, 38°13'W, 2196–2379 m (USNM 896362, 2 lv); NE of South Georgia Island, RV *Eltanin*, cruise 9, sta. 726, 52°53'S, 33°52'W, 2818–2855 m (USNM 896521, 1 lv.).

**Morphology:** Protoconch (Fig. 5 F) smooth, rather large, diameter ~1.65 mm, height 1.3 mm, ~2 rounded whorls. Operculum (Fig. 5 D) small, comprising 0.25 of aperture length, leaf-shaped, translucent, with the subterminal nucleus situated at the lower-right.

Radula (Figs 6 A-C) of hypodermic marginal teeth, with distinct ligament and thin, strong subradular membrane maintaining radular integrity within the radula sac. Tooth base rounded, apical opening large, oval, lateral. Tip of tooth armed with two sharp barbs, one immediately distal to apical opening, the other lateral and proximal to opening. Tooth length ~ 310 µm (2.4% of AL).

**Remarks:** The syntypes of this species are nearly smooth, except for fine growth lines, indistinct spiral riblets, and several faint, strongly oblique, irregularly spaced riblets along the upper teleoconch whorls. Some specimens collected off South Georgia (USNM 897551) at similar depths have more pronounced oblique ribs that extend onto the last whorl (eg. Fig. 5 G).

While the majority of examined specimens were collected at outer continental shelf depths (97–186 m), two records were from depths in excess of 2,000 m (Fig. 5 H-J). These deep-water

specimens resemble the shallow water records in general morphology, but have slightly thinner shells, more pronounced spiral sculpture, axial ribs parallel to growth striae, and shoulders that become more pronounced with increasing depth. The radula of a deep-water specimen (Fig. 6 D-F) [tooth length ~310  $\mu\text{m}$  (2.4% of AL)] is similar to those from shallow water, but has shorter, more obtuse barbs. At present, we provisionally regard these specimens as deep-water phenotypes of *T. purissima*, but recognize that additional data may show them to be an undescribed species.

<FIGURE 6 ABOUT HERE>

With their pronounced axial ribs, these deep-water specimens somewhat resemble the Patagonian species *Typhlodaphne strebeli* Powell, 1951 (holotype, NHMUK 1961617 from off Cape Horn – Fig. 5 K-L), also from outer shelf depths. Conchological differences between *T. purissima* and *T. strebeli* are subtle, with *T. strebeli* distinguished on the basis of its buff color, slightly more slender shell with a smaller protoconch and the presence of oblique ribs.

In his description of *T. strebeli*, Powell (1951: 175) listed, but did not further discuss, a second specimen from the type locality of *T. purissima* (This specimen could not be located in the collections at NHMUK, A. Salvador, personal communication). At present, we consider *T. purissima* and *T. strebeli* to be different species.

**Distribution:** South Georgia and Shag Rock Bank, live 94–2380 m. Zelaya (2005) considered the reports of this species from off Argentina and Tierra del Fuego (Carcelles 1944; Castellanos and Landoni 1993) to be referable to *T. strebeli* Powell, 1951.

***Typhlodaphne paratenoceras* (Powell, 1951), n. comb.**

(Figs 6 G-M; 7 A-K)

*Leucosyrinx paratenoceras* Powell 1951: 168-169, pl. 9, fig. 54; Castellanos and Landoni 1993: 6, pl. 3, fig. 21; Troncoso and Aldea 2008: 1261.

**Type locality:** *Discovery* sta. 1952, between Penguin Island and Lion's Rump, King George Island, South Shetland islands, 367–382 m.

**Type material:** Holotype: NHMUK 1961607, SL 38.75 mm (Fig. 7 A-C).

**Material examined:** South Orkney islands, of North Laurie Island, RV *Eastwind*, cruise 66, 60°31'12"S, 44° 46' 48"W, 761 m (USNM 678478, 1 lv2 sh); South Shetland islands, W of Elephant Island, RV *Eltanin*, cruise 6, sta. 410, 61°18'S, 56°06'W, 220–240 m (USNM 870249,

2 lv); W of South Orkney islands, RV *Eltanin*, cruise 7, sta. 538, 60°30'S, 47°30'W, 616–662 m (USNM 870328, 2 sh); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1002, 62°42'S, 54°42'W, 265 m (USNM 870559, 1 sh); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1003, 62°42'S, 54°42'W, 210–220 m (USNM 870608, 1 sh); Scotia Ridge, SE of South Orkney islands, RV *Eltanin*, cruise 12, sta. 1078, 61°24'S, 41°54'W, 604 m (USNM 870613, 1 sh); Scotia Ridge, SE of South Orkney islands, RV *Eltanin*, cruise 12, sta. 1079, 61°24'S, 41°54'W, 593–598 m (USNM 870629, 10 lv, one radula examined); South Orkney islands, Scotia Ridge, RV *Eltanin*, cruise 12, sta. 1084, 60°24'S, 46°54'W, 298–403 m (USNM 870640, 1 sh); South Orkney islands, Inaccessible Island, RV *Islas Orcadas*, cruise 876, sta. 113, 60°30'S, 46°43'12"W, 124–128 m (USNM 894445, 1 sh); South Orkney islands, RV *Islas Orcadas*, cruise 876, sta. 118, 62°1'48"S, 43°06'W, 759–857 m (USNM 894461, 1 sh); South Orkney islands, Coronation Island, RV *Islas Orcadas*, cruise 876, sta. 108, 60°25'48"S, 46°23'24"W, 152–159 m (USNM 894467, 1 sh); South Orkney islands, Laurie Island, RV *Islas Orcadas*, cruise 876, sta. 129, 60°57'S, 44°24'W, 225–234 m (USNM 894479, 1 sh); Scotia Ridge, SE of South Orkney islands, RV *Eltanin*, cruise 12, sta. 1079, 61°24'S, 41°54'W, 593–598 m (USNM 896403, 2 lv); South Shetland islands, Deception Island, RV *Hero*, cruise 833, sta. 2, 62°54'36"S, 60°30'W, 130–210 m (USNM 897549, 1 lv).

<FIGURE 7 ABOUT HERE>

**Morphology:** Protoconch smooth, rather large, ~ 2 rounded whorls, diameter ~ 2.1 mm, height ~ 1.7 mm. Operculum (Fig. 6 J) present, large, narrow, occupying ~ ½ of aperture, with terminal nucleus very slightly shifted to right.

Radula (Fig. 6 G-I, K-M) of hypodermic marginal teeth. Subradular membrane vestigial. Teeth straight, with medium sized swollen base and lateral basal opening of tooth canal. Teeth attached to membrane by distinct ligament. Apical opening with small sharp distal barb and another larger, obtuse barb at proximal end of opening of tooth canal. Teeth length ~320 µm long (1.08% of SL).

**Remarks:** *Typhlodaphne paratenoceras* was described in the genus *Leucosyrinx* entirely on conchological grounds. Powell (1951: 168) stated: "I have included the two following species (*Leucosyrinx paratenoceras* and *L. paragenota*) in *Leucosyrinx* in preference to *Aforia* because the anal sinus is wide, occupying most of the shoulder, and the species lack the strong peripheral carina which is so characteristic of *Aforia*. Unfortunately, none of the specimens contained the animal. Both *Aforia* and *Leucosyrinx* belong to the subfamily Cochlespirinae."



The genus *Leucosyrinx* Dall, 1889 (type species *Pleurotoma verrillii* Dall, 1881) as currently accepted (Bouchet *et al.* 2011) belongs to the family Pseudomelatomidae, which is characterized by a radula of non-hypodermic duplex marginal teeth and the absence of a central tooth. As the radula of "*Leucosyrinx*" *paratenoceras* is comprised of hypodermic marginal teeth, this species cannot be attributed to Pseudomelatomidae, or to *Leucosyrinx*. Radular morphology suggests this species is referable to the family Borsoniidae. The morphology of its shell is most similar to that of *Typhlodaphne purissima*, sharing such features as large size (reaching 45 mm in *T. paratenoceras*, 32 mm in *T. purissima*), narrow shell, high spire and slightly concave subsutural ramp, and similarly shaped subsutural anal sinus with its deepest point around the midpoint of subsutural ramp. *Typhlodaphne paratenoceras* has more pronounced spiral sculpture, comprised of closely spaced spiral cords, while *T. purissima* has faint spiral striations that are best observed in oblique light. The operculum of *T. paratenoceras* is larger in proportion to the shell, spanning ~ 1/2 the aperture length, compared to 1/4 the aperture length in *T. purissima*. The radulae of both species are remarkably similar. However, the barb below the apical opening of the tooth canal is pointed in *T. purissima*, obtuse in *T. paratenoceras*.

**Distribution:** Bellingshausen, Scotia and Weddell Seas, 60°22'S to 64°21'S; 41°55'W to 62°58'W; 124–857 m, live 130–761 m (USNM materials).

***Typhlodaphne cf paratenoceras* (Powell, 1951)**

(Fig. 6 N-R, 7 L-O)

**Material examined:** Scotia Sea, RV *Eltanin*, cruise 22, sta. 1511, 59°00'S, 51°54'W, 3010–3510 m (USNM 1113019, 3 sh); (USNM 1113020, 2 lv.).

Several specimens from the Scotia Sea were collected at substantially greater depths (>2800 m) than the majority of records for this species (124–857 m). Conchologically these specimens fall within the range of variability of *T. paratenoceras*. The operculum (Fig. 6 R) differs in having its nucleus deflected to right, more so than in shallow water specimens (Fig. 6 J). Radular teeth (Fig. 6 N-Q) are very similar to those of *T. paratenoceras* in general shape and size (teeth length 490 µm, or 1.08% of SL), but differ in having a reduced lower apical barb. We provisionally attribute these specimens to *Typhlodaphne cf paratenoceras*, recognizing that additional material may warrant segregating the abyssal population as a separate species.

## Family MANGELIIDAE P. Fischer, 1883

### Genus *Lorabela* Powell, 1951

*Lorabela* Powell 1951: 171. Type species (by original designation): *Bela pelseneri* Strebel, 1908; Recent Antarctica.

**Diagnosis:** Shell small, attaining 11.5 mm, ovate-biconic, with low spire, high, strongly convex last whorl and short, wide siphonal canal. Protoconch medium sized, ~ 2 convex, smooth or finely granulated whorls. Teleoconch whorls convex, evenly rounded or angulated at shoulder, subsutural ramp weakly concave to nearly straight. Anal sinus subsutural, shallow, with the deepest point on subsutural ramp. Axial sculpture of sharp, narrow, arcuate ribs. Spiral sculpture of subequal, dense spiral cords or, in some species, of inconspicuous riblets, covering the entire shell. Aperture moderately high, narrow ovate-pyriform.

Operculum present, small, with terminal nucleus.

Radula of short, hypodermic, marginal teeth with long base and lateral basal opening, without barb at the tip.

**Remarks:** Four species, all Antarctic, are currently recognized in *Lorabela*. *Bela notophila* Strebel, 1908 was attributed to *Lorabela* by Powell (1951), but has been transferred to a new, monotypical genus *Strebela* Kantor and Harasewych, 2013 (Buccinulidae).

There is a conspicuous similarity among several Antarctic species and boreal "Oenopotinae" in the morphologies of their shell, protoconch, radula and in the presence of an operculum. In his description of *Lorabela*, Powell (1951) noted its similarity to the boreal genus *Propebela* Iredale, 1918. Bouchet and Warén (1980) synonymized 12 genera with *Oenopota*, among them *Lorabela* Powell, 1951 and *Belalora* Powell, 1951, from Antarctic and Magellanic waters. Bogdanov (1987) subsequently erected the subfamily Oenopotinae, and later (1990) revised the northern genera and species of this subfamily, recognizing five genera and four subgenera. Bouchet *et al.* (2011: 281) synonymized Oenopotinae with Mangeliidae, and listed *Lorabela* and *Belalora* as questionable synonyms of *Propebela*. Beu (2011) discussed the position of several Recent and fossil turrids from New Zealand in some detail, and treated *Lorabela*, *Belalora*, *Antiguraleus* Powell 1942 and *Paraguraleus* Powell 1944 as synonyms of *Propebela*. Most recently, Engl (2012) followed Bouchet and Warén (1980) in synonymizing *Lorabela* and *Belalora* with *Oenopota*.

Phylogenetic analyses (Fig. 8) of new COI sequence data from three specimens of *Lorabela* and a selection of previously sequenced taxa now assigned to Mangeliidae (Puillandre *et al.* 2011), revealed *Propebela* to be more closely related to *Toxicochlespira* Sysoev & Kantor,

1990 from the western Pacific than to *Lorabela*. Based on morphological data, Lundberg *et al.* (1996) showed that most *Propebela* (including the type species *Murex turricula* Montagu, 1803) form a monophyletic group within the “*Oenopota/Propebela* complex”. Therefore, despite the conchological and radular similarities of *Lorabela* (and *Belalora*) to boreal “oenopotine” genera, we treat these two Antarctic/subantarctic genera as distinct .

**Distribution:** Antarctica, 98–650 m.

<FIGURE 8 ABOUT HERE>

***Lorabela pelseneri* (Strebel, 1908)**

**(Fig. 9 A-C)**

*Bela pelseneri* Strebel 1908: 15-16, pl. 2, fig. 27 a-b.

*Lorabela pelseneri*. – Powell 1951: 171; Powell 1966: pl. 19, fig. 14; Castellanos and Landoni 1993: 20, pl. 2, fig. 15.

*Lorabela pelseneeri*. – Hain 1990: 70, pl. 8, fig. 1, pl. 26, fig. 5; Zelaya 2005: 128, fig. 50 (text and figure captions erroneously refer to fig. 52; which represents "*Bela fulvicans*"); Numanami 1996: 211.

*Oenopota pelseneri*. – Engl 2012: 182, pl. 74, fig. 3 (lectotype).

**Type locality:** Outer Cumberland Bay, South Georgia Island, 54°11'S, 36°18'W, in 252–310 m, Swedischen Südpolar-Expedition, sta. 34.

**Type material:** Lectotype (designated by Engl 2012: 182, pl. 74, fig. 3), SMNH Type-1065, SL 7.6 mm, 2 paralectotypes SMNH Type-5762 (from type locality).

**Material examined:** Type material; off South Georgia Island, RV *Eltanin* Cruise 22, sta. 1535, 53.9°S, 37.6°W, 97–101 m (USNM 886042, 1 lv); off Antarctic Peninsula, 63°40'4.8"S, 57°18'56.4"W, 260 m (USNM 1121974, 1 lv, sequenced).

**Morphology:** The protoconch was eroded on all available specimens. Powell (1951: 171) reported the operculum to be vestigial, thin, oval, with a terminal nucleus. Although the lectotype lacks an operculum, the scar of the opercular disc on the dorsal part of the foot is clearly seen (Engl 2012: pl. 74, fig. 3). The radula was illustrated by Hain (1990: pl. 26, fig. 5) as having short, hypodermic marginal teeth with a long base, a large, oval, lateral basal opening and a medium sized lateral apical opening of the tooth canal.

**Remarks:** The sequenced specimen (USNM 1121974 – Fig. 9C) from the Antarctic Peninsula differs from the lectotype (Fig. 9A) in having a narrower shell with a more attenuated base. It more closely resembles the paralectotype (Fig. 9B).

**Distribution:** South Georgia, the Bransfield Strait and the Weddell Sea, in 98–310 m (Powell 1951; Engl 2012).

<FIGURE 9 ABOUT HERE>

***Lorabela glacialis* (Thiele, 1912)**

**(Fig. 9 D–I)**

*Bela glacialis* Thiele 1912: 215, pl. 14, fig. 5.

*Typhlodaphne glacialis*. – Egorova 1982: 51, fig. 212.

*Oenopota glacialis*. – Engl 2012: 182, pl. 74, figs 1a-b.

**Type locality:** *Gauss*-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** 9 syntypes, ZMB Mol 62985.

**Material examined:** The type material.

**Morphology:** The protoconch (Fig. 9 F) is paucispiral, ~ 2 smooth, rounded whorls, (diameter 1.33 mm, height 0.98 mm in one of syntypes). The animal is unknown.

**Remarks:** No new records of this species have been reported since it was described. Egorova's (1982) treatment of this taxon is based on Thiele's description.

**Distribution:** Known only from the type locality.

***Lorabela plicatula* (Thiele, 1912)**

**(Fig. 9 J–R)**

*Bela plicatula* Thiele 1912: 215, pl. 14, fig. 4;

*Lorabela plicatula*. – Powell 1951: 171; 1958: 202; 1960: 159; 1966: 122; Egorova 1982: 48, fig. 203 (based on published data only); Hain 1990: 71, pl. 8, fig. 2 (shell), pl. 26, fig. 6 (radula); Numanami 1996: 210-211, figs 146A-D.

*Oenopota plicatula*. – Engl 2012: 182-183, pl. 74, figs 4a-b.

not *Lorabela plicatula* sensu Dell 1990: 238, figs 405, 407.

**Type locality:** *Gauss*-Station, Davis Sea, 66°02'09"S, 89°38'E, in 385 m.

**Type material:** 6 syntypes, ZMB Mol 62986.

**Material examined:** type material; off Antarctic Peninsula, 63°40'4.8"S, 57°18'56.52"W, 260 m (USNM 1121967, 1 lv, sequenced); off Antarctic Peninsula, 63°40'4.8"S, 57°18'56.52"W, 260 m (USNM 1121969, 1 lv, sequenced).

**Morphology:** Protoconch paucispiral, ~ 2 rounded whorls, with dense spiral rows of micropustules and narrow, prosocyr, axial ribs on the last 1/5 whorl. Diameter 1.0 mm, height 0.86 mm in syntype (Fig. 9 L); diameter 1.1, height 0.99 mm (Numanami 1996: fig. 146C). Operculum absent (Numanami 1996: 210).

Radula (Fig. 9 P-R) of hypodermic marginal teeth with long, solid, transversely striated base spanning 1/5 of tooth length. Tooth long [230 µm, ≈ 4.2% of aperture length (AL) without siphonal canal], with well pronounced spur. Basal opening of tooth canal large oval, lateral, distal opening narrow, elongate, lateral. Long blade present along distal third of tooth opposite the distal opening, barbs absent.

**Remarks:** Syntypes of *L. plicatula* are immature, dead collected and slightly worn specimens, the largest 6.2 mm in length. The largest specimen we examined was 11 mm in length (Fig. 9 O). *Lorabela plicatula* is similar conchologically to *L. glacialis* and some of the syntypes of both species can hardly be differentiated (eg. Figs 9 D and 9 J).

*Lorabela glacialis* and *L. plicatula* occur in sympatry, but may be distinguished by presence of a stronger shoulder with a more gently sloping subsutural ramp in *L. plicatula*, as well as by its slightly smaller protoconch [*L. plicatula* D = 1.0 mm, H = 0.86 mm vs D = 1.3, H = 0.98 in one syntype of *L. glacialis*).

COI sequence data (Fig. 8) demonstrate a close relationship between *L. plicatula* and *L. pelseneri* that were collected sympatrically.

Dell (1990: figs 405, 407) mistakenly illustrated a buccinulid species, probably "*Pareuthria*" *plicatula* Thiele, 1912 (the generic position of this species is still unresolved – see Kantor and Harasewych 2013).

**Distribution:** Ross Sea, off Enderby Land, off Adelie Land; Weddell Sea, 155–640 m, live 260–270 m (Numanami 1996; USNM material).

### ***Lorabela davisii* (Hedley, 1916)**

(Fig. 9 S)

*Oenopota davisii* Hedley 1916: 54, pl. 8, fig. 84; Engl 2012: 181-182, pl. 74, fig. 2.

*Lorabela davisii*. – Powell 1958: 202; 1960: 159; 1966: 122; Dell 1990: 238, figs 408, 409; Numanami 1996: 208, figs 144A-D.

Turridae sp. 2 – Hain 1990: 73, pl. 8, fig. 8, pl. 27, fig. 4.

not *Lorabela davisii* – Egorova 1982: 47, fig. 202.

**Type locality:** RV *Aurora*, sta. II, off Mertz Glacier tongue, Adelie Land, 66°52'S, 145°30'E, 527 m.

**Type material:** Holotype, AMS (C.46688), SL 7.0 mm.

**Material examined:** no material available.

**Morphology:** Protoconch (Numanami 1996: fig. 144C) (diameter 1.3 mm, height 1.0 mm) wide, conical, ~ 2 finely granulated, evenly rounded, convex whorls with very thin, nearly orthocline growth striae on last ¼ whorl. Transition to teleoconch marked by sinuous axial rib. Operculum absent (Numanami 1996: 209). The radula was illustrated by Hain (1990: pl. 27, fig. 4) and Numanami (1996: fig. 144D). Marginal hypodermic teeth long (~ 250 µm, ≈ 2.2% of AL), loosely enrolled, with long base, spanning 1/4 of tooth length. Basal opening of tooth canal large, oval, lateral, with distinct spur, distal opening lateral, long.

**Remarks:** The holotype is a juvenile specimen. This species attains a length of 16.5 mm (Numanami 1996). Although Hedley (1916: 54) only compared *L. davisii* to *L. plicatula*, it more closely resembles *L. glacialis*, a similarity noted by Engl (2012: 182). Specimens of *L. davisii*, illustrated by Dell (1990: fig. 408) and Numanami (1996: fig. 144 A-B) appear intermediate between the holotype of *L. davisii* and syntypes of *L. glacialis* raising the possibility that these two taxa may be conspecific.

Egorova (1982) reported three specimens of *L. davisii*, reaching 24.8 mm, from 540 m in the Davis Sea. However, her illustration of the shell (Egorova 1982: fig. 202) differs substantially from the type of *L. davisii* (Engl 2012: pl. 74, fig. 2). She also described the radula (p. 48) as having duplex rather than hypodermic marginal teeth, which precludes the inclusion of her sample in Mangeliidae. Her specimen may represent a juvenile of *Conorbela antarctica*.

**Distribution:** From the western Weddell Sea, Enderby Land, Adelie Land and the Ross Sea, in 193–640 m (Dell 1990; Numanami 1996).

### **Genus *Belalora* Powell, 1951**

*Belalora* Powell 1951: 171. Type species (by original designation): *Belalora thielei* Powell, 1951; Recent, Magellanic.

**Diagnosis:** Shell small, attaining 7 mm, ovate-biconic, with low spire, high last whorl and short, wide siphonal canal. Protoconch large, dome-shaped, ~ 3 whorls, initial part smooth and flattened, followed by a whorl of closely spaced spiral threads and, finally, a whorl of spiral ribs crossed by axial threads. Teleoconch whorls convex, may be strongly angulated at shoulder.

Subsutural ramp concave to weakly convex. Anal sinus subsutural, moderately shallow to deep. Axial sculpture of sharp, narrow, oblique and arcuate ribs. Spiral sculpture of cords of varying size covering entire shell. Aperture moderately high, narrow, ovate-pyriform.

Operculum present, small, with terminal nucleus.

Radula of short hypodermic marginal teeth with very wide basal opening and distinct barb at the tip.

**Remarks:** Three species are currently recognized in the genus *Belalora*. The type species is from off the northwestern coast of the Falkland islands, the remaining two species are from off Antarctica.

In his description of the genus *Belalora*, Powell (1951: 171) noted that it resembled the Arctic genus *Propebela* in shape and sculpture of the teleoconch, but differed in having a characteristic protoconch. Protoconchs of several species of *Propebela* are similar (see Bogdanov 1990: figs 401-403), and the radula of *Belalora striatula* (Hain 1990: pl. 26, fig. 7) resembles those of *Propebela spitzbergensis* (Friele, 1886), *P. svetlanae* Bogdanov, 1989, and others (see Bogdanov 1990: figs 432, 435). A small, oval operculum with a terminal nucleus is present in *Propebela*.

As was demonstrated for representatives of the closely related genus *Lorabela* (see above) molecular data do not support a close relationship between Antarctic species and north Atlantic/Arctic *Propebela*. Despite morphological similarities with the genus *Propebela*, we provisionally retain *Belalora* as a separate genus. Further molecular studies will be needed to resolve this issue.

**Distribution:** Magellanic Region, Antarctica, in 160–4800 m.

<FIGURE 10 ABOUT HERE>

### ***Belalora striatula* (Thiele, 1912)**

(Fig. 10 A–F)

*Bela striatula* Thiele 1912: 215, pl. 14, fig. 3.

*Belalora striatula*. – Powell 1951: 171; 1960: 159; 1966: 122; Egorova 1982 (part.): 48, figs 207, 208 (not fig. 61); Dell 1990: 236, figs 421, 422; Hain 1990: 71, pl. 8, fig. 3, pl. 26, fig. 7.

*Oenopota striatula*. – Schwabe *et al.* 2007: 1838 (record only).

**Type locality:** Gauss-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** 6 syntypes, ZMB Mol 62987.

**Material examined:** type material; Ross Sea, McMurdo Sound, *Deep Freeze I*, sta. ED-8, 77°21'S, 169°30' E; 321 m (1 sh, USNM 612782).

**Morphology:** Protoconch (Fig. 10 C) ~ 3 whorls, first one smooth and flattened, remaining whorls convex with 8–9 narrow distinct, widely spaced spiral cords. Protoconch/teleoconch border is marked by appearance of narrow axial ribs. Protoconch diameter – 1.5 mm, height –1.3 mm. The radula (Hain 1990: pl. 26, fig. 7) consists of hypodermic marginal teeth that are short ( $\approx 17 \mu\text{m}$ ), with a very wide ( $\approx 4.5 \mu\text{m}$ ), nearly terminal basal opening, well developed spur and distinct barb at the tip. Apical opening of tooth canal lateral, small, oval, below the barb. Operculum small, with terminal nucleus (Powell 1951: 171).

**Remarks.** This species is easily recognizable on the basis of its characteristic shell and protoconch. Egorova (1982: figs 207, 208) illustrated the shell and operculum of this species. However, her description and illustration of the radula (fig. 61) does not correspond to Hain's (1990) subsequent micrograph, but rather depicts paired duplex teeth, characteristic of the family Pseudomelatomidae or Horaiclavidae.

**Distribution:** Davis Sea, Enderby Land, Ross Sea, Weddell Sea, 193–752 m (Powell 1960; Dell 1990; Engl 2012).

***Belalora weirichi* (Engl, 2008), comb. nov.**

(Fig. 10 G–J)

*Oenopota weirichi* Engl 2008a: 50, 52, figs 1-6; Engl 2012: 183, pl. 74, figs 6a-c.

**Type locality:** Weddell Abyssal Plain, 65°34.34'S–36°31.18'W – 65°35.72'S–36°28.40'W, 4,794–4,805 m (RV *Polarstern* ANT 22/3, sta. 102-11).

**Type material:** Holotype: ZSM Mol 2005 1067, SL 7 mm.

**Material examined:** no material was available.

**Morphology:** Protoconch eroded in specimens described by Engl (2008: figs 3, 4; herein, Fig. 10 I–J), of 3 protoconch whorls, only the last one retained sculpture, consisting of 11 subequal spiral cords, similar to the protoconch of other species of the genus. Diameter 1.25 mm, height 1.18 mm. Radula unknown. Eyes and operculum are absent.

**Remark:** Although Engl proposed this species in the genus *Oenopota*, its protoconch and shell shape suggest a close affinity to *Belalora*. We transfer this species to *Belalora*, pending additional information on its radular morphology,

**Distribution:** Weddell Abyssal Plain, live 1,812–4,805 m.

**Family RAPHITOMIDAE Bellardi, 1875**



## Genus *Pleurotomella* Verrill, 1872

### Subgenus *Pleurotomella* (*Pleurotomella*) Verrill, 1872

*Pleurotomella* Verrill 1872: 15. Type species (by monotypy): *Pleurotomella packardi* Verrill, 1872; Recent, Northeastern United States.

**Diagnosis:** Shell extremely variable, from 4 to 75 mm, with short to medium high spire and large convex or angulated last whorl and short to long siphonal canal. Protoconch multispiral, up to nearly 5 whorls, strongly ornamented either with axial cords, or diagonally cancellated. Teleoconch whorls convex, evenly rounded or angulated at shoulder, subsutural ramp from weakly concave to nearly straight or even weakly convex. Anal sinus subsutural, shallow, with the deepest point on subsutural ramp. Axial sculpture extremely variable, ranging from absent to strongly arcuate varices. Spiral sculpture of variable cords or keels. Aperture from medium to high, widely ovate or ovate-pyriform.

Operculum absent (in all Raphitomidae).

Radula of short hypodermic marginal teeth with large base and wide basal opening, with or without barb(s) at the tip.

**Remarks.** Seventy three species of *Pleurotomella* are currently recognized as valid (Bouchet and Gofas 2014, no subgenera recognized). Two species of the nominotypical subgenus, including one new species described herein, are recorded from Antarctic waters. Another 12 species from Antarctic waters, of which one is described as new, are referred to the subgenus *Pleurotomella* (*Anomalotomella*) Powell, 1966.

Powell (1966) established the subgenus *Anomalotomella* for a group of subantarctic – Antarctic species that differ from typical *Pleurotomella* (which have a multispiral diagonally cancellated protoconch) in having a paucispiral protoconch of two whorls. The validity of the subgenus was questioned by Beu (2011), who synonymized *Anomalotomella* with *Pleurotomella* s.s., and this opinion was accepted in Gofas (2015).

The shift from a multispiral protoconch (the plesiomorphic state within Raphitomidae) to a paucispiral protoconch was analyzed within a shallow water complex of Indo-Pacific raphitomids (*Kermia-Pseudodaphnella*) based on a molecular phylogeny (Fedosov and Puillandre 2012). The results demonstrated convincingly that changes in the mode of development occurred several times within the group. Antarctic and subantarctic species of *Pleurotomella* with non-planktotrophic development (indicated by a paucispiral protoconch) are derived from species with multispiral protoconchs and planktotrophic development that have only recently been discovered in Antarctic waters (Engl 2008b; herein). It is not clear whether this shift in developmental mode occurred once and resulted in an adaptive radiation that gave rise to

a monophyletic *Anomalotomella*, or whether, as in the tropics, the shift occurred in multiple, independent lineages. The latter premise seems less parsimonious. There are only two Recent Antarctic species with planktotrophic protoconch that we attribute to *Pleurotomella*. None are present in the Magellanic fauna (Castellanos and Landoni 1993) or the fauna of New Zealand (Spencer et al. 2009). Nor are there any Raphitomidae in the Antarctica fossil record (Beu 2009). Since most of raphitomids have thin shells, their absence in fossil deposits may be an artefact of preservation. There are few species with planktotrophic development that could have given rise to multiple lineages of *Pleurotomella* with non-planktotrophic development. Future molecular studies may clarify the situation and further subdivide *Anomalotomella*.

**Distribution:** Atlantic, Indo-Pacific, Magellanic, Antarctic, in bathyal to abyssal depths.

<FIGURE 11 ABOUT HERE>

***Pleurotomella (Pleurotomella) maitasi* Engl, 2008**

(Fig. 11 A-D)

*Pleurotomella maitasi* Engl 2008b: 57-58, figs 1-2; Engl 2012: 187, pl. 77, fig. 2a-b (holotype).

**Type locality:** East of South Sandwich islands, from 58°15.07'S–24°22.03'W to 58°15.31'S–24°21.20'W, 3931–3948 m, *Polarstern* ATN XIX/4 (AN-DEEP II) Exp., sta. 139-5.

**Type material:** Holotype: ZSM Mol 2006 2201, SL 8 mm.

**Material examined:** IORAS, 3 lv, Scotia Sea, RV *Akademik Kurchatov*, st. 914, 56°21'S, 50°48'W, 5700–5650 m (Fig. 11 A-D).

**Morphology:** Protoconch ~ 3 whorls, first whorl (protoconch I), smooth, brownish, adpressed, remaining whorls (protoconch II) beige, covered with closely spaced, irregularly shaped, meandering axial ribs, more distinct on last protoconch whorl, which also bears indistinct oblique spiral cords. Protoconch/teleoconch transition (Fig. 11 H-I, arrow) marked by appearance of growth lines and axial folds and distinctive spiral sculpture of widely spaced, raised spiral cords. Protoconch height 880 µm (around 0.9 mm in holotype), diameter 1.0 mm

One specimen was dissected. Head bulbous, with short tentacles, eyes absent. Very large rhynchostomal sphincter present anteriorly that may also comprise short, strongly contracted introvert. Proboscis straight, of medium length, with very strongly contracted walls, septum surrounding proboscis base. Venom gland short but thick, muscular bulb small and oval. Oesophagus very thick. Radula ~ 20 rows of teeth, radular sac very short relative to anterior foregut.

Radula of simple, hypodermic marginal teeth. Subradular membrane maintains radular integrity in the radular sac. Teeth small, ~ 60 µm long (0.9% of AL without siphonal canal), straight. Tooth canal opening at tooth base laterally. Apical opening lateral, long, narrow oval. No barbs or blade. Tooth with short, blunt spur above the basal opening.

**Distribution:** Scotia Sea, live 3900–5700 m.

*Pleurotomella (Pleutoromella) tippetti* n. sp.

(Fig. 11 E-J)

*Oenopota* sp. – Schwabe *et al.* 2007: 1836.

Turridae species 1 – Engl 2012: 189, pl. 78, fig. 4.

**Type material:** Holotype ZIN No 62070, paratype ZIN No 62071.

**Type locality:** NW of Coronation Island, South Orkney islands, 60°12.9'S, 43°59'W, 5450–5480 m, RV *Akademik Kurchatov*, st. 909.

**Description:** Shell medium sized (to 13 mm), oval-fusiform, very thin and fragile, glossy, with elevated spire and slightly attenuated siphonal canal. Protoconch of 3 whorls, first whorl (protoconch I) is smooth, brownish. Remaining whorls (Protoconch II) variably marbled in bright colours, with irregular darker spots, with indistinct, very thin spiral striation and closely spaced, arcuate axial ribs that become more irregularly spaced near the protoconch/teleoconch transition (Fig. 11 G, H, arrow) that is marked by disappearance of axial ribs. Diameter 1.25 mm, height 1.1 mm. Teleoconch ~ 3.5 convex whorls, separated by weakly adpressed suture. Subsutural ramp weakly concave. First half whorl of teleoconch nearly smooth, except for dense microtubercles. Axial sculpture limited to dense, irregularly spaced, slightly raised growth lines that form closely spaced arcuate axial riblets on subsutural ramp. Spiral cords narrow, distinct, slightly sinuous, covering entire shell surface, including subsutural ramp. Number of cords 10–11 on penultimate and earlier whorls, ~ 55 on last whorl, of which 10 are on the siphonal canal. Cords vary slightly in width, interstices narrower than cords. Anal sinus shallow, subsutural, strongly asymmetrical, with deepest point just below the suture. Last whorl very high, convex, comprising 0.78 of SL. Aperture high (0.66 SL), wide, oval. Outer lip thin, evenly rounded. Parietal region with broad, extremely thin callus, overlaying spiral sculpture. Columella short (~ 0.5 AL), slightly concave, with thicker, more distinct callus. Siphonal canal short, widely open, poorly differentiated from aperture. Shell color beige, with irregularly spaced axial bands and separate livid spots. Paratype very similar to holotype, but with less inflated last whorl.

Radula not studied.

<TABLE 2 ABOUT HERE >

**Remarks:** *Pleurotomella tippetti* is readily distinguished from Antarctic and subantarctic congeners on the basis of its nearly ovoid shell, very tall last whorl, and weakly pronounced spiral sculpture. Its protoconch is multispiral, suggesting planctotrophic development, its sculpture is similar to that of *Pleurotomella packardi* (Bouchet and Warén 1980: fig. 216) and, to a lesser degree, to that of *P. maitasi*. This new species differs from *P. maitasi* in lacking axial folds, and in having more rounded whorls and a different pattern of spiral sculpture. *Pleurotomella tippetti* superficially resembles *Xanthodaphne translucida* (Fig. 15 A-E) in shell outline, but differs in having multispiral, adpressed, strongly sculptured protoconch rather than the smooth, paucispiral protoconch characteristic of *X. translucida* (Fig. 15D).

**Distribution:** In addition to the type material, the species was collected by *Polarstern* ANT XIX/3 (ANDEEP I) expedition on South Scotia Ridge at 2359–2380 m (Engl 2012: 189).

**Etymology:** The species honors the memory of the late Donn L. Tippet, M. D., an expert in the systematics of “turrids” and our good friend and colleague for many years.

#### **Subgenus *Pleurotomella* (*Anomalotomella*) Powell, 1966**

*Pleurotomella* (*Anomalotomella*) Powell 1966: 132; Dell 1990: 241.

**Type species** (original designation): *Pleurotomella anomalapex* Powell, 1951.

**Diagnosis:** Shell reaching 12 mm, extremely variable, from elongate oval to fusiform and pagodiform, with short to medium high spire, large, convex, often angulated last whorl and distinct, medium to long siphonal canal. Protoconch paucispiral, up to 2 1/2 whorls, with a finely granulose surface. Teleoconch whorls convex, in most species (except *P. rossi* and *P. nipri*) angulated at shoulder, subsutural ramp pronounced, from deeply concave to nearly straight. Anal sinus subsutural, of moderate depth, with the deepest point on subsutural ramp. Axial sculpture very variable, varices absent to strongly arcuate. Spiral sculpture variable, consisting of cords and, in some species, of strong keels. Aperture medium to high, widely ovate or ovate-pyriform.

Radula of short hypodermic marginal teeth with a large base and wide basal opening, without barb(s) at the tip.

**Remarks:** Twelve species occur in the Antarctic (one described herein). Of these, one also occurs in the Falkland islands.

**Distribution:** Antarctic and subantarctic.

<FIGURE 12 ABOUT HERE>

***Pleurotomella (Anomalotomella) anomalapex* Powell, 1951**

(Fig. 12 A-E)

*Pleurotomella? anomalapex* Powell 1951: 173, pl. VI, fig. 19.

*Pleurotomella (Anomalotomella) anomalapex*. – Powell 1966: 132, pl. 21, fig. 15.

*Propebela anomalapex*. – Castellanos and Landoni 1993: 18, pl. 1, fig. 5

*Oenopota anomalapex*. – Figueira and Absalão 2010: 475.

*Pleurotomella* species 1. – Engl 2012: 188, pl. 77, fig. 6.

**Type locality:** between Falkland islands and Patagonia, 50°20'S, 62°30'W, 161–162 m  
(*Discovery* st. WS 225).

**Type material:** Holotype: NHMUK 1961614, SL 7.8 mm.

**Material examined:** NE of Zavodovski Island, South Sandwich islands, RV *Islas Orcadas*, cruise 575, sta. 74, 56°12'S, 27°23'53.9"W, 179–238 m (1 sh, UNSM 887840).

**Morphology:** Protoconch (Fig. 12 D-E) of 2 moderately convex, evenly rounded whorls, diameter 0.9, height 0.8 mm, very densely sculptured by very narrow spiral striae. Protoconch-teleoconch border marked by distinct nearly orthocone varix and onset of growth lines, more prominent on subsutural ramp. Animal unknown.

**Remarks.** This species was previously known only from the holotype. The USAP collections contain a dead collected specimen (UNSM 887840, SL 6.3 mm) (Figs 12 A-E) that resembles the holotype, but differs in having fewer and less oblique axial ribs, as well as more rounded and more pronounced shoulder. We provisionally refer this specimen, collected NE of Zavodovski Island, South Sandwich islands to *Pleurotomella anomalapex*, thus greatly expanding the distribution of the species. *Pleurotomella* species 1, illustrated by Engl (2012: 188, pl. 77, fig. 6) from Bransfield Strait is conspecific.

This species was transferred to *Propebela* or *Oenopota* (both Mangeliidae) by Castellanos and Landoni (1993) and Figueira and Absalão (2010), respectively, although its protoconch and teleoconch are very similar to other Antarctic species of *Pleurotomella*.

**Distribution:** From the Falkland islands to the South Sandwich islands, 161–238 m.

***Pleurotomella (Anomalotomella) bathybia* Strebel, 1908**

(Fig. 12 F)

?*Pleurotomella bathybia* Strebel 1908: 16, pl. 2, fig. 26 a-b.

*Pleurotomella bathybia*. – Zelaya 2005: 128, fig. 53; Engl 2012: 185-186, pl. 76, fig. 2a (neotype), 2b.

*Lorabela bathybia*. – Powell 1966: 122; Castellanos and Landoni 1993: 21-22, pl. 2, fig. 17.

**Type locality:** South Georgia, 54°27.63'S, 35°41.33'W, 256 m (*Polarstern*, ANT XIX/5, st. 182-1) [The material on which Strebel's description was based was collected at South Georgia, outer Cumberland Bay, 54°11'S, 36°18'W, 252–310 m, Swedischen Südpolar-Expedition, sta. 34].

**Type material:** Neotype (designated by Engl 2012: 186): ZSM (Mol 2002 1313), lv, SL 11 mm.

**Material examined:** No material available.

**Morphology:** Protoconch and animal not studied.

**Remarks:** The holotype had been missing from SMNH for some time (Engl 2012: 186), prompting the designation of a neotype.

**Distribution:** South Georgia, 94–310 m (Zelaya 2005).

### *Pleurotomella (Anomalotomella) frigida* Thiele, 1912

(fig. 12 G)

*Pleurotomella frigida* Thiele 1912: 216, pl. 14, fig. 9, pl. 19, fig. 20 (radula); Powell 1958: 203; 1960: 159; Egorova 1982: 49, figs 62 (radula), 200 (based on published data only); Engl 2012: 187, pl. 77, figs 1a(lectotype)-1c.

*Pleurotomella (Anomalotomella) frigida* – Powell 1966: 132; Dell 1990: 243-244, figs 398, 426-428; Numanami 1996: 216, figs 151A-C.

**Type locality:** *Gauss*-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** Lectotype (designated by Engl 2012: 187): ZMB M.62982a, SL 5.2 mm, paralectotype, same locality ZMB M.62982 (juvenile).

**Material examined:** off Allen McDonald Glacier, Coats Land, Weddell Sea, *Deep Freeze III*, 75°31'S, 26°43'W, 22 m (USNM 612974, 1 sh); Ross Sea, Victoria Land, RV *Eltanin*, cruise 32, sta. 1996, 72°4'58.8"S, 172°8'31.2"E, 348–352 m (USNM 886147, 2 lv); Wilkes Land, Budd Coast, RV *Wilkes Station*, sta. AZ, 66°16'8.92"S, 110°31'4.8"E, 128–146 m (USNM 896329, 1 lv); Ross Sea, Victoria Land, RV *Eltanin*, cruise 32, sta. 2005, 73°1'58.8"S, 176°52'1.2"E, 864–870 m (USNM 898098, 1 sh).

**Morphology:** Protoconch (Numanami 1996: fig. 151 C) comparatively small, elevated, of ~ 2.5 moderately convex whorls, diameter 0.75 mm, height 0.89 mm, densely covered by

microtubercles forming spiral lines. Dell (1990: fig. 426) illustrated a very similar protoconch, although without scale bar or measurements.

Radula (Thiele 1912: pl. 19, fig. 20) of simple, hypodermic marginal teeth with large base, very small, ~ 33 µm in length. Although the drawing is not very detailed, the general shape the teeth is similar to those of other studied species of *Pleurotomella*.

**Remarks:** The species attains 11.4 mm (USNM 612974), more than twice the size of the lectotype.

**Distribution:** Davis Sea, off Enderby Land, Weddell and Ross Seas, probably circumAntarctic, 193–870 m (Powell 1960; Dell 1990; Numanami 1996), live 128–348 m.

### *Pleurotomella (Anomalotomella) annulata* Thiele, 1912

(Fig. 12 H-K)

*Pleurotomella annulata* Thiele 1912: 217, pl. 14, fig. 10, 11; Egorova 1982: 49, figs 199, 206 (based on published data only); Engl 2012: 185, pl. 76, figs 1a (lectotype), 1b.

*Pleurotomella (Anomalotomella) annulata*. – Powell 1966: 132; Numanami 1996: 218, figs 153A-C.

*Pleurotomella (Anomalotomella) cf. annulata*. – Dell 1990: 244.

**Type locality:** Gauss-Station, Davis Sea, 66°02'09"S, 89°38'E, in 385 m.

**Type material:** Lectotype (designated by Engl 2012: 185): ZMB Mol. 62981, SL 5.2 mm, two paralectotypes, ZMB (both are fragments of the shell).

**Material examined:** South Shetland islands, between Deception and Livingston islands, K. Halanych, sta. 59, 62°48'29.9"S, 60°43'30"W, 203 m (1 lv, USNM 1123584).

**Morphology:** Protoconch high, paucispiral, of 2 rounded whorls, diameter ~ 0.8 mm, height ~ 0.92 mm, with finely granular surface. The protoconch-teleoconch transition marked by onset of spiral sculpture. Operculum absent. Radula (Fig. 12 J-K) of hypodermic simple marginal teeth. Teeth small (~ 60 µm long, 2.5% of AL without siphonal canal), straight. Tooth canal opens laterally at tooth base, opening roughly triangular, large. Apical opening lateral, long, narrow oval. No barbs or blade. Tooth forms short, blunt spur above the basal opening (Fig. 12 K, s). Teeth connected to vestigial subradular membrane by wide and very thin ligament.

**Distribution:** Davis Sea, off Enderby Land, Ross Sea, 193–385 m (Powell 1960; Numanami 1996), live 203 m.

***Pleurotomella (Anomalotomella) deliciosa* Thiele, 1912**

(Fig. 12 L-M)

*Pleurotomella? deliciosa* Thiele 1912: pl. 14, fig. 12.

*Pleurotomella deliciosa*. – Engl 2012: 186, pl. 76, fig. 3a(holotype), 3b-c.

*Typhlodaphne deliciosa*. – Egorova 1982: 51, fig. 211 (based on published data only).

**Type locality:** Gauss-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** Holotype: ZMB (Moll 62980). SL 4 mm.

**Morphology:** Protoconch and radula not studied.

**Material examined:** Holotype.

**Remarks.** The holotype is a fragment 4 mm in length, with most of the ventral side missing (published figures show only the dorsal aspect). Engl (2012) was the first to treat this species since its original description. He illustrated an intact, adult shell (Engl 2012: pl. 76, fig. 3c) (SL 7.5 mm) that he considered to be conspecific with *Pleurotomella deliciosa*. It strongly resembles *P. enderbyensis*, as was mentioned by Engl.

Egorova (1982) placed the species in *Typhlodaphne* without discussion.

**Distribution:** Davis and Weddell seas (Engl 2012).

<FIGURE 13 ABOUT HERE>

***Pleurotomella (Anomalotomella) simillima* Thiele, 1912**

(Fig. 13 A-D)

*Pleurotomella simillima* Thiele 1912: 216, pl. 14, fig. 8; Egorova 1982: 49, fig. 200 (based on published data only); Engl 2012: 188, pl. 77, Figs 5a (holotype) - 5c.

*Pleurotomella (Anomalotomella) simillima* Dell 1990: 241, fig. 423;

*Pleurotomella similliana* [sic, lapsus calami] – Hain 1990: 72, pl. 8, figs 5a, b, pl. 27, fig. 1;

*Pleurotomella simillana* [sic, lapsus calami] – Numanami 1996: 214, figs 149A-D.

**Type locality:** Gauss-Station, Davis Sea, 66°02'09"S, 89°38'E, 385 m.

**Type material:** Holotype: ZMB (M.62983), SL 11 mm.

**Material examined:** Scotia Sea, South Sandwich islands, SE of Visokoi Island, RV *Islas Orcadas*, cruise 575, sta. 61, 56°42'18"S, 27°0'24.1"W, 93–121 m (USNM 881740, 2 lv); Ross Sea, Victoria Land, E of Moubray Pennell Bank, RV *Eltanin*, cruise 32, sta. 2117, 73°0'S,



178°06'W, 595–600 m (USNM 898193, 1 sh); Ross Sea, Victoria Land, E of Moubray Pennell Bank, RV *Eltanin*, cruise 5, sta. 272, 64°54'S, 68°24'W, 412 m (USNM 898750, 1 lv); Scotia Sea, South Sandwich islands, RV *Islas Orcadas*, cruise 575, sta. 70, 56°24'S, 27°23'36"W; 161–210 m (USNM 904646, 1 lv).

**Morphology:** Protoconch (Numanami 1996: Fig 149C) of ~ 2 moderately convex whorls, diameter 1.1 mm, height 0.92 mm, first whorl flattened on top, protoconch translucent white in color, covered by very narrow spiral riblets. Protoconch height of holotype is 0.85 mm, diameter 1.1 mm (Fig. 13 C).

Radula (Numanami 1996: Fig 149D; Hain 1990: pl 27, fig. 1) of hypodermic, simple marginal teeth. Teeth small, ~ 100 µm long (1.5% of AL without siphonal canal), straight. Tooth canal opening at tooth base laterally, opening roughly triangular, large. Apical opening lateral, long, narrow, oval. No barbs or blade. Tooth with short, blunt spur above the basal opening. Teeth connected to vestigial subradular membrane by wide and very thin ligament.

**Distribution:** Davis Sea, Ross Sea, Weddell Sea, south of Kerguelen, 30–600 m (Powell 1960; Dell 1990; Numanami 1996), live 93–412 m.

### *Pleurotomella (Anomalotomella) enderbyensis* Powell, 1958

(Fig. 13 E)

*Pleurotomella enderbyensis* Powell 1958: 203, pl. 2, fig. 8; Hain 1990: 71, pl. 8, fig. 4, pl. 26, fig. 8; Engl 2012: 186-187, pl. 76, fig. 5a (holotype) – 5c.

*Pleurotomella (Anomalotomella) enderbyensis* – Numanami 1996: 220–222, figs 155A-C.

**Type locality:** off Enderby Land, 65°48'S, 53°16'E, 193 m (B.A.N.Z.A.R.E. sta. 41).

**Type material:** Holotype: SAM (D15512), 8.8 mm.

**Material examined:** 90 miles E of Coulman Island, Victoria Land, Antarctica, *Deep Freeze III*, 73°40'S, 175°17'W, 521 m (USNM 612831, 1 sh); S of Coulman Island, Victoria Land, Antarctica, RV *Eltanin*, cruise 27, sta. 1885, 74°30'S, 170°12'W, 311–328 m (USNM 870941, 1 sh); Moubray Bay, E of Cape Hallett, Victoria Land, Antarctica, RV *Eltanin* cruise 32, sta. 1995, 72°00'S, 172°24'W, 344–338 m (USNM 870988, 1 sh); off Franklin Island, Victoria Land, Antarctica, RV *Eltanin*, cruise 51, sta. 5765, 76°07.2'S, 170°12'W, 571–587 m (USNM 899801, 1 lv).

**Morphology:** Protoconch (Numanami 1996) ~ 2.5 strongly convex whorls, diameter 1.1 mm, height 0.98 mm, translucent white in color, with dense microtubercles, forming irregular axial lines (Fig. 155C). Operculum absent. Radula illustrated by Hain (1990) hypodermic simple marginal teeth, very similar in shape to other studied species of the genus.

**Remarks:** This species is easily distinguished from other congeners by its two broadly rounded carinae (shoulder and anterior carinae) and pronounced axial sculpture especially evident as broad knobs along the carinae. Dell (1990: 244) considered the specimens from the Ross Sea to be closely related to *P. enderbyensis* but possibly to represent a new species distinguished by a weaker anterior carina and stronger spiral sculpture. He deferred describing this form until more and better material became available.

**Distribution:** From off Enderby Land to the Weddell Sea and Bransfield Strait, in 188–193 m, provisionally from the Ross Sea in 311–587 m (Dell 1990; USNM material), live 275–587 m (Numanami 1996; USNM material).

***Pleurotomella (Anomalotomella) endeavourensis* Dell, 1990**

(Fig. 13 F)

*Pleurotomella (Anomalotomella) endeavourensis* Dell 1990: 242, fig. 420 (holotype).

*Pleurotomella endeavourensis*. – Engl 2012: 186, pl. 76, fig. 4 (holotype).

**Type locality:** Ross Sea, 76°07'S, 168°10'E, 188–194 m [TAE, Trans–Antarctic (New Zealand) Expedition, st. 98]

**Type material:** Holotype: NMNZ (M.256622), SL 10.9 mm (Fig. 12 E); paratype NZ Oceanographic Institute (P.755).

**Material examined:** No additional material available.

**Morphology:** Protoconch (Dell 1990: 242) of slightly less than 2 whorls, sculptured with fine spiral threads crossed by fine axial riblets, forming a varix at transition to teleoconch. Operculum and radula unknown.

**Remarks:** This species is known only from the type material.

**Distribution:** Ross Sea, in 188–377 m (Dell 1990), live 188–194 m.

***Pleurotomella (Anomalotomella) rossi* Dell, 1990**

(Fig. 13 G)

*Pleurotomella (Anomalotomella) rossi* Dell 1990: 243, figs 424, 425, 429.

*Pleurotomella rossi*. – Engl 2012: 187, pl. 77, fig. 4 (holotype).

**Type locality:** Ross Sea, 77°50'S, 166°30'E, 369 m [New Zealand Oceanographic Institute, st. A470]

**Type material:** Holotype: NIWA (# 276), SL 11.9 mm, paratypes – NIWA (P.756, according to Dell 1990), NMNZ (M.256623).

**Material examined:** Ross Sea, Victoria Land, Moubray Bay, E of Cape Hallett, RV *Eltanin*, cruise 32, sta. 1995, 72°0'S, 172°23'E, 344–348 m (USNM 886122, 1 sh).

**Morphology:** Protoconch (Dell 1990: fig. 425) conical, of ~ 2.5 moderately convex whorls, diameter 1.17 mm, height 1.01 mm, very densely sculptured by microtubercules, arranged in irregular spiral striae.

The animal is unknown.

**Distribution:** Ross Sea, 133–377 m (Dell 1990).

***Pleurotomella (Anomalotomella) innocentia* (Dell, 1990), n. comb.**

(Fig. 13 H-L)

*Typhlodaphne innocentia* Dell 1990: 240–241, Figs 394, 406; Engl 2012: 178, pl. 72, fig. 4. not *Typhlodaphne innocentia* sensu Aldea and Troncoso 2008 [= *Falsimohnia minor* (Strebel, 1908) – Kantor and Harasewych 2013: 51].

**Type locality:** Ross Sea, 72°00'S, 172°28'E, 530–549 m (RV *Eltanin*, st. 1997).

**Type material:** Holotype: USNM 860147, SL 4.2 mm, paratype NMNZ (M.256621), SL 3.7 mm.

**Material examined:** holotype; Ross Sea, Victoria Land, RV *Eltanin*, cruise 32, sta. 1996, 72°4'48"S, 172°8' 24"E, 348–352 m (1 lv, USNM 886157).

**Morphology:** Protoconch (holotype, Fig. 13 K-L) high, obtusely conical, of 1.75 convex whorls, diameter 0.67 mm, height 0.6 mm, smooth, except last half whorl, which bears inconspicuous axial riblets. Protoconch-teleoconch transition marked with orthocone varix and appearance of sinuous growth lines.

**Remarks:** Dell (1990: 241) attributed his new species to *Typhlodaphne* without discussion and compared *Typhlodaphne innocentia* not to *T. purissima*, the type species of the genus, but with two species that are now attributed to *Xanthodaphne* (Raphitomidae), namely *X. corpulenta* and *X. translucida*. Dell treated *Typhlodaphne* very broadly and included many unrelated species in this genus (see above). Nevertheless, the described species is much smaller than *Xanthodaphne* and is conchologically similar to other species attributed here to *Pleurotomella* (*Anomalotomella*), especially to *P. frigida*, which has a wider shell with more pronounced spiral sculpture. It has little in common with *Typhlodaphne purissima* and there are no conspicuous reasons to retain it in that genus. Pending data on radular morphology, we transfer this species to *Pleurotomella*.

The record of Aldea and Troncoso (2008) of this species from the Bellingshausen Sea is based on a specimen of *Falsimohnia minor* (Strebel, 1908) (Kantor, Harasewych 2013).

**Distribution:** Ross Sea, 348–549 m, live 348–352 m.

***Pleurotomella (Anomalotomella) nipri* (Numanami, 1996), n. comb.**

(Fig. 14 A-C)

*Typhlodaphne nipri* Numanami 1996: 212–213, figs 148 A-C; Engl 2012: 178, pl. 72, fig. 5.

**Type locality:** Breid Bay, Queen Maud Land, Antarctica, 70°09.0'S, 23°46.3'E, 275–283 m.

**Type material:** Holotype: NSMT Mo70633, SL 3.1 mm, 2 paratypes NSMT Mo70634, 70635.

**Material examined:** No material available.

**Morphology:** Protoconch (Numanami 1996: fig. 148C) not large, of ~ 2 convex whorls, diameter 0.88 mm, height 0.66 mm, pale yellow in color. The surface is covered with microtubercules, more dense on second whorl, where they are arranged in spiral lines.

The animal is unknown.

**Remarks:** Numanami (1996: 213) attributed this species to *Typhlodaphne* on the basis of its resemblance to *Typhlodaphne innocentia* Dell, 1990 and also compared it with *Pleurotomella frigida*, but not with the type species of the *Typhlodaphne*, *T. purissima*.

"*Typhlodaphne*" *nipri* bears no resemblance to *T. purissima* or *T. paratenoceras*, being much smaller (up to 5.3 mm *versus* nearly 50 mm in *T. paratenoceras*), with a nearly oval shell outline rather than the narrow, fusiform outline of *Typhlodaphne*. The shell outline and protoconch of "*Typhlodaphne*" *nipri* is more similar to species of *Pleurotomella (Anomalotomella)*, particularly to *P. innocentia* and *P. frigida*, differing primarily in having a smooth shell. Pending data on radular morphology, we transfer this species to *Pleurotomella*.

This species is presently known only from the material examined by Numanami. It is very similar to "*Typhlodaphne* species", illustrated by Engl (2012: pl. 72, fig. 6a-b). If they prove to be conspecific, then the distribution of *P. nipri* would be extended to the Weddell Sea.

**Distribution:** Off Breid Bay, Queen Maud Land, Antarctica, 270–289 m, live 276–289 m (Numanami 1996).

<FIGURE 14 ABOUT HERE>

***Pleurotomella (Anomalotomella) petiti* n. sp.**

(Fig. 14 D-L)

**Type locality:** Antarctica, between Deception and Livingston islands, K. Halanych, sta. 59, 62°48'29.88"S, 60°43'30"W, 203 m.

**Type material:** Holotype, USNM 1123582, paratype, USNM 1123581.

**Description:** Shell (Figs 14 D-E) small (to 5.7 mm), very thin, fusiform/ pagodiform, with low (spire angle 76–79°), stepped spire and concave sutural ramp with posteriorly deflected carina along its periphery. Protoconch (Fig. 14 I) tall (900 µm), conical, increasing in diameter from ≈ 225 to 930 µm in 2 evenly rounded whorls, with fine granules arranged in spiral rows. Transition to teleoconch distinct, marked by the appearance of sinuate axial grown lines, a strong shoulder, and 2 spiral cords below the shoulder. Teleoconch of up to 3 sharply shouldered, convex whorls. Suture adpressed, subsutural area sloping to posteriorly deflected, thickened carina at shoulder. Spiral sculpture of low spiral cords with narrower interstices, 7 weak cords between suture and shoulder, ~ 45 cords between shoulder and siphonal canal, 15 cords on siphonal canal that are slightly wider than on shell periphery. Axial sculpture limited to fine prosocline growth lines that are strongly sinuous between shoulder and suture (corresponding to anal sinus). Last whorl high, ≈ 0.76 of SL. Anal sinus wide, deep (~1/8 whorl). Aperture large (AL/SL = 0.46), wide (AL/AW = 1.8), oval, deflected from coiling axis by 28°, with broad, convex parietal region, short, weakly sinuous columella, and long, wide, open, axial siphonal canal. Outer lip thin, fragile, smooth. Shell color yellowish white, with darker, caramel colored bands along shoulder and between shell periphery and distal siphonal canal. Entire teleoconch surface is finely granulose. Operculum absent. Radula of holotype (Fig. 14 J-L) with simple, hypodermic marginal teeth. Teeth small, ~ 50 µm long (1.7% of AL and 1.1% of SL), straight.

Tooth canal opening laterally at tooth base, opening roughly triangular, large. Apical opening lateral, long, narrow, oval. No barbs or blade. Tooth with short, blunt spur above the basal opening (Fig. 14 K, s). Teeth connected to vestigial subradular membrane by wide and very thin ligament.

< TABLE 3 ABOUT HERE >

**Remarks.** *Pleurotomella petiti* may be easily distinguished from all congeners by its characteristic pagodiform shell with a sharply angled shoulder and posteriorly deflected carina. It somewhat resembles *P. annulata*, which has a laterally directed carina at the shoulder, as well as an anterior carina, and multiple raised spiral cords between the suture and shoulder and along the last whorl that are absent in *P. petiti*.

**Etymology:** The species is named in the memory of the late Richard E. (Dick) Petit, expert in the systematics of the Cancellariidae as well as the history and literature of malacology, and our good friend for many years.

### Genus *Xanthodaphne* Powell, 1942

*Xanthodaphne* Powell 1942: 166. Type species (by original designation): *Pleurotoma* (*Thesbia*) *membranacea* Watson, 1886; Recent, New Zealand (North Island).

**Diagnosis:** Shell medium sized, attaining 24 mm, ovate to widely ovate, with low to medium high spire, high last whorl and short, medium to wide siphonal canal. Protoconch large, either paucispiral, bulbous, and smooth or very finely striated, or multispiral, reticulated. Teleoconch whorls evenly convex or slightly angulated at shoulder, subsutural ramp variously pronounced, in most species very weak, nearly straight. Anal sinus subsutural, deep, with deepest point on subsutural ramp. Axial sculpture limited to growth lines, some raised, producing the appearance of very narrow axial ribs. Spiral sculpture of narrow, dense spiral cords. Aperture high, wide, ovate.

Operculum absent.

Radula of short conic hypodermic marginal teeth with very wide basal opening and lacking barb at the tip.

**Distribution:** North and tropical Atlantic, Tropical Pacific, subantarctic, Antarctic, from sublittoral to abyssal depths.

**Remarks:** Thirty-one species are currently recognized in the genus *Xanthodaphne* (Gofas 2015), mostly from temperate and tropical waters. Only three species, including one described below, are currently known from within the Antarctic Convergence.

The genus *Xanthodaphne* was originally established by Powell (1942: 166) to include two deep-water New Zealand species, *Pleurotoma* (*Thesbia*) *membranacea* Watson, 1886 and *P.* (*Th.*) *xanthias* Watson, 1886. Later Powell (1966: 129) added a single species, *Xanthodaphne maoria* Dell, 1956. The genus has gradually expanded to contain a total of 31 Recent species, mostly from deep-water, including species with both planctotrophic and non-planctotrophic development. *Xanthodaphne* is poorly defined conchologically, and radular morphology remains unknown for most species. As currently understood, this genus is likely paraphyletic.

<FIGURE 15 ABOUT HERE>

### *Xanthodaphne translucida* (Watson, 1881)

(Fig. 15 A-E)

*Pleurotoma* (*Thesbia*) *translucida* Watson 1881: 444; 1886: 330, pl. 25, fig. 11.

*Typhlodaphne translucida*. – Powell 1951: 175; Dell 1990: 239–240.

*Xanthodaphne translucida* – Numanami 1996: 222–224, figs 157A-E, 158; Engl 2012: 189, pl. 78, fig. 2a-b.

**Type locality:** Challenger, stns. 145, between Marion Island and Prince Edward Island, 46°43'S, 38 °04'30"E, 256 m; 149b, Royal Sound, Kerguelen Island, 49°28'S, 70°30'E, 46 m; 149d, Royal Sound, Kerguelen Island, 49°28'S, 70°13'E, 51 m.

**Type material:** Syntypes (Figs 15 A-E): NHMUK 1187.2.9.1041-5, st. 145 (3 syntypes), st. 149b (1 syntype), 149d (1 syntype).

**Material examined:** type material.

**Morphology:** Protoconch paucispiral (Fig. 15 D), ~ 2.5 whorls, obtuse, conical, nearly smooth. Diameter (syntype) 1.12 mm, height 0.9 mm (Numanami 1996: fig. 157, diameter 1.2, height 0.8 mm).

Radula (Numanami 1996: fig. 157 D-E), of very short hypodermic, loosely enrolled marginal teeth. Length ~ 55 µm (0.75% of AL), conic, unbarbed, with very wide basal opening of tooth canal spanning ~ 1/2 of tooth length, and long slit-like apical opening, spanning ~ 1/5 of tooth length. At the level of upper part of basal opening there is a small outgrowth, probably homologous to a spur. Teeth have a well developed ligament.

Operculum absent.

**Remarks:** *Pleurotoma (Thesbia) translucida* was attributed to the genus *Typhlodaphne* Powell, 1951 (type species *Bela purissima* Strebel, 1908) by Powell (1951: 175). However, the type species of *Typhlodaphne* has an operculum, and belongs to the family Borsoniidae based on the morphology of its foregut and radula. Numanami (1996: 224) provisionally transferred this species to *Xanthodaphne* on the basis of its shell and radular morphology and lack of operculum.

The radula of this species, which consists of short, simplified, marginal hypodermic teeth, clearly indicates its position within Raphitomidae, while the shell of *X. translucida* closely resembles that of *X. membranacea* (Watson, 1886), the type species of *Xanthodaphne*.

**Distribution:** Marion Island, 99–113 m, Kerguelen Island, 20–168 m, off the Crozet islands (115–205 m), Enderby Land, Antarctic continent between 49°E–53 °E, 193–300 m (Powell 1960; Dell 1990), live 275–289 m (Numanami 1996).

***Xanthodaphne raineri* (Engl, 2008), n. comb.**

(Fig. 15 F-J)

*Pleurotomella raineri* Engl 2008b: 58-59, figs 3-4; Engl 2012: 187, pl. 77 fig. 3a-b.

**Type locality:** west of Antarctic Peninsula, Bellinshausen Sea (Pacific Antarctic Basin), from 62°31.37'S–64°40.20'W to 62°31.33'S–64°40.52'W, 3798–3799 m, *Polarstern* ATN 22/3 (AN-DEEP III) Exp., sta. 154-7.

**Type material:** Holotype: ZSM Mol 2005 0880, SL 6 mm.

**Material examined:** IORAS, Davis Sea, RV *Ob'*, st. 285, 59°29'S, 97°06.7' E, 4540 m (1 lv).

**Morphology:** Protoconch consists of ~ 2.5 whorls, height ~ 0.95 mm, diameter 1.25 mm; it is brownish, partly eroded, so microsculpture is not discernible (Engl 2008). First whorl adpressed, upper 1 1/2 protoconch whorls light brownish, darker than the remaining protoconch and teleoconch whorls.

Anatomy of single available specimen (shell Fig. 15 F-G) was examined. Head with moderately long cylindrical tentacles (Fig. 15 J, ct), eyes absent. Penis very short but stout, with small antero-lateral papilla situated in a depression of the right wall of the proboscis. Rhynchostome with large sphincter (Fig. 15 J, rhsp) and probably short contracted funnel. Proboscis (Fig. 15 J, pr), short, cylindrical, strongly contracted, with telescoping folds. Venom gland moderately long, muscular bulb (Fig. 15 J, mb), comparatively very large, longer than proboscis. Radula sac short, radula consists of ~ 25 rows of teeth.

Radula (Fig. 15 I) of simple, hypodermic, marginal teeth. Teeth small, ~ 140 µm long (1.4% of AL without siphonal canal), straight. Tooth canal opening at tooth base laterally, opening large, oval. Apical opening lateral, long, narrow, oval. No barbs or blade. Tooth forming short, blunt spur above the basal opening (Fig. 15 I, s). Teeth connected to vestigial subradular membrane by wide and very thin ligament.

**Remarks.** *Pleurotomella raineri* was described from a juvenile specimen with a shell of about two teleoconch whorls and a broken lip, obscuring its shape. Based on comparisons of the partially broken protoconch, upper teleoconch whorl sculpture, as well as the shape of the anal sinus, we consider a single specimen, collected by the Russian RV *Ob'* in the Davis Sea at 4540 m to be conspecific with *Pleurotomella raineri*. This specimen differs considerably from the type in size (32.5 mm *versus* 6 mm). The protoconch of this specimen (Fig. 15 H) is eroded, with a height of 0.9 mm, diameter 1.2 mm, but agrees well with Engl's (2012:187) description, especially with regard to the lack of microsculpture (with only inconspicuous axial ribs visible with oblique light).

The shape and size of adult shell requires a reconsideration of the generic position of *Pleurotomella raineri*. The next largest Antarctic *Pleurotomella*, *P. maitasi*, attains a length of 14.5 mm, less than half the length of the specimen from the Davis Sea. As currently understood,



*Xanthodaphne* includes species with moderately developed spiral sculpture and a pronounced subsutural ramp. Therefore we provisionally transfer *Pleurotomella raineri* to *Xanthodaphne*.

**Distribution:** Bellinshausen and ?Davis Sea, live 3,800–4,540 m.

***Xanthodaphne pastorinoi* n. sp.**

(Fig. 16)

**Type material:** holotype, USNM 881383.

**Type locality:** Candlemas Island, South Sandwich islands, Scotia Sea; 56°58'42"S, 26°30'36"W, 1,651–1,684 m, RV *Islas Orcadas*, cruise 575, st. 37.

**Description:** Shell medium sized (to 23 mm), fusiform, very thin, fragile, glossy, with elevated spire and slightly attenuated siphonal canal. Protoconch eroded, nucleus missing. Remaining portion of protoconch consists ~ 2 whorls, diameter 950 µm. Protoconch/teleoconch transition marked by onset of spiral sculpture. Teleoconch of 7 convex whorls. Suture weakly adpressed. Subsutural ramp very weakly convex, nearly flat. Axial sculpture limited to irregularly spaced, slightly raised growth lines, some forming closely spaced, arcuate axial riblets along subsutural ramp, ~ 50 on penultimate whorl. Spiral cords narrow, distinct, absent on subsutural ramp, covering remaining portions of shell. Number of cords increases from five on first teleoconch whorl to 20 on penultimate whorl and 65 on last whorl, of which 10 are on the siphonal canal. Cords vary in width, interstices narrower than cords. Anal sinus deep, subsutural, nearly symmetrical, with deepest point along middle of subsutural ramp. Last whorl convex, high (0.68 of SL). Aperture high (0.55 of SL), wide, oval, with thin, evenly rounded outer lip. Parietal region with broad, extremely thin callus overlaying spiral sculpture. Columella short (~ 0.33 AL), with thicker, more distinct callus. Siphonal fold present, distinct. Siphonal canal short, widely open, poorly differentiated from aperture. Shell chalky white.

Measurements: SL 23.0 mm, BWL 15.9 mm, AL 12.9 mm, SW 10.3 mm.

Soft tissues of the holotype were rehydrated. Body lacks pigmentation. Head well defined, with long, likely distensible snout. Cephalic tentacles long, cylindrical, rounded distally. Eyes absent. Foot long, narrow, with broad propodium. Operculum absent. Proboscis of moderate length, straight, with contracted walls, basal region surrounded by septum with wide orifice. Venom gland and muscular bulb large. Radula comprised of short, hypodermic, loosely enrolled marginal teeth. Length ~ 140 µm (0.93% of AL), elongate-conic, unbarbed. Basal opening of tooth canal broad, nearly terminal, apical opening long slit-like, spanning ~ 1/5 of tooth length. Base of the tooth with poorly pronounced spur (Fig. 16 D, arrow). Teeth with well developed ligament.

**Remarks:** Although this new species is presently known only from the holotype, it is readily distinguished from *Xanthodaphne translucida*, the only other Antarctic species on the basis of protoconch and shell morphology.

*Xanthodaphne pastorinoi* belongs in the family Raphitomidae, as is confirmed by absence of an operculum, and by the characteristic shape of the head and radula. It is far larger than *Xanthodaphne translucida* (23.0 mm vs 14.1 mm for the largest known specimen of *X. translucida*) and has a more elongated shell with a much lower last whorl, more distinct spiral cords, and arcuate axial riblets on the subsutural ramp. Radular teeth are very similar in both species.

**Distribution:** Known only from the type locality.

**Etymology:** This new species honors Dr. Roberto Guido Pastorino, Senior Researcher at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", a colleague and collaborator for many years, in recognition for his numerous contributions to studies of Antarctic and subantarctic molluscan faunas.

<FIGURE 16 ABOUT HERE>

## Family COCHLESPIRIDAE Powell, 1942

### Genus *Aforia* Dall, 1889

*Mangilia* (*Aforia*) Dall 1889: 99. Type species (original designation): *Pleurotoma circinata* Dall, 1873; Recent, North Pacific (Unalaska, Alaska).

*Steiraxis* Dall 1896: 14. Type species (original designation): *Pleurotoma* (*Steiraxis*) *aulaca* Dall, 1895; Recent, off Acapulco, Mexico.

*Irenosyrinx* Dall 1908: 257. Type species (original designation): *Pleurotoma* (*Leucosyrinx*) *goodei* Dall, 1890; Recent off NW coast of Patagonia.

*Aforia* (*Dallaforia*) Sysoev and Kantor 1987: 115 Type species (original designation): *Irenosyrinx?* *crebristriata* Dall, 1908; Recent, off Sitka, Alaska.

*Aforia* (*Abyssaforia*) Sysoev and Kantor 1987: 117. Type species (original designation): *Aforia* (*Abyssaforia*) *abyssalis* Sysoev & Kantor, 1987; Recent, off Kurile islands.

**Diagnosis:** Shell large to very large, attaining 97 mm, elongate-fusiform, with high spire, and long siphonal canal. Protoconch almost always decollated, smooth, paucispiral or multispiral when preserved. Teleoconch whorls moderately to strongly convex, in some species angulated at shoulder. Subsutural ramp pronounced to varying degrees, from shallowly concave to convex. Anal sinus deep, with rounded apex and deepest point on lower portion of subsutural ramp. Axial sculpture limited to growth lines. Spiral sculpture of spiral cords varying in strength, some species with one or two keels. Aperture moderately high, ovate.

Operculum present, oval, with terminal nucleus distinctly turned to left, in *A. goodei* (Dall, 1890) nucleus subcentral, situated in lower part of operculum.

Radula consists of a wide, crescent-shaped, unicuspid central tooth and duplex lateral teeth, with a pointed obtuse major limb and a large accessory limb of similar length.

**Remarks:** As presently understood, *Aforia* is a very widely distributed genus, ranging from the upper boreal waters of the Pacific and Atlantic Oceans to the Southern Ocean surrounding Antarctica. Twenty species have been included in the genus primarily on the basis of shell morphology, and, in some cases, radular characters. Sysoev and Kantor (1987) recognized the complex structure of the genus and described two new subgenera, based on the pattern of spiral sculpture. Dell (1990) disputed the validity of these subgenera, noting that at least some of the Antarctic species could not be attributed to any recognized subgenus on the basis of spiral sculpture. We follow the opinion of Dell and do not recognize subgenera.

The broad, nearly bipolar distribution of *Aforia* had not been previously corroborated by molecular data. Our analysis using COI sequences from two Antarctic species as well as the recently described *Aforia serranoi* Gofas, Kantor & Luque (2014) from bathyal depths off the Iberian Peninsula, in addition to some closely related Cochlespiridae demonstrates that the three species of *Aforia* constitute a well supported clade (posterior probability value = 1), indicating a close relationship among geographically distant species (Fig. 17).

**Distribution:** Atlantic, north and tropical eastern Pacific, subantarctic and Antarctic, at bathyal to abyssal depths.

<FIGURE 17 ABOUT HERE>

*Aforia goniodes* (Watson, 1881)

(Fig. 18 A-E)

*Pleurotoma clara* von Martens 1880: 35, pl. 8, fig. 1 (non *Pleurotoma clara* Reeve, 1845).

*Pleurotoma (Surcula) goniodes* Watson 1881: 394; 1886: 291, pl. 20, fig. 4 (fig. 5 in text – *lapsus calami*).

*Aforia goniodes*. — Engl 2012: 179. pl. 73, fig. 1.

*Aforia gonioides* (sic). – Dell 1990: 234, figs 402, 403.

**Type locality:** south-east of Rio de la Plata, Argentina, 37°17'S–52°52'W, 1,097 m.

**Type material:** Lectotype NHMUK (1887.2.9.970), SL 22.9 mm (Fig. 18 A-B). Neither in the original description (1881), nor in the *Report on the Scientific Results of the Voyage of H.M.S. Challenger* (1886) did Watson mention how many specimens of this species he had examined. Dell (1995: 234) referred to the specimen as "holotype", a valid lectotype designation before 2000 (Article 74.6 of ICZN (1999)).

**Material examined:** type specimen; Scotia Sea, Falkland islands, Beauchene Island, RV *Eltanin*, cruise 6, sta. 339, 53°6'0"S, 59°30'0"W, 512–586 m (USNM 870139, 1 sh); Scotia Sea, Falkland islands, Beauchene Island, RV *Eltanin*, cruise 6, sta. 340, 53°6'0"S, 59°30'0"W, 567–578 m (USNM 870155, 1 sh); Scotia Sea, Falkland islands, Beauchene Island, RV *Eltanin*, cruise 6, sta. 340, 53°6'0"S, 59°23'59"W, 567–578 m (USNM 870158, 3 sh); South Shetland islands, Bransfield Strait, South of Penguin Island, RV *Eltanin*, cruise 6, sta. 428, 62°42'0"S, 57°47'59"W, 662–1120 m (USNM 870295, 1 sh); Scotia Sea, NE of East Falkland Island, RV *Eltanin*, cruise 7, sta. 557, 51°53'59"S, 56°36'0"W, 855–866 m (USNM 870341, 1 sh); Scotia Sea, Falkland islands, Beauchene Island, RV *Eltanin*, cruise 6, sta. 340, 53°6'0"S, 59°30'0"W, 567–578 m (USNM 881883, 4 lv); Scotia Sea, Drake Passage, RV *Eltanin*, cruise 6, sta. 399, 59°12'0"S, 56° 6'0" W (USNM 881889, 1 lv); Drake Passage, E of Cape Cape Horn, RV *Eltanin*, cruise 9, sta. 740, 56°6'0"S, 66°24'0"W, 384–494 m (USNM 898860, 1 sh); Argentina, 54°28'47.99"S, 62°12'36"W, 318 m (USNM 1123638, 1 lv); Argentina, 54°22'48"S, 61°52'48"W, 274 m (USNM 1123679, 1 lv).

**Morphology:** Protoconch paucispiral, bulbous, of ~ 2 smooth rounded whorls, diameter ~ 1.3 mm, height 1.2 mm, protoconch/teleoconch transition is marked by appearance of sutural keel. Operculum oval-triangular, with terminal nucleus.

Radula (Fig. 18 E) short, consisting of 22 transverse rows of teeth, 7-8 nascent. Central tooth wide crescent-shaped, with indistinct anterior border gradually fusing into subradular membrane. Posterior margin slightly thickened, with short obtuse central cusp. Lateral tooth length ~ 250 µm (2.7% of aperture length without siphonal canal), duplex, with pointed major limb with sharp edges, and large accessory limb of same length.

**Remarks.** Engl (2012: 179) expressed doubt that this species occurs in Antarctic waters. Dell (1990, figs 402, 403) illustrated two specimens from the South Shetland islands (*Eltanin*, st.

428, USNM 870295). Another specimen, USNM 881889, was collected in the Scotia Sea north of Elephant Island.

**Distribution:** This species ranges from off Argentina southward throughout the Magellanic Province to South Shetland islands, at depths of 150 m to 1120 m, live 274–578 m.

<FIGURE 18 ABOUT HERE>

***Aforia watsoni* nom. nov.**

(Figs 18 F-I)

*Pleurotoma (Surcula) lepta* Watson 1881: 391; 1886: 288, pl. 18, fig. 7 (non *Pleurotoma lepta* Edwards 1861: 244, pl. 28, figs 10a-c. Stubbington and Bracklesham Bay, Eocene).

*Aforia lepta*. – Sysoev and Kantor 1987: 107, figs 1F, G, 5B, 6E-H, 8A-E; Dell 1990: 234, fig. 404.

**Type locality:** Southern Ocean, southwest of Australia, *Challenger* st. 157, 53°55'S, 108°35'E, 3,566 m.

**Type material:** Holotype: NHMUK 1889.11.11.7, SL 40.6 mm (Fig. 18 F-G).

**Material examined:** Southwest Pacific Basin, RV *Eltanin*, cruise 11, sta. 913, 65°47'59"S, 115°00'W, 4773 m (USNM 881947, 1 lv); Antarctic Ocean, Marie Byrd Land, RV *Eltanin*, cruise 13, sta. 1154, 65°36'S, 123°54'W, 4709 m (USNM 881995, 2 lv); Southwest Pacific Basin, NE of Ross Sea, RV *Eltanin*, cruise 20, sta. 134, 59°47'59"S, 144°48'W, 3200–3259 m (USNM 896401, 1 lv); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1003, 62°40'47.99"S, 54°43'1.19"W, 210–220 m (USNM 896402, 3 lv); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1003, 62°40'47.99"S, 54°43'1.19"W, 210–220 m (USNM 898513, 1 sh); Antarctic Ocean, RV *Eltanin*, cruise 23, sta. 1668, 63°54'S, 108°48'W, 4930–4963 m (USNM 1114797, 1 lv).

**Morphology:** Protoconch eroded in all examined specimens. Operculum pale yellow, thin, oval, with terminal nucleus, shifted to the left.

Radula not examined.

**Remarks:** The homonymy of *Pleurotoma (Surcula) lepta* Watson, 1881 and *Pleurotoma lepta* Edwards, 1861 was first recognized by Tucker (2004: 554), but no replacement name had been proposed.

**Distribution:** From southwest Australia and New Zealand, to Kerguelen Island, the Weddell Sea and the Antarctic Peninsula (Dell 1990; Sysoev and Kantor 1987; USNM collections), live 220–4963 m.

**Etymology:** The new name honors Rev. Robert Boog Watson (1823–1910), the author of *Challenger* report on Scaphopoda and Gastropoda.

***Aforia magnifica* (Strebel, 1908)**

(Fig. 19 A-I)

?*Surcula magnifica* Strebel 1908: 19, pl. 3, fig. 32 a-d.

*Aforia magnifica*. – Powell 1951: 167, fig. M 91 (radula); Dell 1990: 231, figs 411, 412, 436; Hain 1990: 69, pl. 7, figs 8a-c (shell), pl. 26, figs 1,2 (radula); Castellanos and Landoni 1993: 5, pl. 3, fig. 28; Engl 2012: 179, pl. 73, figs 2a (lectotype), 2b.

*Danilacarina elenae* Bozzetti 1997: 43, fig. 1.

**Type locality:** Off Graham Land, Antarctica, 64°03'S, 56°37'W, 360 m, Swedischen Südpolar-Expedition, sta. 8.

**Type material:** Lectotype: SMNH Type-1328 (designated by Engl 2012: 179), SL 63.0 mm. Paralectotypes- SMNH Type-6172, st. 8 (SL 54.9 mm, siphonal canal broken); SMNH Type- 6304, SW of Snow Hill Island, 64°36'S, 57°42'W, 120 m, Swedischen Südpolar-Expedition, sta. 6 (fragment of dead collected shell).

**Material examined:** Palmer Peninsula, E of Hugo Island, RV *Polar Duke*, 65°6'S, 65°54'W, 150 m (USNM 846186, 3 sh); South Shetland islands, N of Livingston Island, RV *Eltanin*, cruise 4, sta. 138, 62°00'S, 61°06'W, 1437 m (USNM 870018, 1 sh); South Shetland islands, W of Elephant Island, RV *Eltanin*, cruise 6, sta. 410, 61°18'S, 56°06'W, 220–240 m (USNM 870244, 1 sh); South Sandwich islands, Zavodovski Island, RV *Islas Orcadas*, cruise 575, sta. 73, 56°16'12"S, 27°30'W, 208–375 m (USNM 894456, 4 sh); Antarctic Peninsula, Bransfield Strait, RV *Hero*, cruise 833, sta. 21-1, 63°23'24"S, 57°0'35.6"W, 276–280 m (USNM 897616, 4 lv); Ross Sea, Victoria Land, Moubray Pennell Bank, RV *Eltanin*, cruise 32, sta. 2119, 73°06'S, 180°00" E, 567 m (USNM 898196, 1 sh); Antarctic Peninsula, RV *Eltanin*, cruise 12, sta. 1003, 62°40'58.8"S, 54°43'1.2" W, 210–220 m (USNM 898899, 1 sh); Antarctica, K. Halanych, sta. 21, 63°09'S, 57°7'12"W, 146–192 m (USNM 1121894, 1 lv); Antarctica, Trinity Peninsula, K. Halanych, sta. 51, 63°22'48"S, 60°3'36"W, 277 m (USNM 1121899, 1 lv); Bellingshausen Sea, off Antarctic Peninsula, K. Halanych, sta. 52, 65°39' 36"S, 68°2'24"W, 282 m (USNM 1121900, 1 lv); Bellingshausen Sea, off Antarctic Peninsula, K. Halanych, sta. 82, 65°39'36"S, 68°1'48"W, 278 m (USNM 1121904, 1 lv); South Shetland islands, Elephant Island, Bransfield Strait, K. Halanych, sta. 38, 62°45'S, 56°45'W, 207 m (USNM 1121906, 1 lv); between Deception and Livingston islands, K. Halanych, sta. 59, 62°48'36"S, 60°43'48"W, 203 m (USNM 11219076, 1 lv).

<FIGURE 19 ABOUT HERE>

**Morphology:** Protoconch eroded in most studied adults, in lectotype (Fig. 19 C) it is tall, ~ 2 convex whorls (the protoconch/teleoconch border is indistinct due to erosion), ~ 1.9 mm in height and 1.8 mm in diameter. Operculum spanning 2/3 of aperture length, elongate oval, with terminal nucleus, turned to left.

Radula (Figs 19 H-I) consists of 56 transverse rows of teeth, 15 nascent. Central tooth wide, crescent-shaped, with indistinct anterior border gradually fusing into subradular membrane. Posterior margin slightly thickened, distinct long, sharp central cusp emanates from anterior margin of tooth base. Lateral tooth length ~ 440  $\mu\text{m}$  (2.9% of aperture length without siphonal canal), duplex, with pointed obtuse major limb (Fig. 19 H, ml) with sharp edges, and large accessory limb (Fig. 19 H, al) of nearly the same length.

**Remarks:** Wiese (2001) regarded *Danilacarina elenae*, described from Kerguelen Island, to be a synonym of *A. multispiralis* Dell, 1990. However, we consider it to be more similar to *A. magnifica* and transfer the name into synonymy of this species.

The radula of this species was first reported by Hain (1990: pl. 26, figs 1-2) and is similar in all details to our observations.

Two specimens were sequenced, from different localities along the Antarctic Peninsula. The COI sequence of a third specimen downloaded from GenBank was more closely related to the geographically more proximal specimen (USNM 1121894) than to the specimen (USNM 1121900) from a more remote locality, suggesting the presence of geographical genetic variation (Fig. 17).

**Distribution:** Antarctic Peninsula, South Shetlands, South Orkneys and the South Sandwich islands (92–1455 m), from the Antarctic continent between 62°E and 74°E (177–437 m) and from the Ross Sea (567–1890 m) (Dell 1990), live 146–280 m.

### *Aforia multispiralis* Dell, 1990

(Fig. 19 J-L)

*Aforia multispiralis* Dell 1990: 231, 233, figs 413, 414, 416, 433, 435; Engl 2012: 180, pl. 73, figs 3a-c.

**Type locality:** off South Shetland islands, 62°27'S, 57°58'W, 1116–809 m (*Eltanin*, sta. 426).

**Type material:** Holotype: USNM 860145, SL 57.0 mm, paratype in the NMNZ (M.256641).

**Material examined:** Holotype; South Sandwich islands, SE of Visokoi Island, RV *Islands Orcadas*, cruise 575, sta. 67, 56°44'35.88"S, 27°2'42"W, 137–155 m (USNM 896288, 2 lv); South Shetland islands, RV *Eltanin*, cruise 4, sta. 138, 62°2'31.2"S, 61°8'31.2"W, 1437 m (USNM 870023, 1 sh); South Shetland islands, Nelson Island, RV *Eltanin*, cruise 6, sta. 432, 62°53'31.2"S, 59°21'W, 884–935 m (USNM 870304, 3 sh); South Orkney islands, RV *Eltanin*, cruise 12, sta. 1084, 60°22'30"S, 46°51'0"W, 298–403 m (USNM 870645, 2 sh); South Shetland islands, Penguin Island, RV *Eltanin*, cruise 6, sta. 428, 62°40'1.2"S, 57°48'28.8"W, 662–1120 m (USNM 881913, 1 lv); South Shetland islands, Nelson Island, RV *Eltanin*, cruise 6, sta. 432, 62°53'31.2"S, 59°21'W, 884–935 m (USNM 881916, 1 sh); Antarctic Peninsula, RV *Eltanin*, cruise 12, sta. 1002, 62°40'1.2"S, 54°44'31.2"W, 265 m (USNM 881973, 2 lv); South Shetland islands, Bransfield Strait, Gibbs Island, RV *Eltanin*, cruise 12, sta. 997, 61°45'S, 55°55'1.2"W, 769 m (USNM 898635, 1 sh).

**Morphology:** Protoconch of "two rather bulbous whorls, smooth" (Dell 1990: 233). Operculum, not studied. Radula not examined.

**Remarks.** Engl (2012) pointed out the difficulties in assigning some specimens either to *A. magnifica* or *A. multispiralis*. The major difference, according to Dell (1990) is the presence of two sharp keels or carinae on upper teleoconch whorls in *A. multispiralis* "instead of the single rounded carina" in *A. magnifica*. In *A. magnifica*, the suture is adpressed onto the more rounded anterior carina, while in *A. multispiralis*, the suture is adpressed below the sharply keeled anterior carina.

**Distribution:** Antarctic Peninsula, Bransfield Strait, South Shetlands, South Orkneys, 137–1455 m (Dell 1990; USNM material), live 137–1120 m.

***Aforia hedleyi* (Dell, 1990), comb. nov.**

(Fig. 20)

*Pontiothauma? hedleyi* Dell 1990: 245, figs 396, 417.

**Type locality:** Ross Sea, 76°S, 165°6'W, 494–498 m (RV *Eltanin*, sta. 2097)

**Type material:** Holotype: USNM 860148, SL 58.0 mm, paratypes USNM 860149, SL 97.1 mm, NMNZ M.256640.

**Material examined:** Holotype; Ross Sea, RV *Eltanin*, cruise 32, sta. 2045, 76°0'28.8"S, 176°46' 1.2"E, 566–569 m (USNM 860149, 1 sh, paratype); Ross Sea, Victoria Land, Moubray



Pennell Bank, RV *Eltanin*, cruise 32, sta. 2039, 76°00'S, 172°06'E, 565–569 m (USNM 896145, 1 lv); Ross Sea, Victoria Land, Moubray Pennell Bank, RV *Eltanin*, cruise 27, sta. 1933, 73°24'S, 177°42'E, 465–474 m (USNM 898517, 2 sh); Adélie Land, RV *Aurora Australis*, cruise *Ceamarc*, sta. 87EV524, 65°29'S, 139°19'E, 414 m (MNHN IM-2009-8188, 1 lv, sequenced).

<FIGURE 20 ABOUT HERE >

**Morphology:** Protoconch (Dell 1990: 245) "rather flat-topped, dome-shaped, of 1 1/2 whorls." Operculum was not available for the study. Radula (Fig. 20 E-F) long, ~ 5.8 mm in length (14% of aperture length without siphonal canal), consists of ~ 80 transverse rows of teeth, of which ~ 15 are nascent. Central tooth wide crescent-shaped, with indistinct anterior border gradually fusing into subradular membrane. Posterior margin slightly thickened, distinct, with long, sharp central cusp emanating from mid region of tooth base. Lateral teeth ~ 460 µm in length (1.1% of aperture length without siphonal canal), duplex, with pointed obtuse major limb with sharp edges, and large accessory limb ~ 2/3 of major limb length.

**Remark:** The species was described on the basis on empty shells and compared to "*Pontiothauma*" *ergata* Hedley, 1916. The holotype (Fig. 20 A) is an immature specimen (slightly over half the maximum known size for this species) and with a very angulated shell base. The paratype (Fig. 20 B-C) (not previously illustrated) shows the morphology of an adult specimen.

A large specimen (with broken base and siphonal canal) (Fig. 20 D) was recently collected off Adélie Coast in 414 m, and was available to anatomical and molecular studies. It is similar to the paratype in size, and to the holotype of *A. hedleyi* in surface sculpture. Its radular morphology and COI sequence (Fig. 17) show clear affinities with *Aforia*.

*Aforia hedleyi* differs from all other Antarctic species of the genus in lacking a pronounced angulation or keel on the shoulder.

**Distribution:** Ross Sea and Adélie Coast, 315–574 m, live 414 m.

## Family PSEUDOMELATOMIDAE Morrison, 1965

### *Conorbela* Powell, 1951

*Conorbela* Powell 1951: 170. Type species (by original designation): *Bela antarctica* Strebel, 1908; Recent, Antarctica.

**Diagnosis:** Shell large, attaining 29 mm, ovate-biconic, with moderately high spire, and short and wide siphonal canal. Protoconch eroded in studied specimens, presumably paucispiral. Teleoconch whorls convex, angulated at shoulder, subsutural ramp shallowly concave, nearly straight. Anal sinus very wide and shallow, occupying subsutural ramp. Axial sculpture limited to growth lines and irregular low folds. Spiral sculpture of dense and narrow spiral cords, cord along shoulder may be more pronounced and thickened to form a keel. Aperture high, widely ovate.

Operculum present, small, oval-triangular, with terminal nucleus.

Radula consists of duplex lateral teeth, with pointed sharp major limb and large accessory limb.

**Remarks:** This genus is monotypic. Powell (1966) attributed this genus to Mangeliinae and did not find a radula. The radula was first illustrated by Dell (1990: fig. 434) as a line drawing, roughly depicting a duplex marginal tooth, which precludes inclusion of the genus in Mangeliidae. Hain (1990: pl. 26, figs 3, 4) published a SEM photo of a similar radula. This genus was questionably attributed to Pseudomelatomidae by Bouchet *et al.* (2011) on the basis of radular morphology. A single specimen (USNM 1121892, Fig. 21 E) was sequenced for COI. A Bayesian analysis of a dataset that included a number of species representing different families of Conoidea with similar radular type, including several Pseudomelatomidae, did not reveal a well supported sister group. The position of *Conorbela* may possibly be clarified by using a multigene approach. Presently we follow Bouchet *et al.* (2011) and retain it in Pseudomelatomidae.

**Distribution:** South Shetland islands, along both sides of the Antarctic Peninsula, in the Weddell, Bellingshausen and Ross Seas.

<FIGURE 21 ABOUT HERE>

***Conorbela antarctica* (Strebel, 1908)**

(Fig. 21)

*Bela antarctica* Strebel 1908: 16-17, pl. 3, fig. 30 a-b.

*Conorbela antarctica*. – Powell 1951: 170; Carcelles 1953: 198; Powell 1960: 159; Powell 1966: 122, pl. 19, fig. 15; Dell 1990: 239, figs 395, 415, 434 (radula); Hain 1990: 70, pl. 7, figs 9a, b, pl. 26, figs 3, 4 (radula); Engl 2012: 183-184, pl. 75, fig. 1a-b (syntype, labelled as holotype), c.

**Type locality:** SW of Snow Hill Island, 64°36'S, 57°42'W, 120 m, Swedischen Südpolar-Expedition, sta. 6; Shag Rock Bank, 53°34'S, 43°23'W, 160 m, Swedischen Südpolar-Expedition, sta. 17.

**Type material:** 2 syntypes, the illustrated syntype from st. 6 (SMNH Type-1062), SL 28.9 mm, and broken specimen from st. 17 (SMNH Type-6302). Only the single specimen from st. 6 was mentioned in the original description. The second shell is so damaged, that its conspecificity can not be confirmed (A. Warén, personal communication).

Engl (2012) erroneously considered one of the syntypes (Fig. 21 A-B) to be the holotype of this species, probably because Strebel (1908) only mentioned this single specimen in the original description. We designate here the syntype from st. 6 as lectotype (SMNH Type-1062).

**Material examined:** Type material; South Shetland islands, N of Livingston Island, RV *Eltanin*, cruise 4, sta. 138, 62°00'S, 61°6'W, 1437 m (USNM 870021, 1 sh); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1002, 62°42'S, 54°42'W, 265 m (USNM 870558, 1 sh); Antarctic Peninsula, Graham Land, NE of Joinville Island, RV *Eltanin*, cruise 12, sta. 1003, 62°42'S, 54°42'W, 210–220 m (USNM 870607, 1 sh); South Shetland islands, Elephant Island, RV *Eltanin*, cruise 6, sta. 410, 61°18'S, 56°6'W, 220–240 m (USNM 881895, 2 lv); South Shetland islands, Bransfield Strait, Penguin Island, RV *Eltanin*, cruise 6, sta. 426, 62°30'S, 58°0'W, 808–1116 m (USNM 881909, 1 lv); South Orkney islands, SE of Laurie Island, RV *Islas Orcadas*, cruise 876, sta. 823, 61°19'47.9"S, 44°26'24"W, 274–280 m (USNM 894432, 1 sh); South Sandwich islands, Zavodovski Island, RV *Islas Orcadas*, cruise 575, sta. 73, 56°16'12"S, 27°30'W, 208–375 m (USNM 894465, 3 lv); South Shetland islands, Elephant Island, Bransfield Strait, K. Halanych, sta. 38, 62°45'S, 56°45'W, 207 m (USNM 1121892, 1 lv, sequenced); South Shetland islands, Elephant Island, Bransfield Strait, K. Halanych, sta. 38, 62°45'S, 56°45'W, 207 m (USNM 1121959, 1 lv).

**Morphology:** The protoconch and upper teleoconch whorls are eroded in all available specimens. Operculum (Fig. 21 C) medium sized, spanning ~ 1/3 of aperture length, triangular in lower part and rounded in upper part, with terminal nucleus. Radula (Fig. 21 D) of duplex marginal teeth along weak subradular membrane. Central teeth absent. Marginal teeth small, ~ 160 µm long (~ 1% of AL), with sharp, flattened major limb with a triangular tip and large, slightly curved accessory limb, spanning 2/3 of tooth length, narrow in middle part and broadening at a base.

**Remarks.** The monotypical genus *Conorbela* is the only representative of the family Pseudomelatomidae in Antarctic waters.

**Distribution:** Scotia Sea, Antarctic Peninsula, Bransfield Strait, South Shetland islands, Ross Sea, 68–1437 m (Dell 1990).

**Family HORAICLAVIDAE Bouchet, Kantor, Sysoev & Puillandre, 2011**

***Micropleurotoma* Thiele, 1929**

*Micropleurotoma* Thiele 1929: 362. Type species (by original designation): *Pleurotoma spirotropoides* Thiele, 1925; Recent, Agulhas Bank off South Africa.

**Diagnosis:** Shell small, attaining 9.2 mm, elongate, turritiform, with high spire, and moderately long, attenuated siphonal canal. Protoconch smooth, paucispiral, globose, ~ 2 whorls. Teleoconch whorls convex, angulated or carinated at shoulder, subsutural ramp from shallowly concave to nearly straight. Anal sinus moderately deep, apex on peripheral cord. Axial sculpture limited to growth lines or low folds, forming knobs along shoulder. Spiral sculpture of indistinct threads or absent. Aperture low, elongate, oval with angulated outer lip.

Operculum present, small, oval, with terminal nucleus.

Radula consists of duplex lateral teeth, with pointed, sharp major limb and small accessory limb.

**Remarks:** Four species are currently recognized within *Micropleurotoma*. This genus was questionably attributed to Pseudomelatomidae by Bouchet *et al.* (2011) on the basis of radular morphology.

**Distribution:** North Atlantic to South Africa (type species) and Antarctica, all at bathyal depths.

<FIGURE 22 ABOUT HERE>

***Micropleurotoma remota* (Powell, 1958)**

(Fig. 22 A-D)

*Spirotropis remota* Powell 1958: 204, pl. 2, fig. 5.

*Micropleurotoma remota*. – Numanami 1996: 205-206, fig. 142 A-D; Engl 2012: 180, pl. 73, fig. 4 a-b.

**Type locality:** off Enderby Land, 66°10'S, 49 °41'E, 300 m (B.A.N.Z.A.R.E. sta. 39).

**Type material:** Holotype: SAM (D 15513), SL 7.7 mm.

**Material examined:** South Shetland islands, RV *Eltanin*, cruise 4, sta. 129, 61°46'58.8"S, 61°30'W, 3678–3816 m (USNM 896502, 1 lv); South Atlantic Ocean, between Falklands and

South Georgia Island, RV *Eltanin*, cruise 7, sta. 552, 52°59'31.20"S, 48°53'31.2"W, 2928–3084 m (USNM 1187809, 1 lv).

**Morphology:** Protoconch (Numanami 1996: 205, fig. 142C) "somewhat glossy white in color, large and roundly inflated, about 2 in number of turns, 1.3 mm in length, 1.0 mm in diameter, with a smooth surface". Operculum (Numanami 1996: 206) "small to the aperture in size, and length occupies about 45% of aperture length and width about 65% of aperture width, corneous, thin, translucent pale yellow in color, ovate with downward by situated nucleus." Radula (Fig. 22 C-D) rather long (0.67 mm, or 0.21 of AL), narrow (65  $\mu$ m, or 2% of AL), of around 50 rows of teeth (4–5 nascent), consists of duplex marginal teeth. Marginal teeth with long and narrow major limb with sharp tip and edges and small accessory limb, spanning about 2/3 of tooth length (around 50  $\mu$ m, or 1.5% of AL).

**Remarks:** the species was transferred to *Micropleurotoma* by Numanami (1996) on the basis of its radular morphology. The radula of the type species, *M. spirotropoides* (Thiele, 1925) was illustrated by Bouchet and Warén (1980: fig. 4), who also extended the range of species, originally described from the Agulhas Bank off South Africa, into the North Atlantic. It is generally similar to that of *M. remota*. The shell of *M. spirotropoides* (Fig. 22 E-G) differs from that of *M. remota* in having a shorter spire and in lacking axial ribs. The radula is typical for Horaiclavidae, but lacks characters diagnostic at the generic level. We retain the position of this species in *Micropleurotoma* as there are not other genera that can better accommodate it.

**Distribution:** off Enderby Land, in 193–955 m (Numanami 1996), Weddell Sea, in 2600–3405 m (Engl 2012) and Scotia Sea (USNM 1187809) live 2928–3816 m.

### Family TURRIDAE H. & A. Adams, 1853

Genus unknown

#### *"Lophiotoma" pseudoannulata* Dell, 1990

(Fig. 22 H-L)

*Lophiotoma pseudoannulata* Dell 1990: 235–236, figs 392 (shell), 432 (radula); Engl 2012: 189, pl. 78, fig. 3a-b.

**Type locality:** Ross Sea, 72.5° S, 177.1° E, 1883 m (*Eltanin*, sta. 2121)

**Type material:** Holotype: USNM 860146, SL 19.0 mm; two paratypes in NMNZ (M.256620, M.261121).

**Material examined:** Holotype; Ross Sea, RV *Eltanin*, cruise 32, sta. 2081, 75°55'12"S, 173°16'48"W, 476 m (1 sh, USNM 898177).

**Morphology:** Protoconch "of two smooth, bulbous whorls with a few brephic axial riblets towards the close of the last whorl" (Dell 1990: 235). Operculum "brown, oval, with a flattened base, and latero-terminal nucleus" (Dell 1990: 235). Dell (1990: 235, fig. 432) reported that the radula consists of short duplex marginal teeth and narrow, broad-based, delicate central teeth with a relatively small median cusp (not illustrated in his drawing).

**Remarks.** The species is known only from the type material and an additional specimen from the Ross Sea.

The taxonomic position of the species is unclear. Radular morphology, as well as the general shell shape and position of the anal sinus indicates that the species belongs in the family Turridae. Dell (1990:236) stated that "generic placement in *Lophiotoma* can only be provisional". Indeed, the shell of "*L.*" *pseudoannulata* differs greatly from any *Lophiotoma* in shape and sculpture. The radula of *Lophiotoma* lacks the central tooth and the marginal teeth are much longer and slender. The radula, as illustrated and described is more similar to that of the genus *Turris* Batsch, 1789 (see SEM of the radula of *Turris crispa* (Lamarck, 1816) (Bouchet *et al.* 2011: fig. 21 F). Nevertheless there are no conchological similarities between "*L.*" *pseudoannulata* and any *Turris* species. The only genus of Turridae dwelling in high latitudes of the Southern Hemisphere is the genus *Ptychosyrinx* Thiele, 1925, which is characterized by very strong axial folds along the shell periphery. Although there is not currently an appropriate genus within Turridae to incorporate "*Lophiotoma*" *pseudoannulata*, we abstain from describing a new monotypic genus due to the lack of adequate material.

**Distribution:** Ross Sea, 205–1890 m (Dell 1990), live 213 m.

INSERTAE SEDIS

### **"*Leucosyrinx*" *macrobertsoni* Powell, 1958**

(Fig. 22 M)

*Leucosyrinx macrobertsoni* Powell 1958: 202, pl. 3, fig. 5; Engl 2012: 184, pl. 75, fig. 3.

**Type locality:** Off MacRobertson Land, 66°45'S, 62°03'E, 177 m (B.A.N.Z.A.R.E. sta. 107).

**Holotype:** SAM (D 15510), SL 42.6 mm.

**Material examined:** no material available.

**Distribution:** Known only from the type locality.

**Remarks.** The species is known only from the dead-collected holotype. The subsutural position of anal sinus is somewhat similar to *Antarctospira*, but the shell shape (with very tall multiwhorled spire, low aperture with short siphonal canal) precludes its inclusion in the latter genus. Without examination of the radula neither generic, nor even familial position can be clarified.

#### ANTARCTIC SPECIES REMOVED FROM CONOIDEA

##### ***Bela anderssoni* Strebel, 1908**

*Bela anderssoni* Strebel 1908: 14-15, pl. 2, fig. 24 a-d; Melvill and Standen 1912: 355; Powell 1951: 56; Engl 2012: 180-181, pl. 73, fig. 6b.

*Falsimohnia anderssoni*. – Kantor and Harasewych 2013: 52, figs 39-41.

**Type locality:** SE of Seymour Island, 64°20'S, 56°38'W, 150 m, Swedischen Südpolar-Expedition, sta. 5.

**Type material:** Holotype: SMNH Type-1063.

**Remarks:** Transferred to *Falsimohnia* Powell, 1951 (Buccinulidae) (Kantor and Harasewych 2013: 52).

**Distribution:** SE of Seymour Island and Elephant Island, South Shetland islands, 150–240 m.

##### ***Bela anderssoni* var. *minor* Strebel, 1908**

*Bela anderssoni* var. *minor*? Strebel 1908: 15; Powell 1951: 59; Engl 2012: 181, pl. 73, fig. 6a.

*Falsimohnia minor*. – Kantor and Harasewych 2013: 51, figs 28-34.

**Type locality:** South Georgia, outer Cumberland Bay, 54°11'S, 36°18'W, 252–310 m, Swedischen Südpolar-Expedition, sta. 34.

**Type material:** three syntypes, SMNH Type-1057.

**Remarks:** Transferred to *Falsimohnia* Powell, 1951 (Buccinulidae) as *Falsimohnia minor* (Kantor and Harasewych 2013: 51).

**Distribution:** South Georgia, Bellinghausen Sea, Peter I Island, 90–310 m.

##### ***Bela fulvicans* Strebel, 1908**

*Bela fulvicans* Strebel 1908: 15, pl. 2, fig. 25 a-d; Melvill and Standen 1912: 356; Powell 1951: 56, 59; Zelaya 2005: 128, fig. 52 (figure erroneously labeled as *Lorabela pelseneeri*); Engl 2012: 181, pl. 73, fig. 7a-c.

*Falsimohnia fulvicans*. – Kantor and Harasewych 2013: 48, figs 21-27, 35-36.

**Type locality:** South Georgia, Cumberland Bay, outside Grytviken, 54°22'S, 36°27'W, 24–52 m (Swedish South Polar Expedition, sta. 25).

**Type material:** Lectotype, SMNH Type 6303 (designated by Engl 2012: p. 181).  
Paralectotypes: SMNH Type 1030 (st. 34, Cumberland Bay, 54°11'S, 36°18'W, 252–310 m);  
SMNH Type 6159 (st. 95, off Astrolabe Island, 64°09'S, 58°17'W, 95 m)

**Remarks:** Transferred to *Falsimohnia* Powell, 1951 (Buccinulidae) (Kantor and Harasewych 2013: 48).

**Distribution:** South Georgia, and questionably Burwood Bank, 95-310 m.

### ***Bela notophila* Strebel, 1908**

*Bela notophila* Strebel 1908: 20-21, pl. 2, fig. 28 a-d; Engl 2012: 181, pl. 73, fig. 5.

*Strebela notophila*. – Kantor and Harasewych 2013: 53, figs 37-38, 44-45.

**Type locality:** South Georgia, outer Cumberland Bay, 54°11'S, 36°18'W, 252–310 m, Swedischen Südpolar-Expedition, sta. 34,

**Type Material:** Holotype, SMNH Type-1064

**Remarks:** The new, monotypical genus *Strebela* Kantor & Harasewych, 2013 (Buccinulidae) was erected to include this species (Kantor and Harasewych 2013: 53).

**Distribution:** South Georgia, 97–310 m.

Insertae sedis

### ***Pleurotoma tcherniai* Gaillard, 1955**

Gaillard 1955: 682-683, fig. 1.

**Type locality:** Adelie Land, 10–100 m.

**Type Material:** Holotype MNHN IM-2000-0241 (photo available online at <http://science.mnhn.fr/institution/mnhn/collection/im/item/2000-0241>), SL 5.5 mm.

**Remarks:** The holotype is the only known specimen and is a badly broken shell. The taxonomic position is unclear and it may represent a species of Buccinoidea.

**Distribution:** Known only from the type locality.

## **DISCUSSION**

***Rich or poor?***



The fauna of Conoidea within the Antarctic convergence includes 42 recognized species and subspecies attributed to 14 genera and subgenera (two being unnamed or undetermined) in at least seven families (Table 4).

< TABLE 4 ABOUT HERE >

Raphitomidae is richest in species (17 species), with *Pleurotomella* s.l. being the most diverse genus (14 species). It is followed by Borsoniidae (10 species, four genera). The majority of genera, incorporating 33 species, are characterized by radulae consisting of hypodermic marginal teeth (for more details see Kantor and Puillandre 2012) (families Mangeliidae, Raphitomidae and Borsoniidae), while the genera with radula of non-hypodermic, duplex marginal teeth (families Cochlespiridae, Pseudomelatomidae, Horaiclavidae, and Turridae) are mostly represented by single species, except for *Aforia*, which includes five Antarctic species. This is similar to the ratio in Arctic waters of Russia, where only one out of approximately 40 species possesses a radula with non-hypodermic marginal teeth [*Spirotropis monterosatoi* (Locard, 1897), Drilliidae]. Only two Antarctic genera (including one undescribed genus incorporating "*Lophiotoma*" *pseudoannulata*) are monotypic (15% of genera).

At a first glance the total number of "turrids" in Antarctic waters seems low, considering the wide bathymetric (30–5700 m) and geographic range, especially when compared to conoidean diversity in the tropical realm. For example, at the Koumac site in New Caledonia, which was extensively sampled mostly at shallow depths (down to 10 m), "turrids" (and Conoidea in general) were the most diverse group of the Neogastropoda, and were represented by 263 morphospecies, more than 48% of total number of Neogastropoda species.

Comparisons of "turrid" species richness with other well studied faunas revealed a similar relative abundance of "turrids" (Table 5). The low number of "turrid" species in Antarctic waters is indicative of the general impoverishment of gastropod fauna in Antarctica, as well as of possible undersampling of gastropods in difficult hydrological conditions and the absence of mollusks in the uppermost bathymetric zone.

< TABLE 5 ABOUT HERE >

### ***Endemism***

Only two genera (*Lorabela* and monotypical *Conorbela*) can be considered as endemic to waters within the Antarctic convergence. Another four (*Antarctospira*, *Typhlodaphne*, *Belalora*, and *Pleurotomella* (*Anomalotomella*)) occur in both Antarctic and subantarctic waters. Six other

genera have broad geographic distributions. The genus that includes "*Lophiotoma*" *pseudoanulata* is not included, nor is "*Leucosyrinx*".

Comparisons of Conoidea to another diverse group of Antarctic Neogastropoda, Buccinoidea, reveals that Buccinoidea are characterized by a higher rate of endemism and a larger proportion of monotypical genera. Out of 18 genera (including one subgenus) of Buccinoidea found within the Antarctic convergence, 11 (61%) are endemic to Antarctic waters, six extend only slightly beyond the Antarctic convergence ( Kerguelen and Crozets islands) and only a single genus (*Meteuthria* Thiele, 1912) occurs both within the convergence and in the Magellanic region (data from Harasewych and Kantor 2004; Kantor and Harasewych 2013). Among Buccinoidea found within the convergence, nine genera (50%) are monotypic, while only two genera of Conoidea are monotypic.

Buccinoidea are characterized by direct development, undergoing the larval stages within the egg capsules, and emerging as crawling young. However, the broad distribution of some conoidean genera recorded in Antarctica does not correlate with mode of larval development. Among broadly distributed genera only *Pleurotomella* s.s. possess a multispiral protoconch that is indicative of planktotrophic larval development. In contrast, *Xanthodaphne* and *Aforia*, which has a very broad distribution that spans the North Pacific and North Atlantic Oceans (as confirmed by molecular data), have paucispiral protoconchs, suggesting intracapsular development. Most of Antarctic conoidean species have non-planctotrophic protoconchs.

At the species level the rate of endemism of turrids in Antarctica is much higher – 82% of species are endemic to Antarctica. Only three species, *Pleurotomella anomalapex*, *Aforia goniodes*, and *Aforia watsoni* extend well beyond the limits of the convergence into the Magellanic Province, Argentina and even southwestern Australia. One species, *Xanthodaphne translucida* extends to Marion Island and the Crozets. In comparison, all the species of Buccinoidea that occur in Antarctic waters are endemic to Antarctica.

### ***Bathymetric distribution***

All genera of Conoidea (except "*Leucosyrinx*" *macrobertsoni*) inhabiting Antarctica waters extend into bathyal depths, and five continue into the abyssal zone (Table 4, Fig. 23). Rather remarkable is the very broad bathymetric range of genera, as well as of some species. Nine species occurring in the upper bathyal zone have a bathymetric range of more than 1000 m, while *Typhlodaphne purissima* (94-2855 m), *Aforia watsoni* (220-4963 m), *Micropleurotoma remota* (193-3084 m) had ranges of 2500 m or more. It should be noted, that we were not able to

examine all the specimens on which these records were based and erroneous identifications and even the existence of species complexes with different bathymetric ranges are quite possible.

<FIGURE 23 ABOUT HERE>

Greatest species diversity occurred at depths between 100 and 400 m with the number of species gradually diminishing down to 2800 m with slight increase in the number of species at depths of 3000-5000 m (Fig. 24).

<FIGURE 24 ABOUT HERE>

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Table 1. Species included in the present work to compile the molecular dataset, with voucher registration and GENBANK accession numbers.

Family	Species	Registration no.	Distribution	Coordinates	Depth, m	COI GB
Mangeliidae	<i>Eucithara coronata</i> (Hinds, 1843)	MNHN IM-2007-17900	Philippines	9°37'5.988"N; 123°46'5.9988"E	intertidal	EU015674
Mangeliidae	<i>Benthomangelia</i> sp.	MNHN IM-2007-17930	Solomon Islands	7°45' 6.012"S; 156°56'17.9664"E	768-890	EU015743
Mangeliidae	<i>Benthomangelia</i> cf. <i>trophonoidea</i> (Schepman, 1913)	MNHN IM-2007-17835	Vanuatu	16°37'30.5976"S; 167°57'22.7844"E	618-641	EU015644
Mangeliidae	<i>Toxicochlespira pagoda</i> Sysoev & Kantor, 1990	MNHN IM-2007-17915	Philippines	8°43' 18.012"N; 123°19'0.0228"E	259-280	EU015730
Mangeliidae	<i>Propebela</i> cf. <i>scalaris</i> (Møller, 1842)	MNHN IM-2007-42325	Norway, Spitzbergen, Hornsund, Svalbard			HQ401582
Mangeliidae	<i>Propebela</i> cf. <i>scalaris</i> (Møller, 1842)	MNHN IM-2007-42326	Norway, Spitzbergen, Hornsund, Svalbard			KT448823
Mangeliidae	<i>Lorabela pelseneri</i> (Strebel, 1908)	USNM 1121974	Antarctic Peninsula	63°40'4.7994"S, 57°18'56.4114"W	260	KT448824
Mangeliidae	<i>Lorabela plicatula</i> (Thiele, 1912)	USNM 1121967	Antarctic Peninsula	63°40'4.7994"S, 57°18'56.4114"W	260	KT448825
Mangeliidae	<i>Lorabela plicatula</i> (Thiele, 1912)	USNM 1121969	Antarctic Peninsula	63°40'4.7994"S, 57°18'56.4114"W	260	KT448826
Borsoniidae	<i>Borsonia</i> sp.	MNHN IM-2007-17839	Coral Sea	21°7'0.0156"S; 158°30'0.0"E	800-923	EU015665
Borsoniidae	<i>Borsonia</i> sp.	MNHN IM-2007-17926	Solomon Islands	7°45'6.012"S; 156°56'17.9664"E	768-890	EU015739
Borsoniidae	<i>Bathytoma visagei</i> Kilburn, 1973	MNHN IM-2009-6252	Mozambique Channel	23°31'40.188" S; 35°45'45.612"E	264 -277	KT448827
Borsoniidae	<i>Bathytoma episoma</i> Puillandre, Sysoev, Olivera, Couloux & Bouchet, 2010	MNHN IM-2007-18061	Philippines	15°58'8.4"N; 121°49'13.206"E	418-456	EU592111.1
Borsoniidae	<i>Bellaturricula gaini</i> (Lamy, 1910)	USNM 1121911	Antarctic Peninsula	64°8'19.32"S; 62°45'35.9994"W	156	KT448828
Borsoniidae	<i>Bellaturricula gaini</i> (Lamy, 1910)	USNM 1121929	Antarctic Peninsula	63°40'12"S; 61°10'12"W	126	KT448829
Borsoniidae	<i>Bellaturricula turrita multispiralis</i> Dell, 1990	USNM 1122047	Antarctic Peninsula	63°8'50.28"S; 57°7'26.4"W	146-192	KT448830
Borsoniidae	<i>Bellaturricula turrita multispiralis</i> Dell, 1990	USNM 1121893	Antarctic Peninsula	63°8'50.28"S; 57°7'26.4"W	146-192	KT448831
Borsoniidae	<i>Bellaturricula ergata</i> (Hedley, 1916)	MNHN IM-2009-8165	Adélie Land	66°01'S, 142°43'E	421-463	KT448832
Borsoniidae	<i>Bellaturricula ergata</i> (Hedley, 1916)	MNHN IM-2009-8177	Adélie Land	66°34'S, 141°20'E	170-210	KT448833
Borsoniidae	<i>Bellaturricula ergata</i> (Hedley, 1916)	MNHN IM-2009-8189	Adélie Land	65°29'S, 139°19'E	397-411	KT448834
Borsoniidae	<i>Genota mitriformis</i> (Wood, 1828)	MNHN IM-2007-42293	Angola, Pta. Das		30-50	HQ401576

			Lagostas			
Cochlespiridae	<i>Comitas bolognai</i> Bozzetti, 2001	MNHN IM-2007-17916	Philippines	8°51'0.00"N; 123°10'0.0192"E	982-989	EU015731
Cochlespiridae	<i>Cochlespira pulchella</i> (Schepman, 1913)	MNHN IM-2007-17842	Coral Sea	21°2'59.9964"S; 158° 36' 0.0216"E	352-370	EU015651
Cochlespiridae	<i>Cochlespira</i> sp	MNHN IM-2007-40568	Coral Sea	21°10'0.012"S; 158°38'59.9784"E	650-723	EU685627
Cochlespiridae	<i>Aforia hedleyi</i> (Dell, 1990)	MNHN IM-2009-8188	Adélie Land	65°29'S, 139°19'E	414 m	KT448835
Cochlespiridae	<i>Aforia serranoi</i> Gofas, Kantor & Luque, 2014	MNCN15.05/60099	East of Galicia Bank	42°41.875'N; 11°26.708'W	1720	KT448836
Cochlespiridae	<i>Aforia magnifica</i> (Strebel, 1908)	USNM 1121900	Bellingshausen Sea	65°39'50.58"S, 68°2'13.4406"W	282	KT448837
Cochlespiridae	<i>Aforia magnifica</i> (Strebel, 1908)	ZSM 20021143	Weddell Sea	62°34'47.9994"S; 55°40'12"W		FM999160.1
Cochlespiridae	<i>Aforia magnifica</i> (Strebel, 1908)	USNM 1121894	Antarctic Peninsula	63° 8' 50.28"S, 57° 7' 26.4"W	146-192	KT448838
Pseudomelatomidae	<i>Conorbela antarctica</i> (Strebel, 1908)	USNM 1121892	South Shetland Islands, Elephant Island	62°45'S, 56°45'W	207	KT448839

Table 2. *Pleurotomella (Pleurotomella) tippetti*, shell measurements (mm)

Specimen	Shell length	Last whorl length	Aperture length	Shell width
Holotype	12.5	9.8	7.9	7.0
Paratype	13.0	10.2	8.3	6.7

Table 3. *Pleurotomella (Anomalotomella) petiti*, shell measurements (mm).

Specimen	Shell length	Last whorl length	Aperture length	Shell width
Holotype	4.3	3.3	2.9	2.7
Paratype	5.7	4.2	3.7	3.5

Table 4. Species richness, geographical and bathymetric distribution of genera of Conoidea, recorded in Antarctic waters.

Family	Genus (subgenus)	Total No of species and subspecies	No. of species and subspecies in Antarctica	Distribution: A – Antarctic, SA – subantarctic, BR – broad distribution	Depth range in Antarctica (our data and published records)
Borsoniidae	<i>Antarctospira</i> new genus	5	3	A, SA	193-1400
	<i>Belaturricula</i> Powell, 1951	5	4	BR	70-695
	<i>Drilliola</i> Locard, 1897	3	1	BR	662-1120
	<i>Typhlodaphne</i> Powell, 1951	4	2	A, SA	90-3510
Mangeliidae	<i>Lorabela</i> Powell, 1951	4	4	A	98-640
	<i>Belalora</i> Powell, 1951	3	2	A, SA	193-4805
Raphitomidae	<i>Pleurotomella</i> ( <i>Pleurotomella</i> ) Verrill 1873	74	2	BR	2359-5700
	<i>Pleurotomella</i> ( <i>Anomalotomella</i> )	12	12	A, Sa	30-600

	<i>Xanthodaphne</i> Powell, 1942	31	3	BR	99-4,540
Cochlespiridae	<i>Aforia</i> Dall, 1889	20	5	BR	92-4963
Pseudomelatomidae	<i>Conorbela</i> Powell, 1951	1	1	A	68-1437
Horaiclavidae	<i>Micropleurotoma</i> Thiele, 1925	4	1	BR	193-3816
Turridae	?	1	1		205-1890
Insertae sedis	" <i>Leucosyrinx</i> "		1		177
Total			42		

Table 5. Relative abundance of Conoidea in Antarctic waters and other faunas.

Region	Total number of Neogastropoda species	Total number of Conoidea species	Total number of "turrid" species	Conoidea as % of total Neogastropod species	"Turrids" as % of total Neogastropod species	Source
Antarctica	160	42	42	26.2%	26.2%	Harasewych and Kantor 2004; Engl 2012; Kantor and Harasewych 2013; herein
New Zealand	489	143	117	29.2%	23.9%	Spencer <i>et al.</i> 2014
Russia	488	130	129	26.6%	26.6%	Kantor and Sysoev 2006
Japan	2011	693	429	34.5%	21.3%	Higo <i>et al.</i> 1999
New Caledonia	723	352	263	48.7%	36.4%	Bouchet <i>et al.</i> 2002



## Captions

**Figure 1.** Shells and radula of species of *Antarctospira* n. gen. **A – F**, *Antarctospira badenpowelli* (Dell, 1990); **A, B**, holotype, USNM 613118, Victoria Land, McMurdo Sound, east of Cape Hallett, 72°08'S, 172°10'E, 433 m, SL 19.9 mm; **C**, paratype, USNM 860180, South Shetland Islands, 72°06'S, 172°12'E, 433 m, SL 21.5 mm; **D – F**, radula of paratype; **D**, teeth and radular membrane; **E**, single marginal tooth; **F**, tooth tip; **G – J**, *Antarctospira principalis* (Thiele, 1912); **G, H**, lectotype, ZMB 62984a, SL 13.7 mm; **I**, juvenile paralectotype, SL 5.0 mm; **J**, radula of paralectotype (after Thiele, 1912); **K**, *Antarctospira mawsoni* (Powell, 1958), holotype, SAM (D 15509), off Mackenzie Sea, 66°48'S, 71°24'E, 456 m, SL 37.75 mm; **L, M**, *Antarctospira paragenota* (Powell, 1951), holotype, BMNH 1961609, Burdwood Bank, south of Falkland Is., 54°04'S, 61°40'W, 171-169 m SL 21.3 mm; **N, O**, *Antarctospira falklandica* (Powell, 1951), holotype, BMNH 1961610, north of Falkland Is., 53°16'S, 64°12'W, 336-342 m. SL 15.8 mm. **A – C, K – O**, shells at the same scale.

**Figure 2.** Bayesian tree based on partial COI sequences showing relationships of Antarctic species of *Bellaturricula* and selected outgroups. Posterior probabilities are shown for each node.

**Figure 3.** Shells and radula of species of *Bellaturricula*. **A – C**, *Belaturricula turrita turrita* (Strebel, 1908); holotype of *Bela turrita* Strebel, 1908, Shag Rock Bank, 53°34'S, 43°23'W, 160 m, SL 60.0 mm; **D – E**, *Belaturricula turrita multispiralis* Dell, 1990; **D**, holotype, USNM 860139, Bransfield Strait, Antarctic Peninsula, 63°14'S, 58°45'W, 73 m, SL 75.6 mm; **E**, USNM 1121893 (sequenced specimen), Antarctic Peninsula, 63°09'S, 57°07'12"W, 146-192 m, SL 74.0 mm; **F – G**, *Belaturricula gaini* (Lamy, 1910); **F**, USNM 860141, off South Shetland Islands, 62°56.9'S, 60°50.1'W, 154 m (holotype of *Belaturricula antarctica* Dell, 1990); **G**, USNM 1121929 (sequenced specimen), Antarctic Peninsula, 63°40'8.76"S, 61°10'3"W, 126 m, SL 53 mm. **H – L**, *Belaturricula ergata* (Hedley, 1916), MNHN IM-2009-8189, Adélie Land, 65°29'S, 139°19'E, 397-411 m; SL 81.4 mm. **H, I**, shell; **J – L**, radula; **J**, marginal teeth in different positions; **K**, enlarged tips of marginal teeth; **L**, enlarged shell base. Shells at the same scale.

**Figure 4.** Shells and radula of *Drilliola antarctica* sp. nov., holotype, USNM 898821, South Shetland islands, Penguin Island, 62°40'1.2"S, 57°48'28.7994"W, 662–1120 m, SL 11.6 mm. **A – B**, ventral and dorsal views of the shell; **C**, operculum; **D – F**, radula (**D**, part of the radular membrane with single row of marginal teeth; **E**, separate marginal tooth; **F**, tip of the tooth).

**Figure 5.** Shells of species of *Typhlodaphne*. *Typhlodaphne purissima* (Strebel, 1908). **A – F**, syntypes of *Bela purissima* Strebel, 1908, Shag Rock Bank, 53°34'S, 43°23'W, 160 m, SMNH Type-1061; **A – C**, SL 22.3 mm, **D**, enlarged operculum; **E**, SL 20.5 mm; **F**, enlarged protoconch. **G**, USNM 897551, off South Georgia, 55.27 S, 35.72 W, 180-186 m, SL 21.5 mm (radula see Fig. 6 A-C); **H – I**, USNM 896362, off South Georgia, 54°59'S, 38°13'W, 2196-2379 m, SL 27.0 and 31.9 mm; **J**, USNM 896521, NE of South Georgia Island, 52°53'S, 33°52'W, 2818-2855 m, SL 27.1 mm (radula see Fig. 6 D-F). **K – L**, *Typhlodaphne strebeli* Powell, 1951, holotype, NHMUK 1961617, between Cape Horn and Staten Island, 56°19.5'S, 67°09.75'W, 121 m, SL 20.0 mm. Shells at the same scale.

**Figure 6.** Radula and operculae of species of *Typhlodaphne*. **A – F**, *Typhlodaphne purissima* (Strebel, 1908); **A – C**, USNM 897551 (shell see Fig. 5 G); **A**, single marginal tooth; **B**, enlarged tip of marginal tooth; **C**, part of radular membrane; **D – F**, USNM 896521 (shell see Fig. 5 J); **D**, single marginal tooth; **E**, enlarged tip of marginal tooth; **F**, enlarged bases of marginal teeth. **G – M**, *Typhlodaphne paratenoceras* (Powell, 1951); **G – J**, USNM 870249 (shell see Fig. 7 J-K); **G**, single marginal tooth; **H**, enlarged tip of marginal tooth; **I**, enlarged base of marginal tooth; **J**, operculum; **K – M**, USNM 870629 (shell see Fig. 7 G-H); **K**, single marginal tooth; **L, M**, enlarged tip of marginal tooth in different orientations; **N – R**, *Typhlodaphne* cf. *paratenoceras*, USNM 1113020, 55°01'S, 39°55'W, 2886-3040 m, SL 45. mm (shell see Fig. 7 N-O); **N, O**, single marginal tooth in different positions; **P, Q**, enlarged tip of marginal tooth in different positions; **R**, operculum.

**Figure 7.** Shells of species of *Typhlodaphne*. **A – K**, *Typhlodaphne paratenoceras* (Powell, 1951); **A – C**, holotype, BMNH 1961607, between Penguin Island and Lion's Rump, King George Island, South Shetland Islands, 367-382 m, SL 38.8 mm; **D – F**, USNM 678478, South Orkney Islands, of North Laurie Island, 60°31'12"S, 44° 46' 48"W, 761 m, SL 47.8 mm; **G – H**, USNM 870629, SE of South Orkney Islands, 61°24'S, 41°54'W, 593-598 m, SL 41.6 mm (radula see Fig. 6 K-M); **J – K**, USNM 870249, South Shetland Islands, West of Elephant Island, 61°18'S, 56°06'W, 220-240 m, SL 29.7 mm (radula see Fig. 11 G-J). **L – M**, *Typhlodaphne* cf. *paratenoceras*, USNM 1113020, South Georgia Island, off W tip of island, RV *Eltanin*, cruise 22, sta. 1537, 55°01'S, 39°55'W, 2886–3040 m, SL 39.9 mm, **N – O**, SL 45. mm (radula and operculum see Fig. 6 N-R). Shells at the same scale.

**Figure 8.** Bayesian tree based on partial COI sequences showing relationships of Antarctic species of *Lorabela* and selected outgroups. Posterior probabilities are shown for each node.

**Figure 9.** Shells and radula of species of *Lorabela*. **A – C**, *Lorabela pelseneri* (Strebel, 1908); **A**, lectotype of *Bela pelseneri*, SMNH Type-1065, outer Cumberland Bay, South Georgia Island, 54°11'S, 36°18'W, 252-310 m, SL 7.6 mm; **B**, paralectotype, SMNH Type-5762, SL 7.9 mm; **C**, USNM 1121974, Antarctic Peninsula, 63°40'4.8"S, 57°18'56.4"W, 260 m, SL 7.5 mm, sequenced specimen; **D – I**, *Lorabela glacialis* (Thiele, 1912), syntypes of *Bela glacialis* Thiele, 1912, ZMB Mol 62985, Davis Sea, 66°02'09"S, 89°38'E, 385 m; **D – F**, SL 5.4 mm (**F** – enlarged protoconch); **G**, SL 5.2 mm; **H, I**, SL 9.0 mm; **J – N**, *Lorabela plicatula* (Thiele, 1912), syntypes of *Bela plicatula* Thiele, 1912, ZMB Mol 62986, Davis Sea, 66°02'09"S, 89°38'E, 385 m; **J – L**, SL 6.2 mm (**L** – enlarged protoconch); **M**, SL 5.6 mm; **N**, SL 4.8 mm; **O – R**, USNM 1121967, Antarctic Peninsula, 63°40'4.8"S, 57°18'56.52"W, 260 m, SL 11.1 mm; **O**, shell; **P – R**, marginal radular teeth in different orientations. **S**, *Lorabela davisi* (Hedley, 1916), holotype of *Oenopota davisi*, AMS (C.46688), off Mertz Glacier tongue, Adelie Land, 66°52'S, 145°30'E, 527 m, SL 7.0 mm. Scale bars – 5 mm for shells, 1 mm for protoconchs. Shells at the same scale. (**S**, photo, courtesy of W. Engl and Conchbooks).

**Figure 10.** Shells of species of *Belalora*. **A – F**, *Belalora striatula* (Thiele, 1912); syntypes of *Bela striatula* Thiele, 1912, ZMB Mol 62987, Davis Sea, 66°02'09"S, 89°38'E, 385 m; **A – B**, SL 4.3 mm; **C**, protoconch of the same syntype, enlarged; **D**, SL 4.5 mm; **E – F**, SL 3.8 mm; **G – I**, *Belalora weirichi* (Engl, 2008); **G**, holotype of *Oenopota weirichi*, ZSM Mol 2005 1067, Weddell Abyssal Plain, 65°34.34'S-36°31.18'W – 65°35.72'S-36°28.40'W, 4,794-4,805 m, SL 7 mm; **H – J**, paratype, 70°39.37'S-14°43.51'W – 70°40.48'S-14°43.77'W, 2,970-3,095 m, SL 4.72 mm; **H**, SEM of the shell, **I – J**, protoconch. **A – F** at the same scale; **G – H** at the same scale. (**G – I**, photos, courtesy of W. Engl and Conchbooks).

**Figure 11.** Shells of species of *Pleurotomella* (*Pleurotomella*). **A – D**, *Pleurotomella maitasi* Engl, 2008, Scotia Sea, 56°21'S, 50°48'W, 5700-5650 m, SL 14.3 mm; **A, B**, ventral and dorsal views of the shell; **C, D**, lateral and apical views of the protoconch and upper teleoconch whorls; **E – J**, *Pleurotomella tippetti* new species, NW of Coronation Island, South Orkney Islands, 60°12.9'S, 43°59'W, 5450-5480 m; **E – H**, holotype, USNM SL 12.5 mm; **E – F**, ventral and dorsal views of the shell; **G – H**, lateral and apical views of the protoconch and upper teleoconch whorls; **I – J**, paratype, SL 13.0 mm. Shells of *Pleurotomella tippetti* at the same scale. Arrows indicate protoconch/teleoconch border.

**Figure 12.** Shells and radula of species of *Pleurotomella* (*Anomalotomella*). **A – E**, *Pleurotomella* (*Anomalotomella*) *anomalapex* Powell, 1951, UNSM 887840, NE of Zavodovski Island, South Sandwich Islands, 56°12'S, 27°23'53.9"W, 179-238 m, SL 6.3 mm; **A**, ventral; **B**, lateral; **C**, dorsal views of the shell; **D, E**, apical and lateral views of the protoconch; **F**, *Pleurotomella* (*Anomalotomella*) *bathybia* Strebel, 1908, neotype, ZSM (Mol 2002 1313), South Georgia, 54°27.63'S, 35°41.33'W, 256 m, SL 11 mm; **G**, *Pleurotomella* (*Anomalotomella*) *frigida* Thiele, 1912, lectotype, ZMB M.62982a, Davis Sea, 66°02'09"S, 89°38'E, 385 m, SL 5.2 mm; **H – K**, *Pleurotomella* (*Anomalotomella*) *annulata* Thiele, 1912, USNM 1123584, South Shetland Islands, 62°48'29.9"S, 60°43'30"W, 203 m, SL 6.4 mm; **H – I**, ventral and dorsal views of the shell; **J – K**, marginal radular tooth (s – spur); **L – M**, *Pleurotomella* (*Anomalotomella*) *deliciosa* Thiele, 1912, holotype, ZMB (Moll 62980), Davis Sea, 66°02'09"S, 89°38'E, 385 m, SL 4 mm. Shells not to scale. (**F, G**, photos, courtesy of W. Engl and Conchbooks). Shells not to scale.

**Figure 13.** Shells of species of *Pleurotomella* (*Anomalotomella*). **A – D**, *Pleurotomella* (*Anomalotomella*) *simillima* Thiele, 1912; **A – C**, holotype, ZMB M.62983, Davis Sea, 66°02'09"S, 89°38'E, 385 m SL 11 mm; **A – B**, shell; **C**, enlarged protoconch; **D**, USNM 898193, Ross Sea, Victoria Land, E of Moubray Pennell Bank, 73°0'S, 178°06'W, 595-600 m, SL 5.7 mm; **E**, *Pleurotomella* (*Anomalotomella*) *enderbyensis* Powell, 1958, ZSM, *Polarstern* ANT 17/3 Ex p., Stn 159-1, Bransfield Strait, 62°55,00' S, 57°39,50'W, 214–218 m, SL 5 mm; **F**, *Pleurotomella* (*Anomalotomella*) *endeavourensis* Dell, 1990, holotype, NMNZ (M.256622), off Enderby Land, 65°48'S, 53°16'E, 193 m, SL 10.9 mm; **G**, *Pleurotomella* (*Anomalotomella*) *rossi* Dell 1990, holotype, NIWA (# 276), Ross Sea, 77°50'S, 166 °30'E, 369 m, SL 11.9 mm; **H – L**, *Pleurotomella* (*Anomalotomella*) *innocentia* (Dell, 1990), comb. nov., holotype, USNM 860147, Ross Sea, 72°00'S, 172°28'E, 530-549 m, SL 4.2 mm; **H**, ventral; **I**, lateral; **J**, dorsal views of the shell; **K, L**, lateral and apical views of protoconch. **E, G**, photos, courtesy of W. Engl and Conchbooks . (**A-B, D**, at the same scale; **F, G**, at the same scale).

**Figure 14.** Shells and radula of species of *Pleurotomella* (*Anomalotomella*). **A – C**, *Pleurotomella* (*Anomalotomella*) *nipri* (Numanami, 1996), comb. nov., holotype, NSMT-Mo 70633, Breid Bay, Queen Maud Land, Antarctica, 70°09.0'S, 23°46.3'E, 275-283 m, SL 3.1 mm; **D – L**, *Pleurotomella* (*Anomalotomella*) *petiti* n. sp. **D – G**, shell of holotype, USNM 1123582, between Deception and Livingston Islands, 62°48'29.88"S, 60°43'30"W, 203 m, SL 4.3 mm; **D**, ventral; **E**, dorsal; **F**, apical; **G**, apico-lateral views; **H, I**, SEM of shell of paratype, USNM

1123581, same locality as the holotype, SL 5.7 mm (**I**, enlarged protoconch); **J – L**, marginal radular teeth of holotype, (**s** – spur); **L**, enlarged tooth tip. **A – C** – photos courtesy of K. Hasegawa.

**Figure 15.** Shells and radula of species of *Xantodaphne*. **A – E**, *Xantodaphne translucida* (Watson, 1881), syntypes of *Pleurotoma (Thesbia) translucida*, BMNH 1187.2.9.1041-3, st. 145, between Marion Island and Prince Edward Island, 46°43'S, 38°04'30"E, 256 m; **A – D**, SL 13.5 mm (**D**, enlarged protoconch); **E**, SL 14.1 mm. **F – J**, *Xantodaphne raineri* (Engl, 2008), comb. nov., IORAS, Davis Sea, 59°29'S, 97°06.7' E, 4540 m; **F – G**, ventral and dorsal views of the shell, SL 32.5 mm; **H**, lateral view of the protoconch; **I**, radula; **J**, dissected anterior part of the cephalopodium. ct – cephalic tentacle; pr – proboscis; mb – muscular bulb of the venom gland; rhsp – rhynchostomal sphincter; s – spur.

**Figure 16.** *Xanthodaphne pastorinoi* n. sp., holotype, USNM 881354, Candlemas Island, South Sandwich islands, Scotia Sea; 56°58'42"S, 26°30'36"W, 1,651–1,684 m, SL 23.0 mm. **A, B** – ventral and dorsal views of the shell, **C** – enlarged shell apex; **D – E** – marginal radular teeth. All shells at the same scale. s – spur.

**Figure 17.** Bayesian tree based on partial COI sequences showing relationships of Antarctic and North Atlantic species of *Aforia* and selected outgroups. Posterior probabilities are shown for each node.

**Figure 18.** Shells and radula of species of *Aforia*. **A – E**, *Aforia goniodes* (Watson, 1881). **A, B**, lectotype, NHMUK 1887.2.9.970, south-east of Rio de la Plata, Argentina, 37°17'S, 52°52'W, 1,097 m, SL 22.9 mm; **C**, USNM 870341, NE of Falkland Island, 51°53'59"S, 56°36'0"W, 855–866 m, SL 27.9 mm; **D, E**, USNM 1123638, Argentina, 54°28'47.99"S, 62°12'36"W, 318 m; SL 18.2 mm (**E**, radula). **F – I**, *Aforia watsoni* nom. nov.; **F – G** – holotype of *Pleurotoma (Surcula) lepta* Watson, 1881, NHMUK 1889.11.11.7, southwest of Australia, 53°55'S, 108°35'E, 3,566 m, SL 40.6 mm. **H**, USNM 896401, Southwest Pacific Basin, NE of Ross Sea, 59°47'59"S, 144°48'W, 3,200–3,259 m, SL 40.2 mm. **I**, USNM 896402, Antarctic Peninsula, Graham Land, NE of Joinville Island, 62°40'47.99"S, 54°43'1.19"W, 210–220 m, SL 42.5 mm. **A – D**, at the same scale; **F – I**, at the same scale.

**Figure 19.** Shells and radula of species of *Aforia*. **A – I**, *Aforia magnifica* (Strebel, 1908); **A – C**, lectotype of *Surcula magnifica*, SMNH Type-1328, off Graham Land, Antarctica, 64°03'S,

56°37'W, 360 m, SL 63.0 mm; **C**, enlarged protoconch; **D**, paralectotype, SL 54.9 mm; **E**, USNM 894456, South Sandwich Islands, Zavodovski Island, 56°16'12"S, 27°30'W, 208-375 m, SL 89 mm; **F**, USNM 1121894, Antarctica, 63°09'S, 57°7'12"W, 146-192 m, SL 66.5 mm (sequenced specimen); **G – I**, USNM 1121900, Bellingshausen Sea, 65°39'36"S, 68°2'24"W, 282 m (**G** – shell, **H – I** – radula) (sequenced specimen). **J – L**, *Aforia multispiralis* Dell, 1990; **J – K**, holotype, USNM 860145, off South Shetland Islands, 62°27'S, 57°58'W, 1116-809 m, SL 57.0 mm; **L**, USNM 870023, South Shetland Islands, 62°2'31.2"S, 61°8'31.2"W, 1437 m, SL 48.0 mm. al – accessory limb of the marginal tooth, ml – major limb of the marginal tooth. Shells at the same scale.

**Figure 20.** Shells and radula of *Aforia hedleyi* (Dell, 1990). **A**, holotype of *Pontiothauma? hedleyi*, USNM 860148, Ross Sea, 76°S, 165°6'W, 494-498 m, SL 58.0; **B, C**, paratype, USNM 860149, SL 97.1 mm. **D – F** – Adelie Coast, 65°29'S, 139°19'E, 414 m, MNHN IM-2009-8188, SL (remaining part) 89.7 mm, **D** – shell, **E – F** – radula. Shells at the same scale.

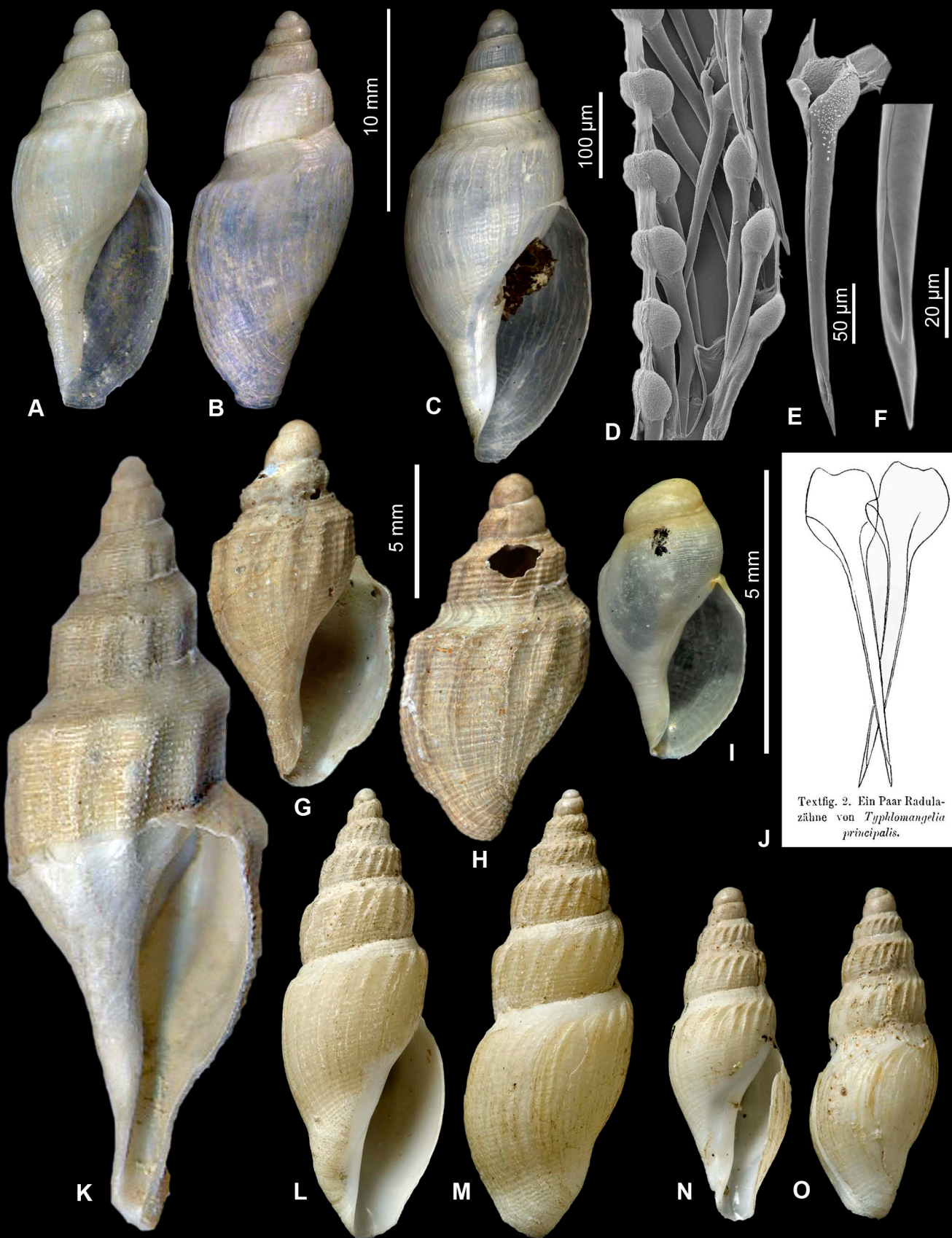
**Figure 21.** Shells and radula of *Conorbela antarctica* (Strebel, 1908), **A – B**, syntype of *Bela antarctica*, SMNH Type-1062, SW of Snow Hill Island, 64°36'S, 57°42'W, 120 m, SL 28.9 mm. **C – D**. USNM 894465, Scotia Sea, South Sandwich Islands, Zavodovski Island, east of island, 56.2667°S, 27.5°E, 208-375 m, SL 24.1 mm (**C** – shell, **D** – radula). **E**. USNM 1121892, South Shetland Islands, Elephant Island, Bransfield Strait, 62°45'S, 56°45'W, 207 m, SL 29 mm (sequenced specimen). Shells at the same scale.

**Figure 22.** **A – D**, *Micropleurotoma remota* (Powell, 1958), USNM 1187809, between Falkland Islands and South Georgia, 52°59'31.20"S, 48°53'31.2"W, 2928-3084 m, SL 8.5 mm; **A, B**, shell; **C, D**, radula. **E – G**, *Micropleurotoma spirotropoides* (Thiele, 1925), possible syntype, ZMB, SL 4.4 mm. **H – L**, "*Lophiotoma*" *pseudoannulata* Dell, 1990; **H, I**, holotype, USNM 860146, Ross Sea, 72.5° S, 177.1° E, 1883 m, SL 19.0 mm; **J – L**, USNM 898177, Ross Sea, 75°55'12"S, 173°16'48"W, 476 m, SL 7.5 mm; **M**, *Leucosyrinx macrobertsoni* Powell, 1958, holotype, SAM (D 15510), off MacRobertson Land, 66°45'S, 62°03'E, 177 m, SL 42.6 mm. **A, B, E**, shells at the same scale, **F – G**, enlarged. **H, I, J**, shells at the same scale, **K – L**, enlarged.

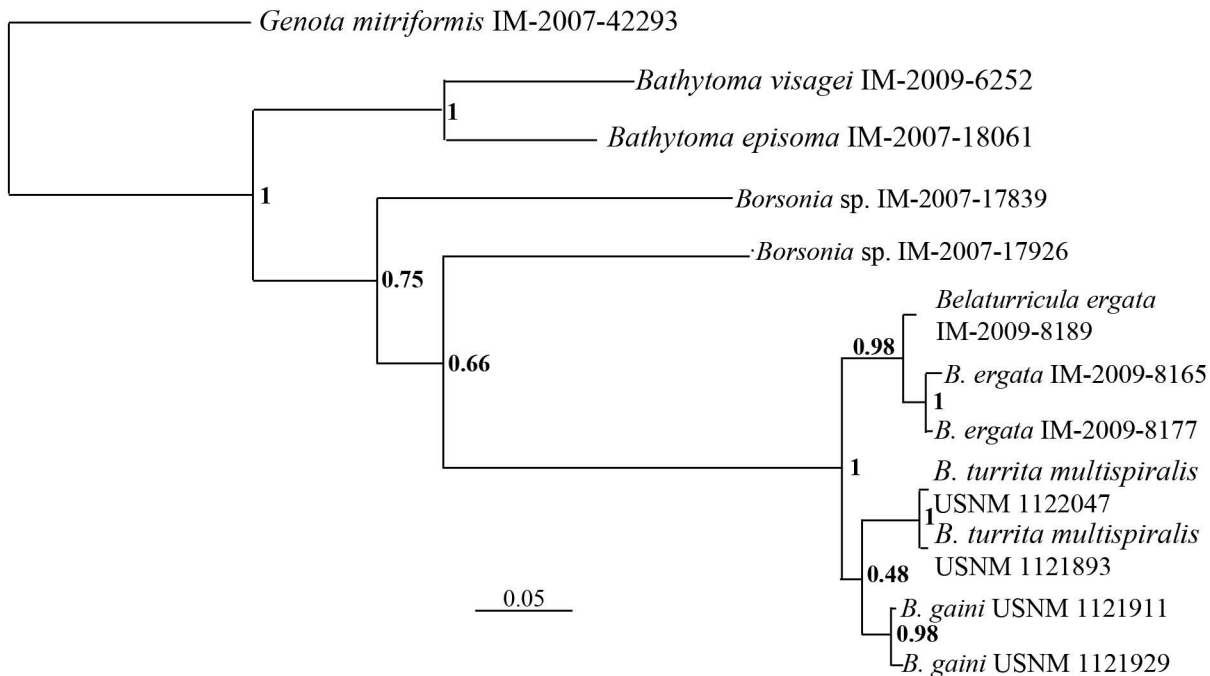
**Figure 23.** Bathymetric ranges of genera of Conoidea in Antarctic waters. A continental shelf; B, upper continental slope; C, lower continental slope; D, continental rise; E, abyssal plain; F, hadal depths.

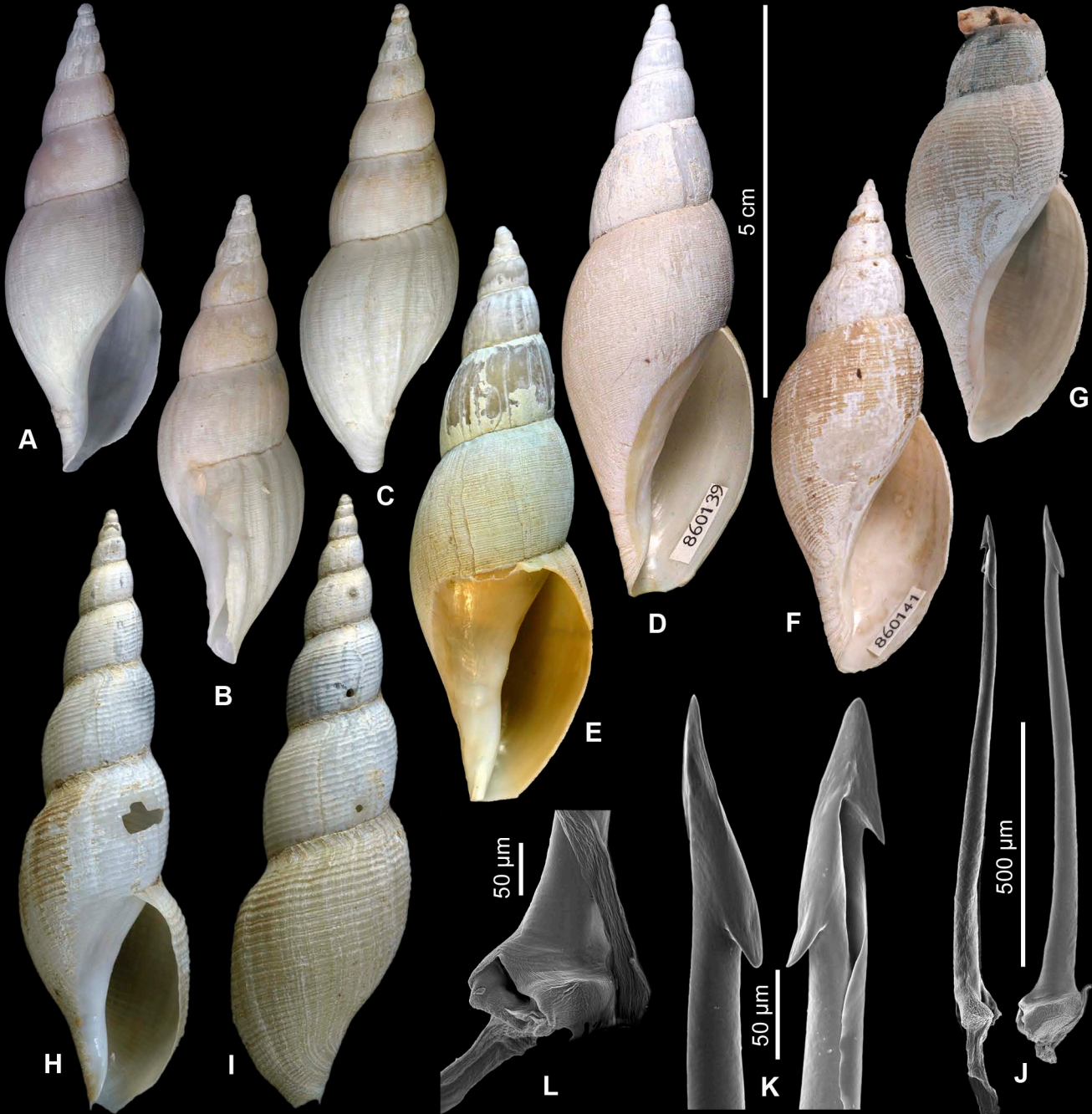
**Figure 24.** Species richness of Conoidea at different depths in Antarctic waters . A continental shelf; B, upper continental slope; C, lower continental slope; D, continental rise; E, abyssal plain; F, hadal depths.

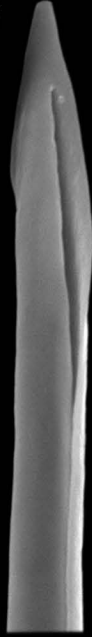
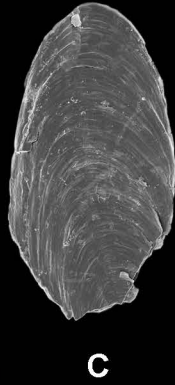


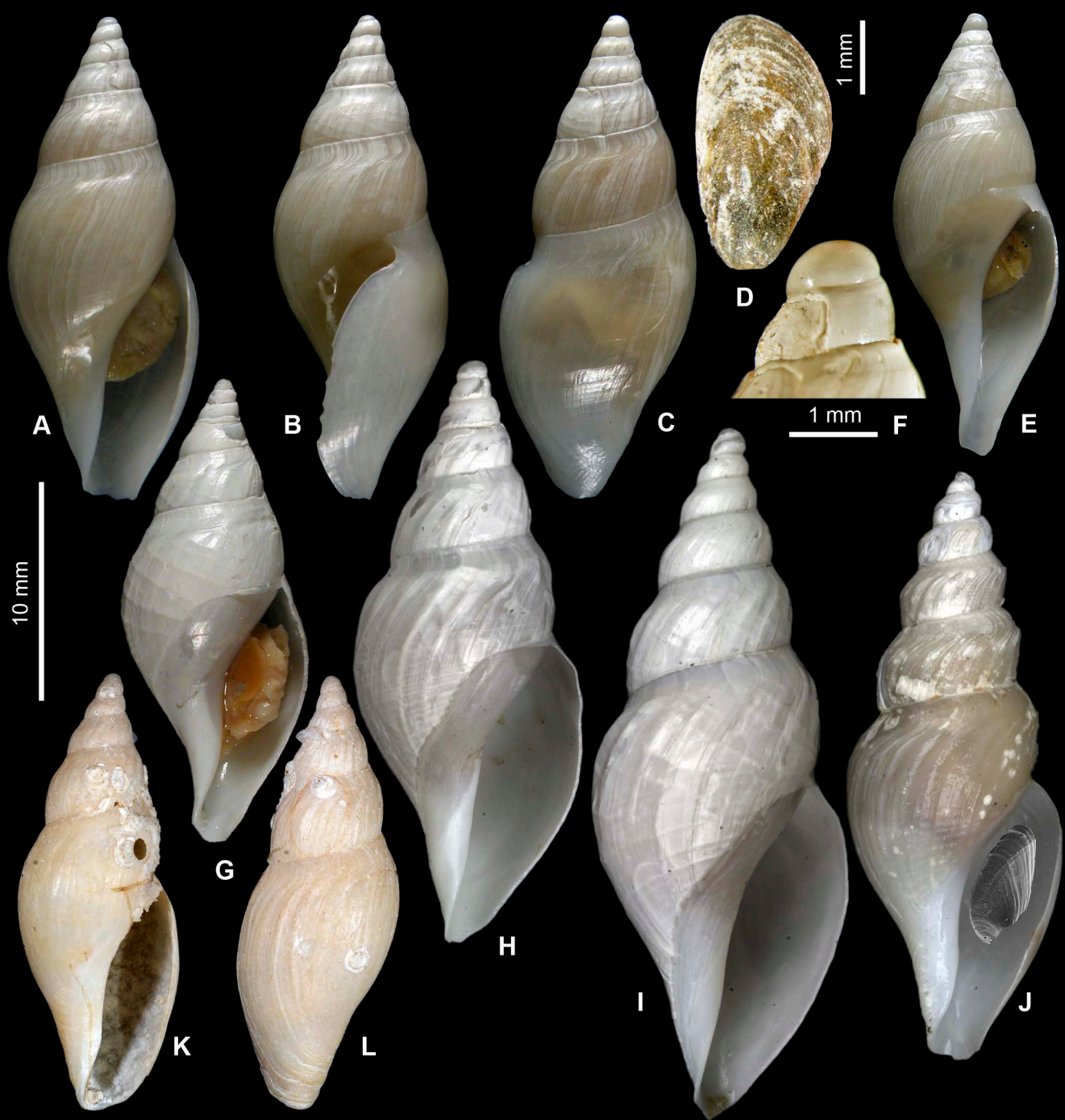




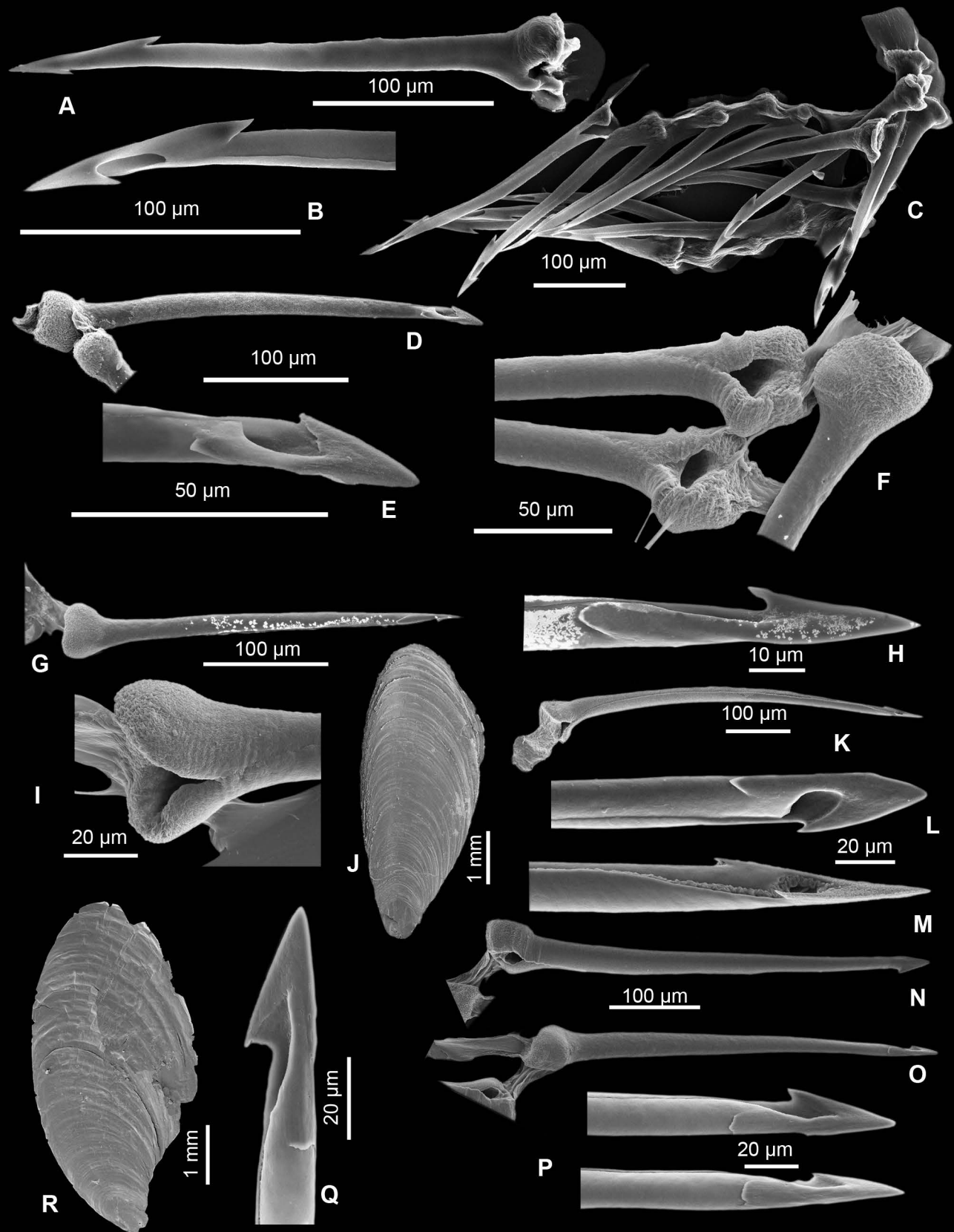




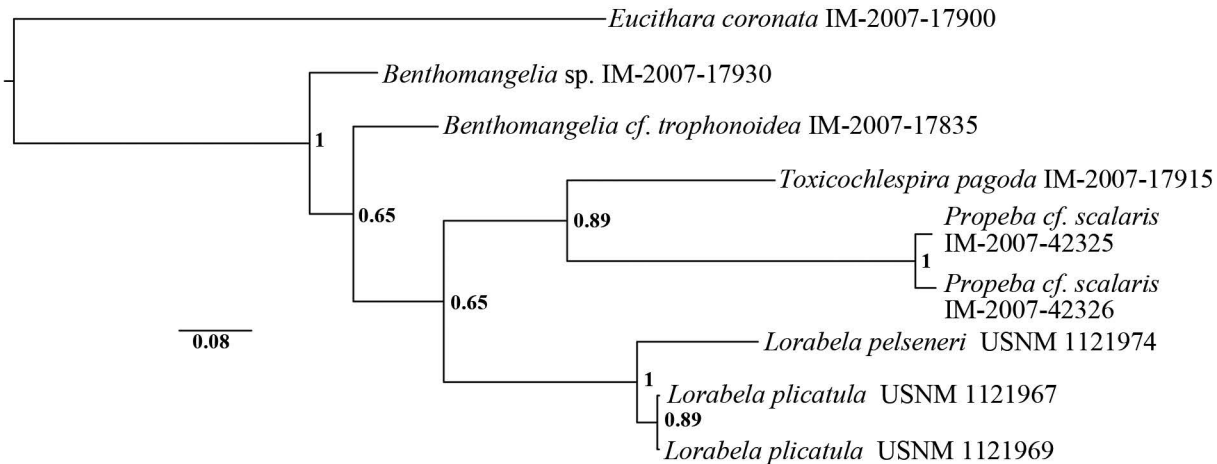




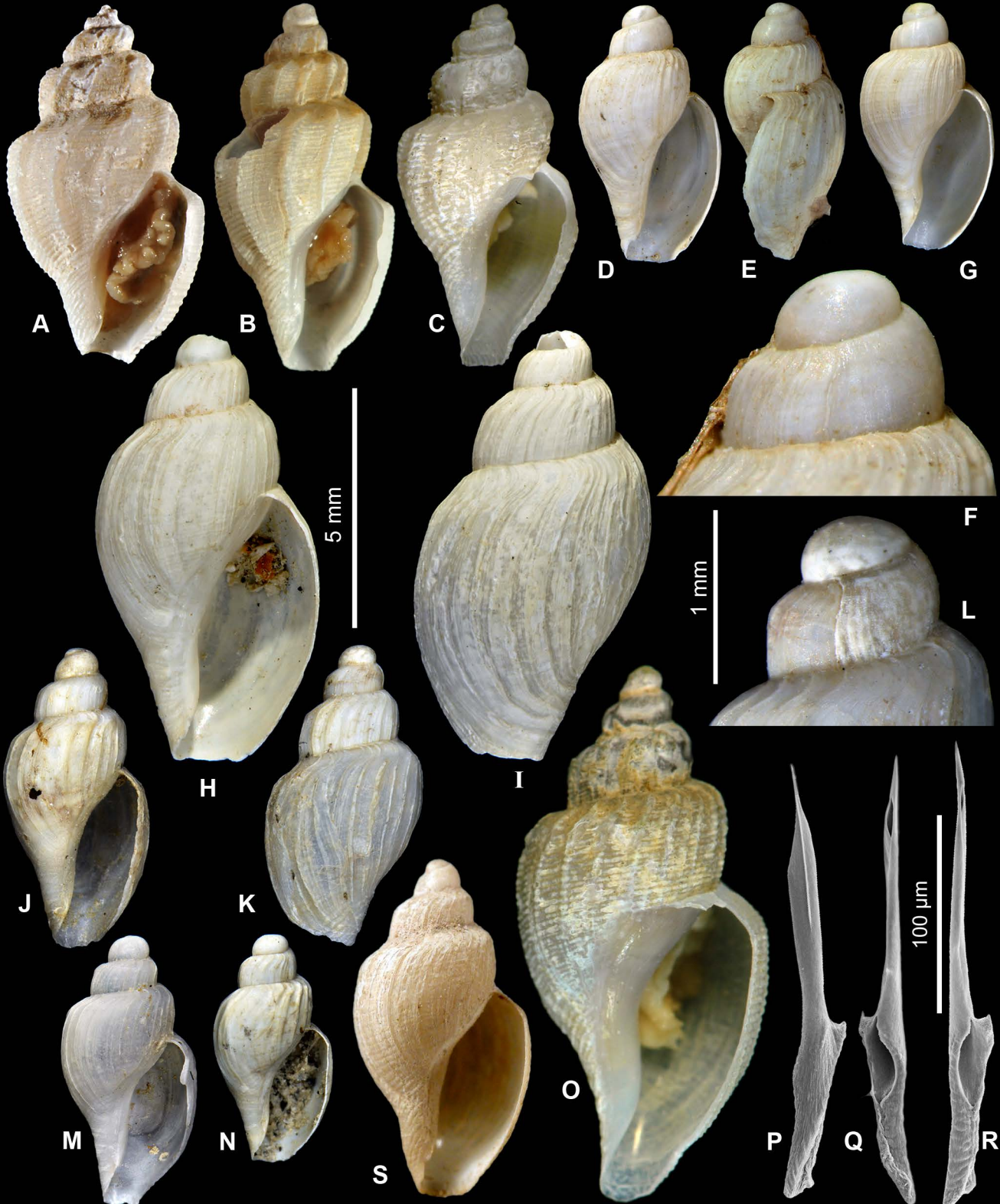




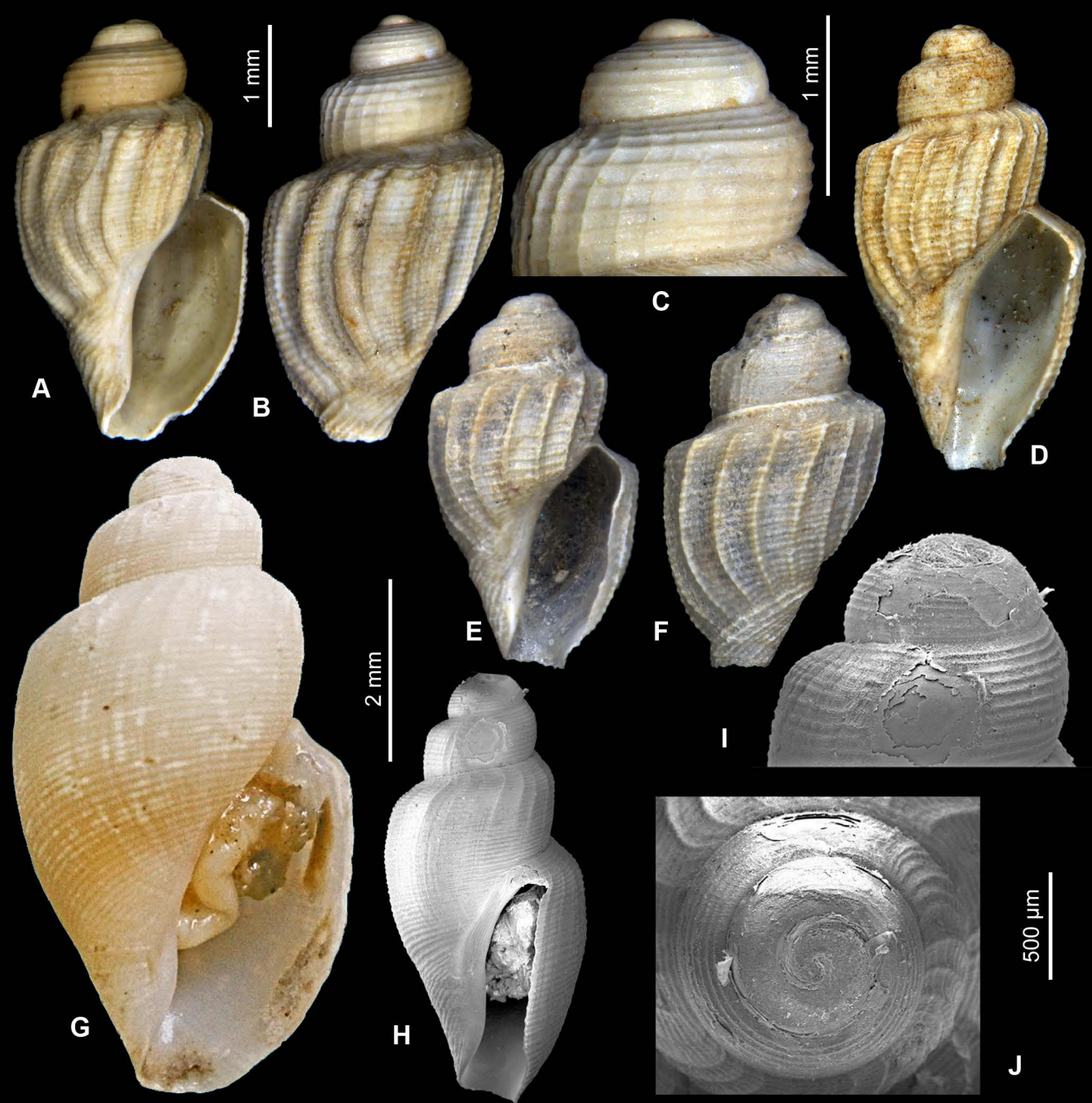


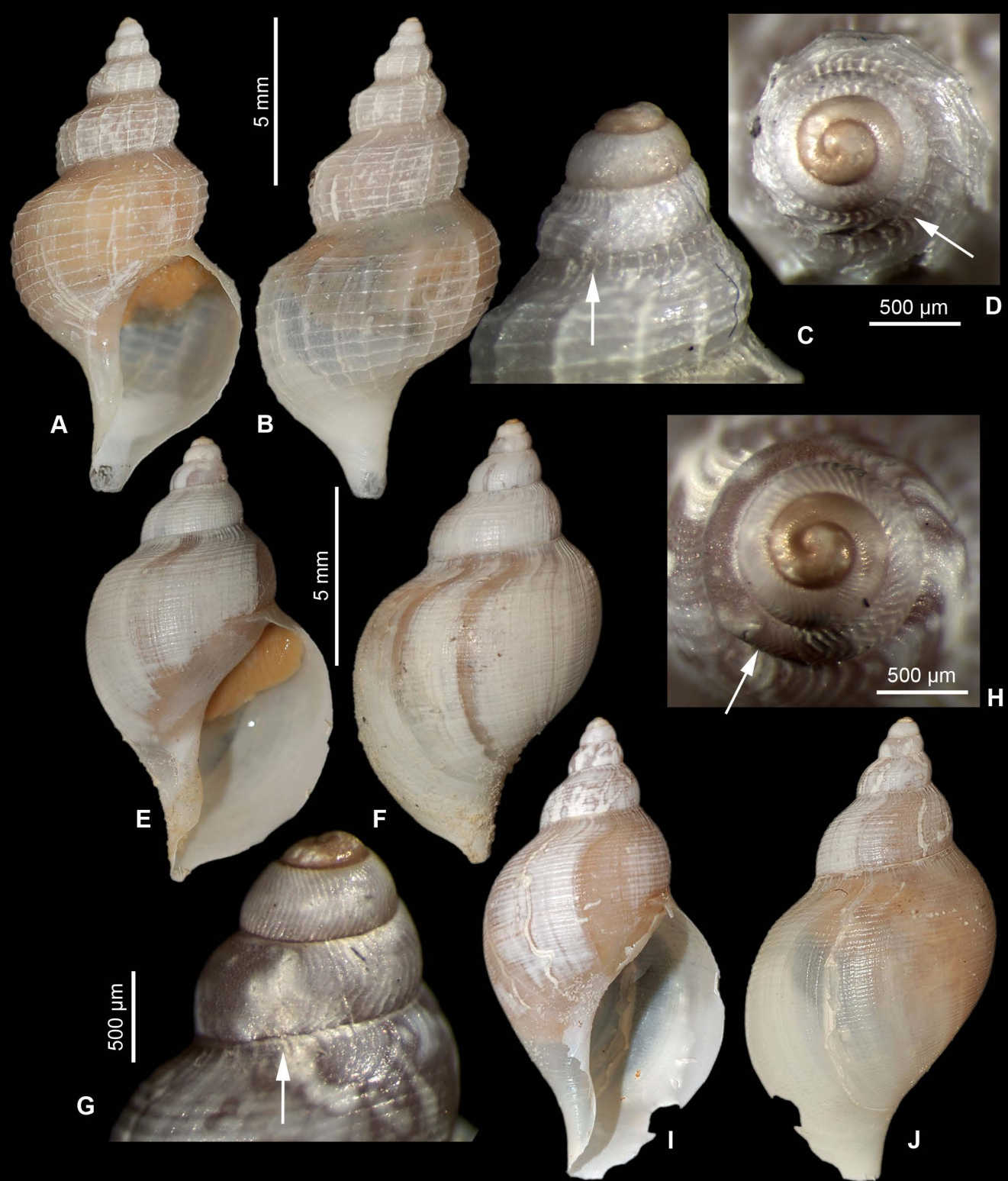




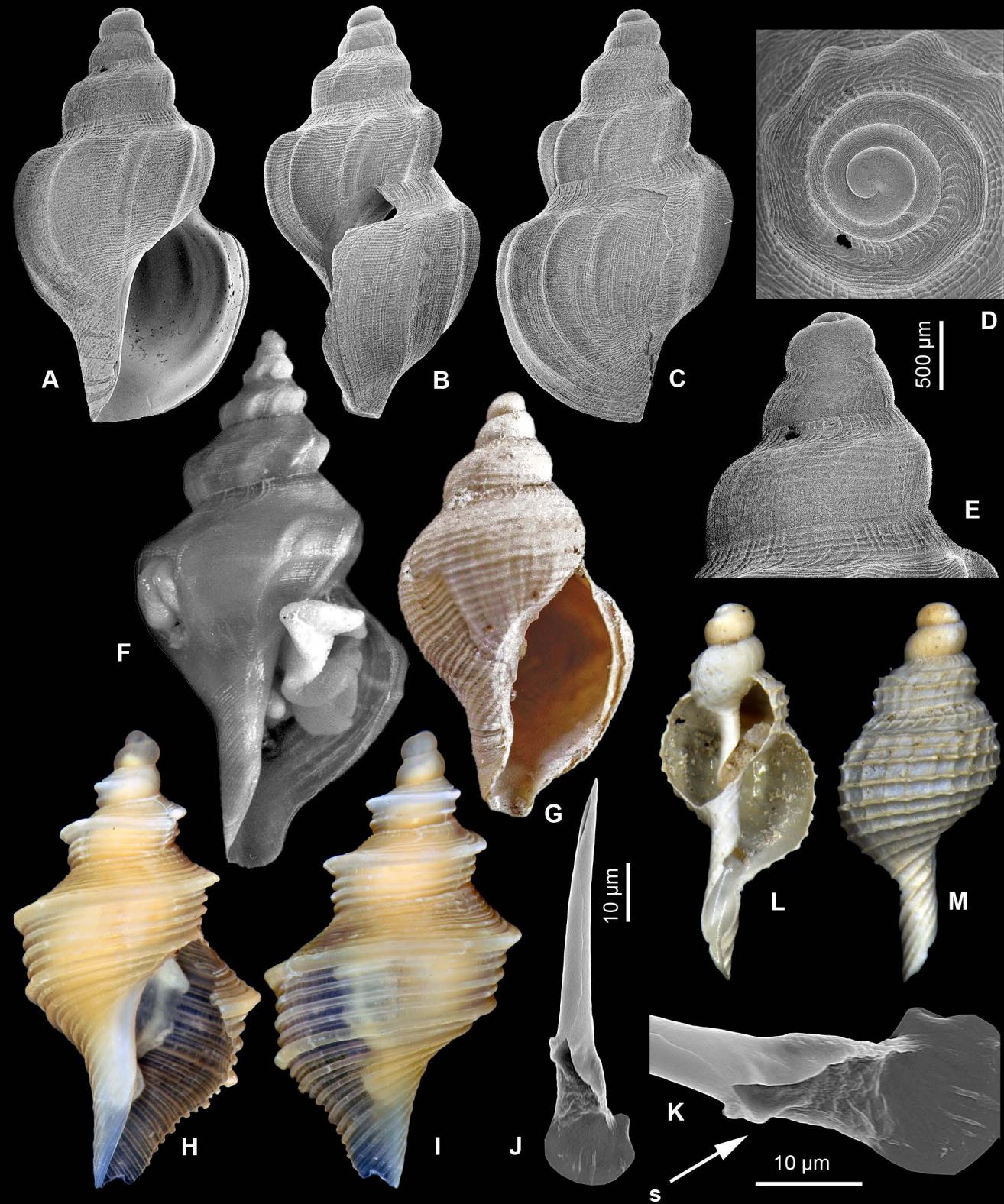
















5 mm



1 mm

A

B

D

E

C



H

I

J

500 µm

1 mm

200 µm

K

L



5 mm

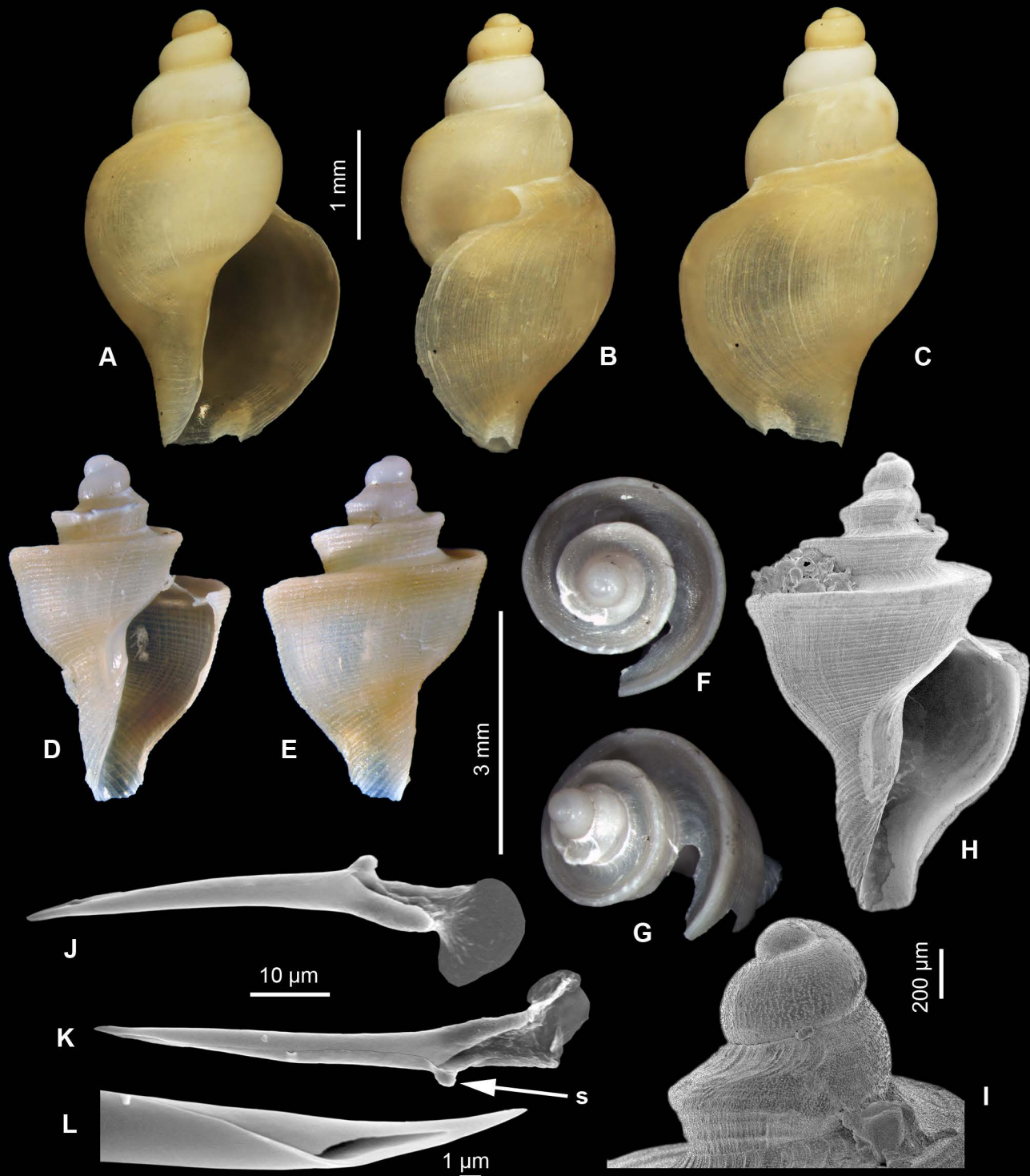


G

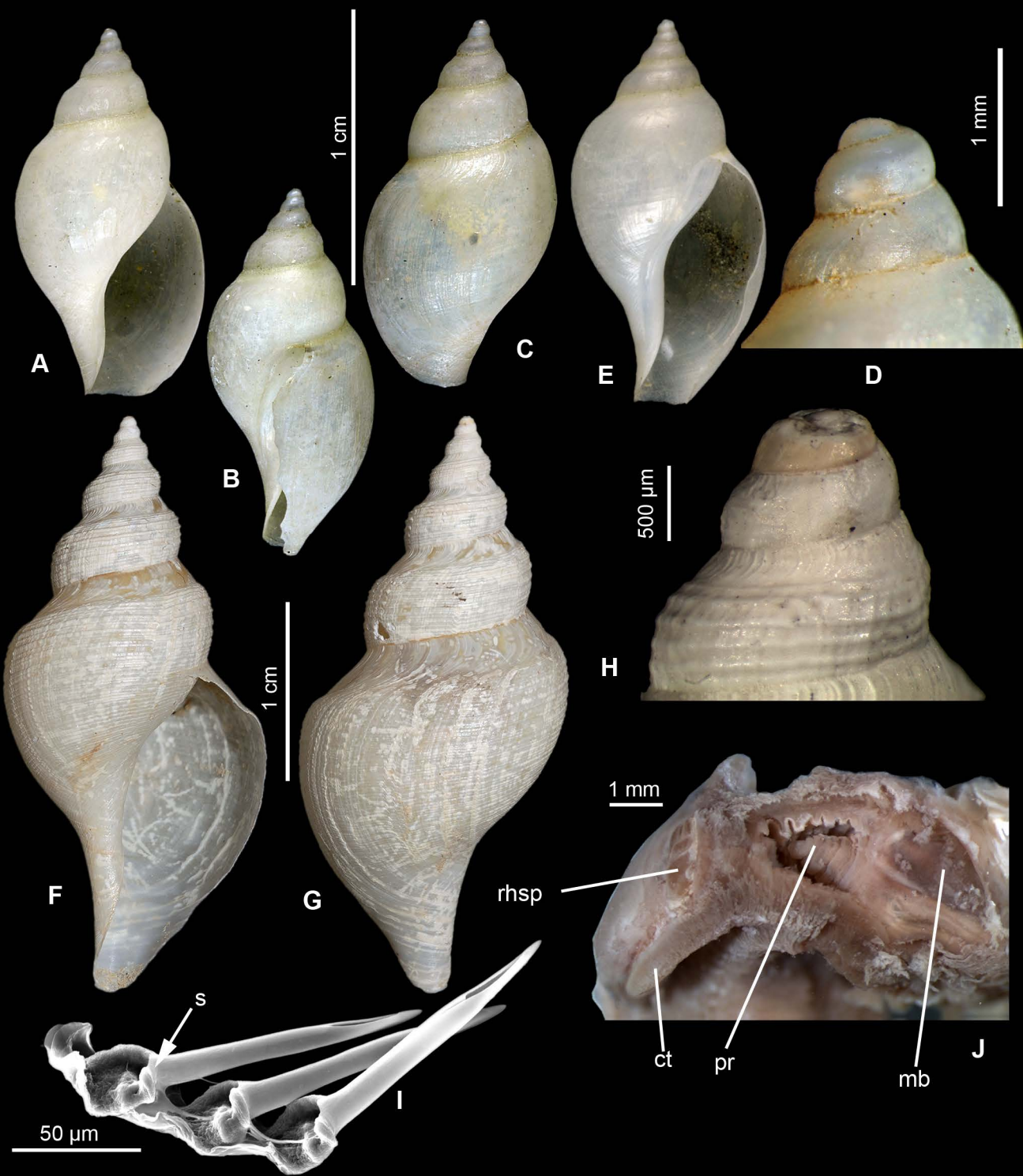


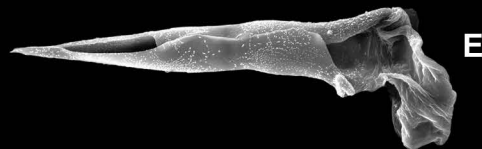
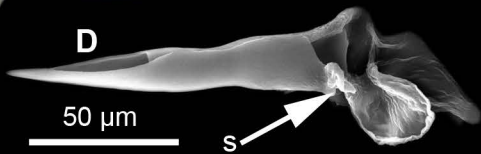
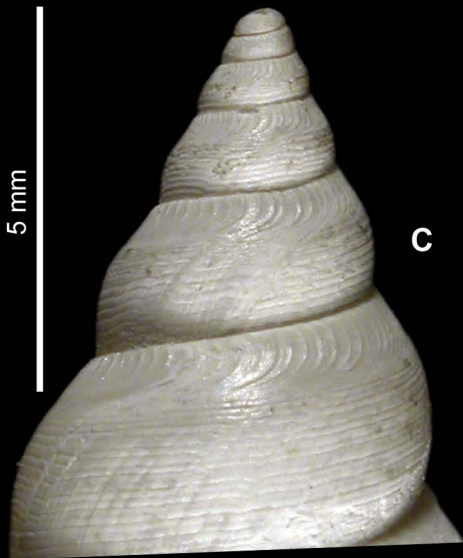
200 µm

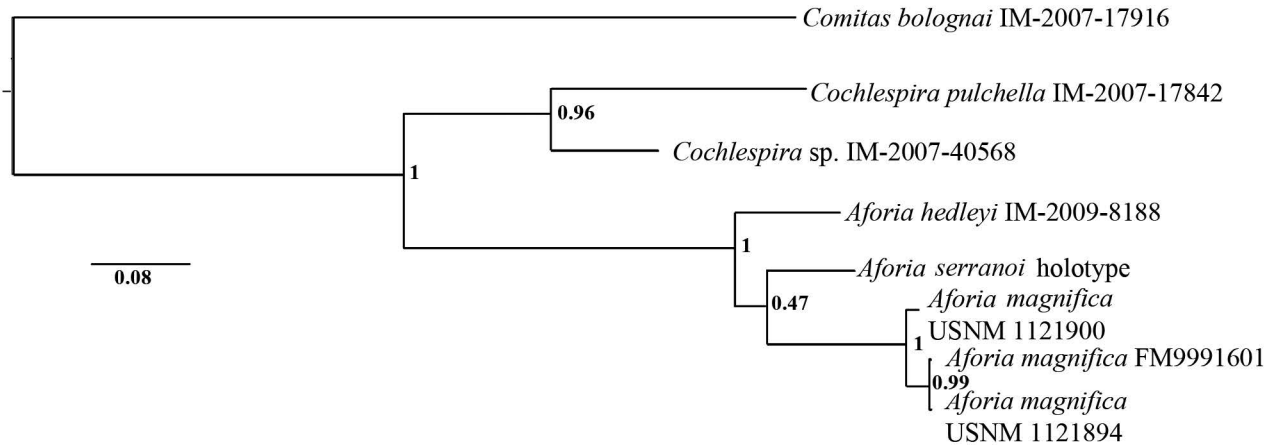




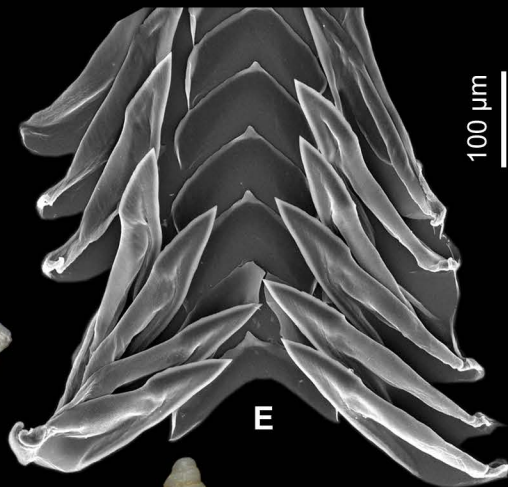


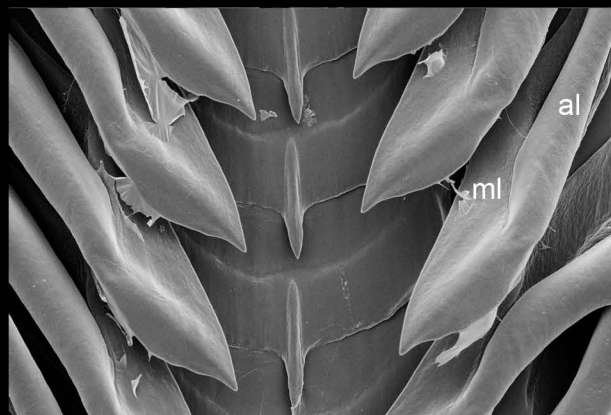
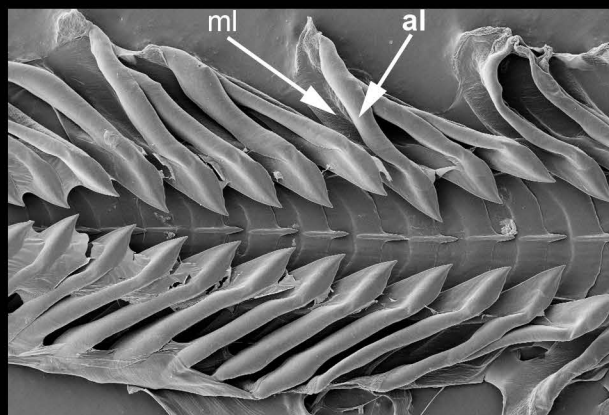
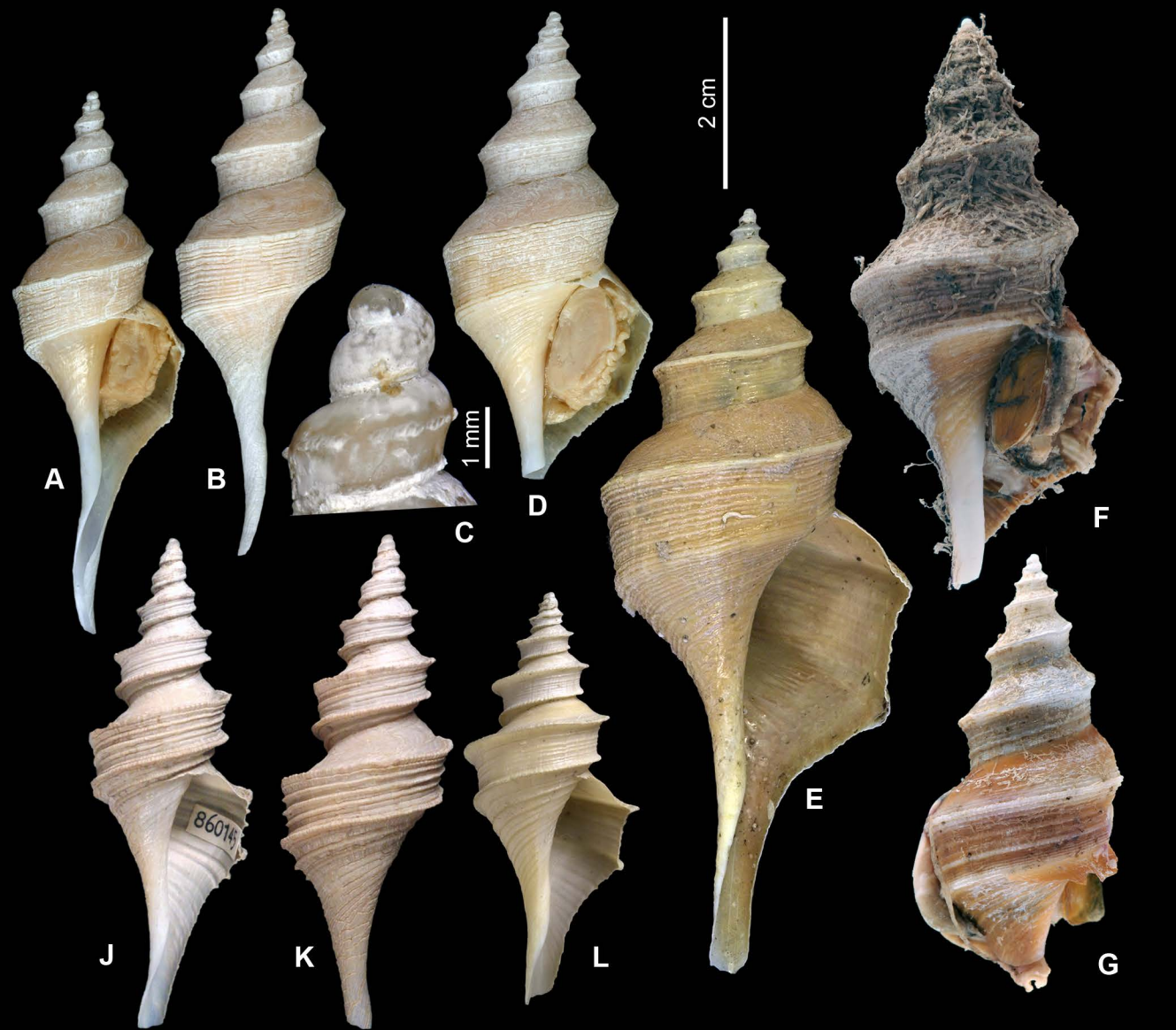












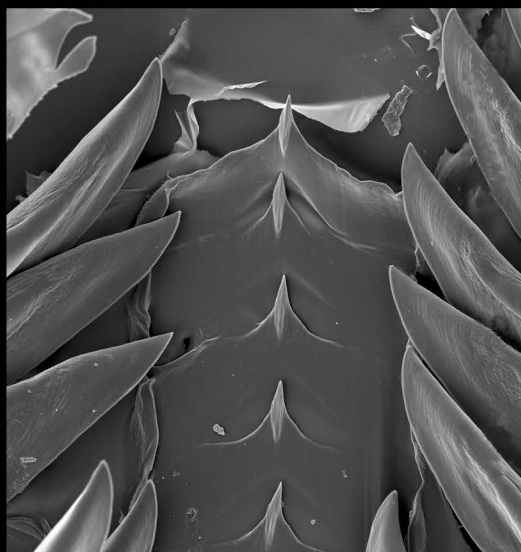
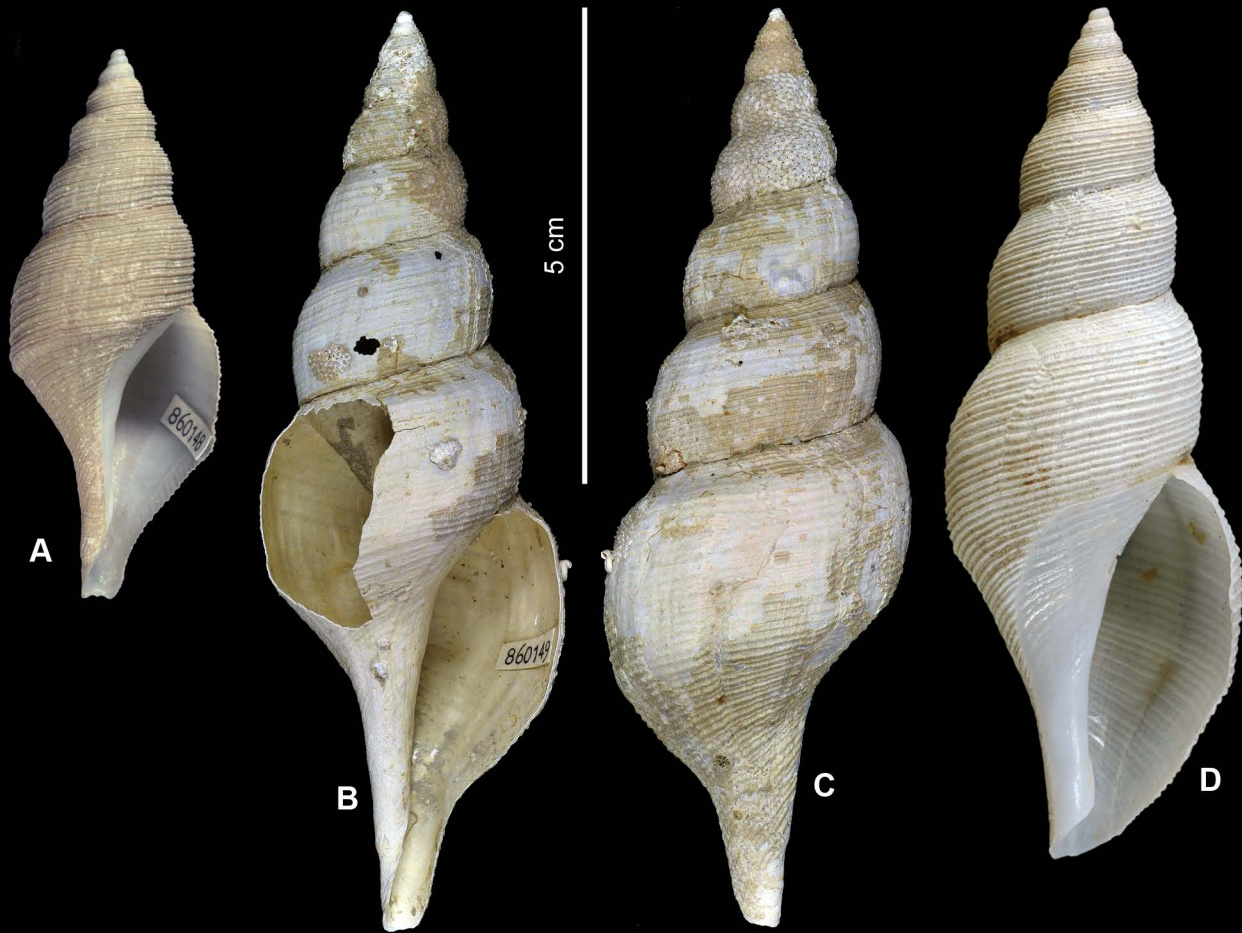
H

100 μm

100 μm

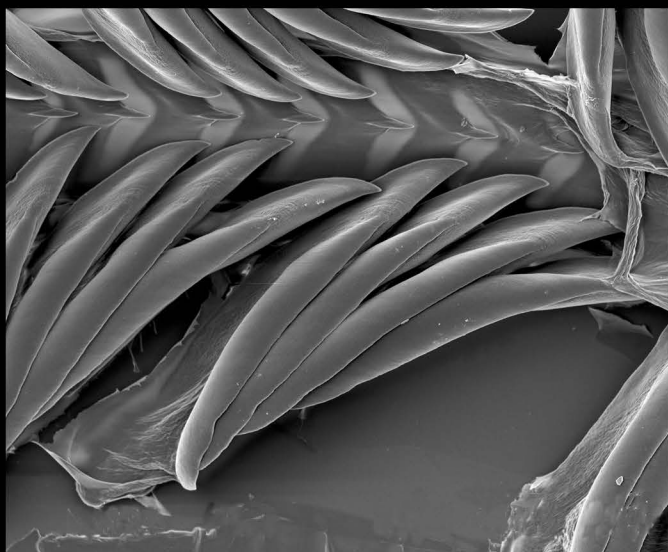
I





**E**

100  $\mu$ m



**F**

100  $\mu$ m



1 cm

A



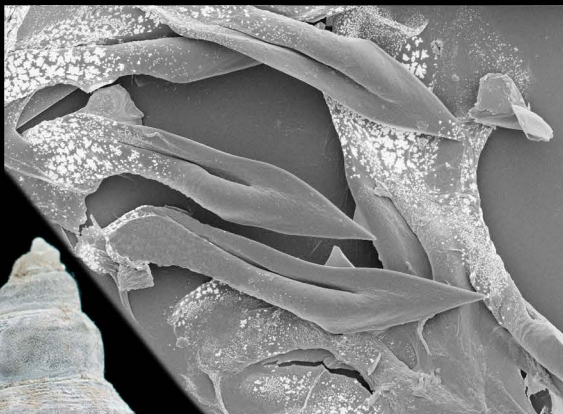
C



B



E



D 50  $\mu$ m

D





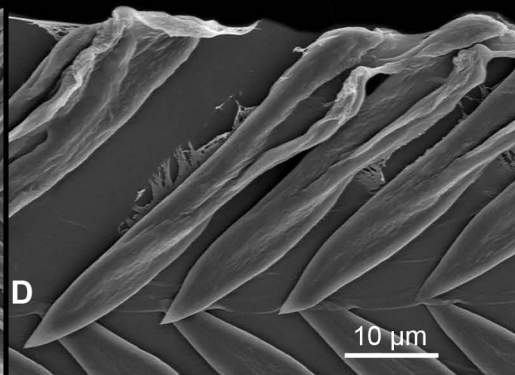
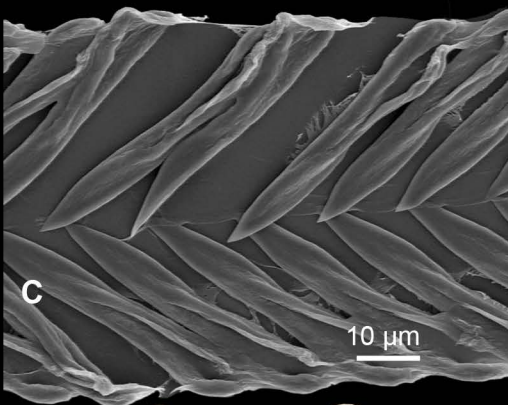
A

B

E

F

G



C

D

10 µm

10 µm



1 cm

H

J



I



5 mm

K



L



M

1 cm

