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REVISION OF THE NORTHEAST ATLANTIC BATHYAL AND ABYSSAL NEOGASTROPODA EXCLUDING TURRIDAE (MOLLUSCA, GASTROPODA)

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This paper constitutes the second part of a monograph of the N.E. Atlantic bathyal and abyssal Gastropoda. Page and figure numbers in this volume follow numbers in the first volume.

Part 1, covering the family Turridae, was published as *J. Moll. Stud.* supplement 8 (1980).

Part. 3, covering the families Eulimidae, Aclididae and Epitoniidae, will also be published by Società Italiana di Malacologia towards the end of 1985.

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CONTENTS

ABSTRACT

A revision of the deep sea neogastropods (excluding Turridae) is presented. The area surveyed covers the Atlantic N of 33° N, E of the Mid Atlantic Ridge, including the Mediterranean and the Norwegian Sea. Only species normally occurring below 300 m are included. All previously published material and unpublished material from the French, British and German deep sea programmes is included. The revision includes species of Muricidae, Coralliophilidae, Nassariidae, Fasciolaridae, Columbellidae, Buccinidae, Olividae, Volutomitridae, Turbinellidae, Cancellariidae and Marginellidae. About 385 names of the species category are discussed and reduced to 80 species.

The new species *Pterynotus atlantideus, Microvoluta superstes, Metzgeria gagei, Iphinopsis alba, I. fuscoapicata, Admete azorica, Volvarina ingolfi* and *Marginella aronnax* are described. *Buccinum sulcatum* Friele is renamed *B. kjennerudae, Turrisipho lachesis* var. *bicarinata* (Friele) is renamed *T. voeringi* and *Colus ventricosus* (Gray) is renamed *C. terraenovae* because of homonymy.

RIASSUNTO

La presente revisione dei Neogastropodi di grande profondità segue la revisione dei Turridae batiali e abissali dell'Atlantico nord-orientale, pubblicata dagli stessi autori (1980). La regione esaminata comprende l'Atlantico settentrionale a nord del 33° parallelo e a est della dorsale medio-oceanica, ivi compresi il Mediterraneo e il mare di Norvegia. Sono prese in considerazione solo le specie che vivono normalmente sotto i 300 m di profondità.

La revisione si basa su tutto il materiale storico e sul materiale proveniente dai programmi di studio del benthos profondo francesi, britannici e tedeschi. In questo volume sono trattate le seguenti famiglie: Muricidae, Coralliophilidae, Nassariidae, Fasciolariidae, Columbellidae, Buccinidae, Olividae, Volutomitridae, Turbinellidae, Cancellariidae e Marginellidae. Sono state discusse 385 denominazioni di gruppo-specie con conseguente riduzione a 80 specie valide. Infine sono state istituite otto specie nuove e sono state proposte tre nuove denominazioni.

Per quanto concerne la nomenclatura e la sistematica delle specie mediterranee si perviene alle seguenti conclusioni:

1. *Trophon echinatus* (Kiener, 1840) è il nome valido per la specie nota generalmente come *Pagodula vaginata* e *P. multilamellosa*. Questa specie presenta un cline batimetrico: le popolazioni batiali atlantiche e mediterranee (-250 / -600 m) appartengoono alla forma *grimaldii* Dautzenberg & Fischer, caratterizzata da un maggior numero di lamelle assiali rispetto a quelle della piattaforma continentale.
2. *Coralliophila squamosa* (Bivona, 1838) è il nome valido per la specie nota come *C. alucoides* e *C. squamulosa*, entrambe pre-occupate.
3. *Coralliophila lactuca* Dall, 1889 è sinonimo di *C. richardi* (P. Fischer, 1882) che ha quindi priorità.
4. *Nassarius frigens* (v. Martens) ha distribuzione limitata all'Atlantico dell'Africa tropicale e subtropicale. La presenza di *Nassarius wolffi* (Knudsen, 1956) in Mediterraneo resta da confermare.
5. *Fusinus gigliolii* (Monterosato, 1890) è da considerarsi come una forma di profondità, priva di valore tassonomico, di *F. rostratus* (Olivi, 1792).
6. *Amphissa acutecostata* (Philippi, 1844) è il nome valido della specie nota sotto il nome, preoccupato, *Amphissa costulata*.
7. Il genere *Colus* è rappresentato in Mediterraneo solamente da *C. jeffreysianus* (Fischer, 1868).
8. *Granulina* Jousseaume, 1888 è il nome del genere valido per le piccole Marginellidae generalmente note sotto il nome *Gibberulina* e *Cypraeolina*.

INTRODUCTION

This revision forms part 2 in a series treating the NE Atlantic deep sea gastropod fauna. For the first part, see Bouchet & Warén (1980). The revision is based on all material we have been able to examine, from numerous sources, which are listed in part 1. For part 2 we have to a higher degree been able to base our work on material in Scandinavian museums, because much of the revision involves northern members of the family Buccinidae. Detailed information about this material can be found in Thorson (1941, 1944, 1951) and Friele & Grieg (1901).

We have also been able to use a large supply of material from the Rockall Trough, collected by Dr John Gage from R.V. *Challenger II.* This material is now in the Royal Scottish Museum, Edinburgh.

A rich supply of NW Atlantic buccinids was collected by Dr J.C. Mahé, Institut Scientifique et Technique des Pêches Maritimes, St Pierre & Miquelon, and put at our disposal. The material is now in MNHN.

Several members of the Bologna group of the Unione Malacologica Italiana have contributed material of rare Mediterranean shelf species and fossil material from their private collections.

Material from the French *Seabed* and *Walvis* expeditions has also been used. The area investigated by these expeditions is to the south of the area we have covered, but the material was useful for comparisons. It is now in MNHN.

Abbreviations are listed in part 1.

SPECIES REFERRED TO TAXA NOT TREATED IN THIS PART

Sipho leptaleus Verrill, 1884:175, pl. 31, fig. 14. We have examined the holotype (USNM 202879), from off Martha's Vineyard, 810 m (off the NE US), and it proved to be a turrid, probably a species of *Taranis.*

Nassa nigrolabra Verrill, 1880:371, from off Martha's Vineyard, 280 m. We have examined the holotype and it is a larval shell, probably of a cymatiid.

Trophon maclaini (Dall, 1902), described from off Greenland, does not belong to *Trophon,* but was based on a species of *Oenopota* (Turridae). We have examined the holotype, USNM 126 194, and it must have been a slip of the pen when Dall placed it in *Boreotrophon.*

Family MURICIDAE

Among the muricids, it is the genus *Trophon* that constitutes the largest group below the continental shelf in the NE Atlantic. This seems to be the case also in other seas. Other genera are represented by scattered species of groups normally inhabiting shallow water or the continental shelf. *Trophon* on the contrary extends from shallow to deep water in high northern or southern areas, while in intermediate latitudes it is restricted to deep water.

Genus *TROPHON* Montfort, 1810

Type species: Murex magellanicus Gmelin, 1791, by original designation. Several generic names have been proposed for the species we include in *Trophon* viz.:
Trophonopsis Bucquoy, Dautzenberg & Dollfus, 1882. Type species: *Murex muricatus* Montagu, 1803, by original designation.
Boreotrophon P. Fischer, 1884. Type species: *Murex clathratus* Linné, 1758, by monotypy.
Pagodula Monterosato, 1884. Type species: *Murex carinatus* Bivona, 1832 (= *Murex vaginatus* De Cristofori & Jan, 1832), by monotypy.
Pinon De Gregorio, 1885. Type species: *Pinon vaginatus* Philippi (sic!), by original designation.
Chalmon De Gregorio, 1885. Type species: *Chalmon muricatus* (Montagu) by original designation.

Pinon and *Chalmon* are thus objective synonyms of *Pagodula* and *Trophonopsis* respectively. There are, however, some doubts whether the Recent or the fossil species known under the name *Trophon vaginatus* should be considered the type species.

Recent workers on the genus (Radwin & D'Attilio, 1976; Vokes, 1976; Houart, 1981) have advocated a separation of the southern species usually included in *Trophon* and the northern ones, which they place in *Boreotrophon* and *Pagodula.* (Houart also used the genera *Nodulotrophon* Habe & Ito, 1965 and *Nipponotrophon* Kuroda & Habe, 1971 for some NE Atlantic species.) We have examined radulae and opercula of the type species, *T. magellanicus,* and of all the NE Atlantic species and are not able to separate them into different groups. The species are so variable that they will usually fit equally well into two or more "genera". It is only *T. fabricii* that to some degree stands out from the others, by its strongly-shouldered whorls and strong spiral sculpture. It also has a radula that is proportionally longer in relation to the height of the shell. The significance of these characters can, however, not be evaluated until they are known for many more species of the group.

The separation of the S American *Trophon* from the N Atlantic genera has been made only on the basis of unspecified differences in shell morphology and on the grounds that SE American *Trophon* should have a "purpuroid" operculum, while the NE Atlantic species should have a "muricoid" operculum (Radwin & D'Attilio, 1976, Vokes, 1976). We have figured the operculum of *Trophon geversianus* and some NE Atlantic species for comparison (Figs 319-327) and although there is a difference in strength of the concentric ridges, this (or any other difference) is not sufficient to divide the S American and NE Atlantic species into two groups. In a comparison of opercula, *T. fabricii* again stands out, by having a much more distinct pattern. (It should be noticed that opercula of young *Trophon* are paucispiral cf. Fig. 322.)

Comparison of the radulae did not reveal anything except details in the proportions of the cusps (Figs 329-332), differences insufficient to warrant separation.

Neither was a separation based on shell characters possible. Strebel (1905) in his treatment of the S American *Trophon* shows very well the variation in shell morphology of the genus, from the large, stout forms like *geversianus* to species like *laciniatus* (Dillwyn, 1817) that in shell morphology agree well with our NE Atlantic species like *T. clathratus.*

The only remaining difference between the S American and NE Atlantic species (pointed out by Thorson (1946), and to us in a letter by E. Vokes) is the egg capsules. Thorson (1940, 1946) reported that the capsules of *T. truncatus* and *T. clathratus* were planoconcavely lens-shaped, with a few embryos, and attached by the flat side to some hard substratum. Jeffreys (1867) described similar egg capsules in *T. muricatus.*

Strebel (1905 & 1920) and Penchaszadeh (1976) reported those of *T. geversianus* and two other S American species to be lens-shaped and attached by a short broad stalk from the edge. It is impossible to understand what this difference means taxonomically, especially as the spawn is known for very few species.

Because of this absence of distinguishing characters we have decided to use *Trophon,* to include all the NE Atlantic species.

The species of *Trophon* are unusually variable (easily seen from the long lists of synonyms) and it may seem possible to arrange a clade connecting all the different forms if one uses specimens from many different localities. We have, however, found it possible to distinguish nine species (possibly only eight), by the characters listed below. These nine (eight?) species have been examined from all or large parts of their geographic and bathymetric distribution. They typically exhibit a variation from strongly-shouldered and spiny specimens, to more slender forms with weak sculpture (cf. Figs 286-287, 309-312). This variation is usually correlated with a depth or geographical cline, but one can also find local populations with a unique appearance. Two exceptions from this are *T. dabneyi* and *T. droueti,* which are fairly constant. A lower degree of variation is consistent with their biology. *T. dabneyi* is the only NE Atlantic species with planktotrophic larvae, which possibly leads to less local variation and *T. droueti* is restricted to the continental slopes around the Azores.

Distinctive characters of the species

Trophon fabricii is an arctic shallow-water species with very distinct spiral sculpture, strongly-shouldered whorls, rather thick and solid axial ribs and usually a crenulated outer lip.

Trophon dabneyi has a yellowish, large larval shell of more than two whorls, slender, rounded whorls and low, never spiny ribs. It is a decidedly bathyal species that is never found on the shelf.

Trophon droueti has a low spire, rather solid shell, and a thickened flaring outer lip with internal crenulations. It is known from the bathyal area of the Azores.

Trophon truncatus is an arctic shallow-water species with rather slender and rounded whorls, rounded larval shell, no spiral sculpture and low, crowded axial lamellae that never form spiny projections.

Trophon clathratus is an arctic shallow-water species with a distinctly angulated larval whorl, high, sparse axial ribs that often form spiny projections from the rather low and convex whorls. No spiral sculpture.

Trophon clavatus is a boreal species occurring in intermediate depths. It resembles *T. clathratus,* but has a rounded larval shell and is half the size of *T. clathratus.* It may have some indication of spiral sculpture, but lacks it normally. Specimens from shallow water often are quite slender, compared with *T. clathratus.*

Trophon barvicensis is a boreal species, possibly reaching the Mediterranean. The shell is greyish to whitish, rather slender, with distinct spiral ribs that give the axial lamellae a fringed appearance. Young specimens may have spiny projections from the lamellae, but we have not seen them in full-grown ones.

Trophon muricatus is a rather southern species, reaching northwards to S Great Britain. It usually has a fairly solid, brownish or reddish shell, strong spiral ribs, low and solid axial ribs and a quite slender shape.

Trophon echinatus is an extremely variable, southern species that occurs from fairly shallow (100 m) down to the lower bathyal. In shallow water the shell is semitransparent and of a glassy structure, in deep water more chalky. The most characteristic feature is the long slender siphonal canal and distinctly shouldered whorls. Shallow-water specimens lack spiral sculpture, while it is well developed in specimens from deep water. Shallow-water specimens have very well-developed spiny projections from the axial ribs, but they may be lacking in specimens from deep water.

Trophon truncatus (Ström, 1768) Figs 282-283

Buccinum truncatum Ström, 1768:369, fig. 26.
Trophon truncatus vars *alba & scalaris* Jeffreys, 1867:320.
Trophon truncatus var. *abbreviata* Mörch, 1869:195.
Trophon truncatus var. *major* Brögger, 1901:654 (1900:50).
Trophon (Boreotrophon) truncatus var. *intermedia* Harmer, 1918:350, pl. 36, fig. 24.
Trophon (Boreotrophon) clathratus var. *attenuata* Harmer, 1918:351, pl. 36, figs 7-8.
Trophon (Boreotrophon) clathratus var. *exilis* Harmer, 1918:352, pl. 36, figs 9-10.

Type material: T. truncatus, lost.
Type locality: T. truncatus, N Norway.

Material examined: Several hundred shells from all parts of its distribution in the N Atlantic (SMNH, ZMC, MNHN, USNM, coll. AW).

Distribution: N Atlantic coastal areas; Parts of Ireland and Scotland (Seaward, 1982), the Kattegat, absent in the Skagerrak and W Norway, common in N Norway (G.O. Sars 1878), the Faroes, Iceland and Greenland (Spärck & Thorson, 1933; Thorson, 1941, 1944, 1951), NE America S to George's Bank (off Massachusetts) (Abbott 1974). The depths are normally 3 — 150 m, although Golikov (1964) has recorded it from 950 m. Probably panarctic.

Remarks: T. truncatus has often been considered a variety or form of *T. clathratus,* but we consider it a good species. It can be distinguished by its more evenly convex whorls, more numerous axial lamellae and rounded protoconch, from *T. clathratus,* which has a distinctly angulated initial whorl. Neither does it have any tendencies to form spiny processes from the ribs as *clathratus.*

The specimens figured by Houart (1981, pl. 6, figs 9-10) as *Boreotrophon* sp. are large specimens of *T. truncatus.*

Trophon clathratus (Linné, 1767) Figs 284, 285, 325-326

Murex clathratus Linné, 1767:1223.
Buccinum lyratum Gmelin, 1790:3494.
Buccinum lamellatum Gmelin, 1790:3498.
Murex bamffius Donovan, 1804: pl. 169.
Fusus costatus Hisinger, 1837:43 (not Philippi, 1836). (*Fide* Hägg, 1925).
Fusus lamellosus Gray, 1839:118, pl. 36, fig. 13 (not Borson, 1821).
Fusus scalariformis Gould, 1840:197.
Tritonium gunneri Lovén, 1846:144.
Tritonium clathratum f. *normalis, elatior, ventricosa* Middendorff, 1849:455-457.
Tritonium rossi Leach (MS?) Mörch, 1858:85.
Trophon richardsoni Gray (MS?) Mörch, 1869:21.
Trophon clathratus var. *grandis* Mörch, 1869:21.
Trophon cepula Sowerby, 1880:61, pl. 404 fig. 14, pl. 405 fig. 27 (replacement name for *Fusus lamellosus* Gray).
Trophon clathratus var. *intermedius, maximus* Verkrüzen, 1881: 84-85.
Trophon gunneri var. *coddi* Harmer, 1918:353.

Type material T. clathratus, in the Linnean Society, London.
Type locality T. clathratus, Icelandic Seas.

Material examined: Several hundred shells and specimens from the Swedish west coast (glacial fossils), N Norway, Spitzbergen, Iceland and Greenland (ZMC, SMNH, coll. AW).

Distribution: Arctic circumpolar in coastal waters and on the continental shelf. It reaches south to the New England area (Macpherson, 1971), E and W Greenland (Thorson, 1951), Iceland (Oskarsson, 1962), the Faroes (Spärck & Thorson, 1933) and Lofoten (N Norway) (G.O. Sars, 1878). The bathymetric distribution is 4.5 m (Macpherson, 1971) to about 300 m.

Remarks: Thorson (1940) described the reproduction. The species has direct development and lens-shaped egg capsules. Some attention should, however, be paid to the fact that *Oenopota elegans* (Turridae) has a very similar larval shell, and we are not aware how Thorson, who identified the capsules from the shells of the embryos, could distinguish between these two species.

We have listed *Fusus lamellosus* Gray as a synonym of *T. clathratus.* This is not certain, but this will not affect any other name, because the name is preoccupied. We have not examined any Pacific material of *T. clathratus,* but the names based on such material are all younger than that of Linné, so they will not change it, if they should prove to be based on the same species. The distribution mentioned under that heading is much more arctic than is usually found in the literature. This is because we have distinguished the southern deep-water populations as a distinct species, *T. clavatus.* For a comparison with that species see p. 130.

Some Icelandic specimens seem to have a more rounded protoconch than the typical arctic form, but the specimens are quite worn. Their shells, however, are typical for the arctic form. This point should be examined when better material becomes available.

Trophon clavatus G.O. Sars, 1878 Figs 286-290, 322-324, 331, 339

Trophon clavatus G.O. Sars, 1878: 249, pl. 15, fig. 12; pl. 23, fig. 14.

Type material: Lectotype and 2 paralectotypes, ZMO D1396 a and b, selected by Houart (1981).
Type locality: Lofoten, N Norway, 200-360 m.

Material examined: Several thousand specimens from SW Norway and the Swedish west coast, 50 — 500 m, coll. AW; THOR 1903, S of Iceland, probably 1000 m, 3 shs; THOR 1904, st 99, 61°15 N,09°35 W, 900 m, 1 spm; INGOLF st 90, 64°45 N, 29°06 W, 1000 m, 2 shs; INGOLF st 78, 60°37 N, 27°52 W, 1505 m 1 sh.

Distribution: Uncertain, known with certainty only from the material examined, and some specimens determined by G.O. Sars (1878).

Remarks: We have decided to keep this species or form separate from *T. clathratus,* as did Houart (1981), although other authors have united it with *T. clathratus.* The distribution is incompletely known because of this "lumping", but probably some specimens referred to *T. clathratus* by Sykes (1911) and Massy (1930) from off NW Scotland and Ireland will prove to belong to *clavatus.*

T. clavatus is very common off the W coast of Norway and Sweden, in 50 — 500 m, often together with *T. barvicensis* (cf. that species), but it seems to be very rare elsewhere.

The reasons why we have decided to distinguish between the two species are:

1. *T. clavatus* has a distinctly rounded larval shell while that of typical *T. clathratus* has a distinctly angulated periphery.
2. In Norway typical *T. clathratus* is restricted to Lofoten and northwards, in 20 — 90 m (G.O. Sars, 1878). This is the large form with angulated larval shell. Further to the south we find the smaller form, with rounded larval shell, and then usually below 100 m with its main distribution between 200 and 500 m.
3. In Iceland typical *T. clathratus* is common, mainly off the N and NW coasts, in 11 — 260 m (Thorson, 1941; Oskarsson, 1962). It has not been recorded deeper. We have, however, found some specimens in ZMC (see above) from 900 — 1500 m. These belong to the same form as we find in deep water in Scandinavia, although they have a tendency to be still more spiny (Fig. 286).
4. In the Faroes typical *T. clathratus* is known from 8 — 50 m (Spärck & Thorson, 1933). The *clavatus* form is not known from there.
5. *T. clathratus* in its typical form is common along the coasts of Greenland and E Canada, S to Maine, in shallow water (30 — 100 m, Verrill, 1882), while in deep water we find *Trophon abyssorum* Verrill, 1885, with a more southern distribution. The *clavatus* form is not known here. Therefore we suppose that two species, (or at least subspecies) have been confused; the more or less panarctic *T. clathratus,* and *T. clavatus* with a rather restricted distribution in the NE Atlantic. G.O. Sars (1878) was not aware of this when he described *T. clavatus,* because he used the name for some extremely large specimens with a typical appearance, while he regarded the S Scandinavian specimens from deep water as a small form of *T. clathratus.*

As our figures illustrate, *T. clavatus* is quite variable. Some specimens resemble *T. barvicensis* closely, but we have noticed this only in young specimens, when sometimes *T. barvicensis* has a poorly-developed sculpture and *T. clavatus* may show some undulations in the axial lamellae. We have never had any difficulties in separating half-grown or larger specimens. Neither have we had any problems separating *T. clavatus* from *T. clathratus,* but that may be because we have not been able to examine more than a few specimens from areas where both species occur.

Trophon barvicensis (Johnston, 1825) Figs 291-296, 341

Fusus barvicensis Johnston, 1825:221.

Type material: Not known.
Type locality: Near Berwick, NE England.

Material examined: Several thousand specimens from S Norway and the Swedish W coast, coll. AW; a few hundred shells and specimens from the British Isles, the French W coast and Iceland, MNHN, USNM, ZMC; some doubtful specimens from the Mediterranean, private collections, MNHN, USNM; off Morocco, a few shells, MNHN.

Distribution: From W Finmark, N Norway (G.O. Sars, 1878), Iceland (Thorson, 1941), southwards on the shelf and in coastal waters to off Morocco (Locard, 1897), where it occurs in the upper bathyal zone.

Remarks: T. barvicensis is often very common on the shelf off S Norway, where it occurs together with *T. clavatus* in large numbers. Some young specimens may then be difficult to distinguish from that species, but they are quite rare and can be separated by having a microsculpture of scattered tubercles on the protoconch, while *T. barvicensis* has these tubercles arranged in lines.

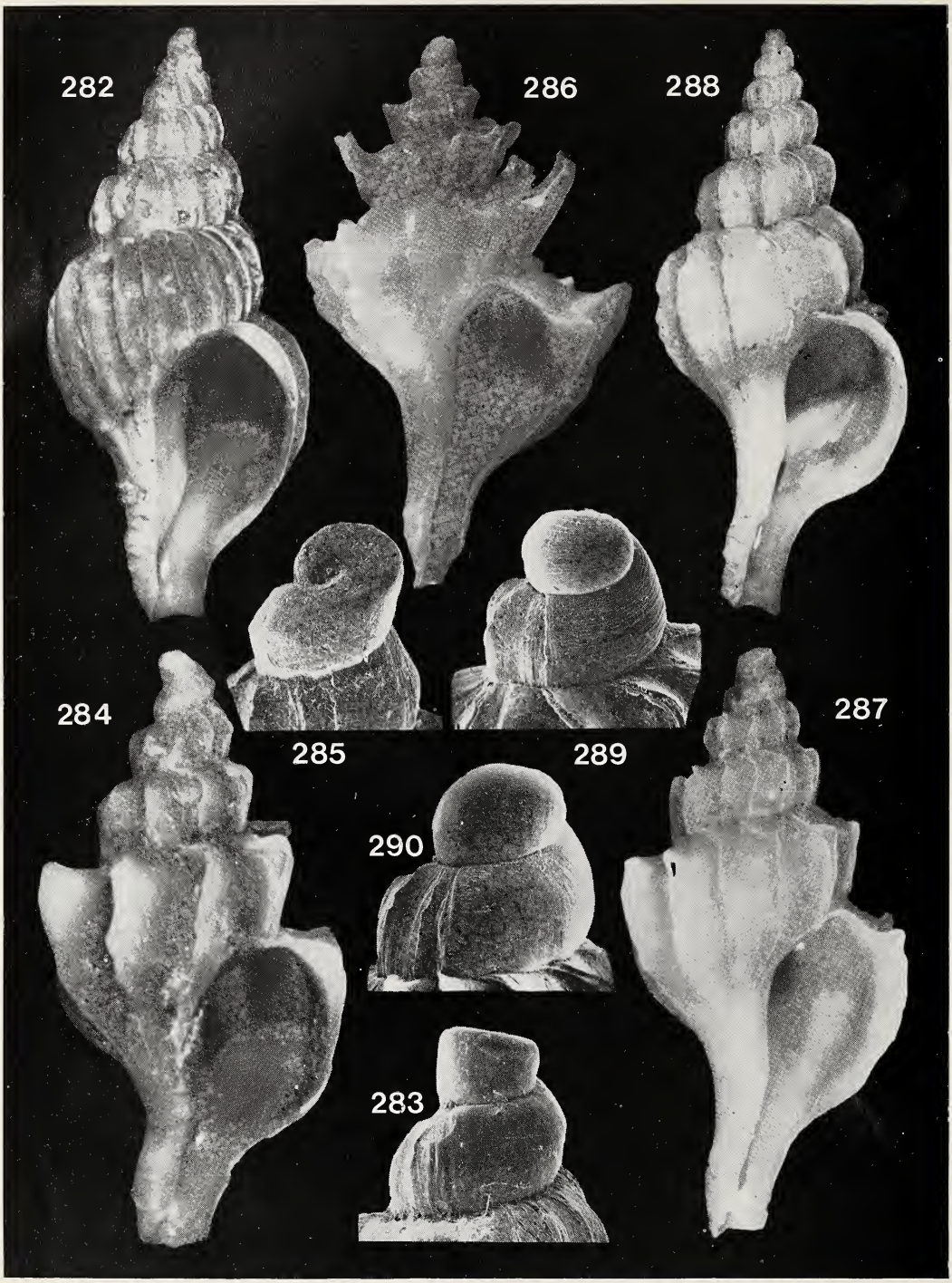
We have not seen any unquestionable Mediterranean specimens. Some specimens reported on by Di Geronimo & Panetta (1973) and Franchini & Frilli (1970), determined as *T. richardi,* resemble *T. barvicensis* closely, but we have seen all interrmediates between these specimens and *T. muricatus* from closely-situated localities. (Similar observations have been made by Chaster (1898) and Chaster & Heathcote (1894) in the British Isles.) Therefore we are not certain if *T. barvicensis* lives in the Mediterranean. The question arises that *T. barvicensis* may be only a deep-water form of *T. muricatus,* an assumption that is supported by the doubts expressed by Chaster (1898). However, in Scandinavia *barvicensis* occurs more shallowly, from 50 m, thus occupying depths where *muricatus* should be expected, yet *barvicensis* does not change form. The problem can, however, not be considered settled.

Some specimens from the Azores (*Trophon* sp., p.131, Fig. 297) resemble *T. barvicensis* closely, but have more convex larval whorls, they are more spiny and occasionally have a coloured shell. This may be a local form of *barvicensis,* but because of the differences mentioned above and the geographical separation, we prefer to keep it separate, at least until we know if *T. barvicensis* occurs on any of the intermediate sea-mounts.

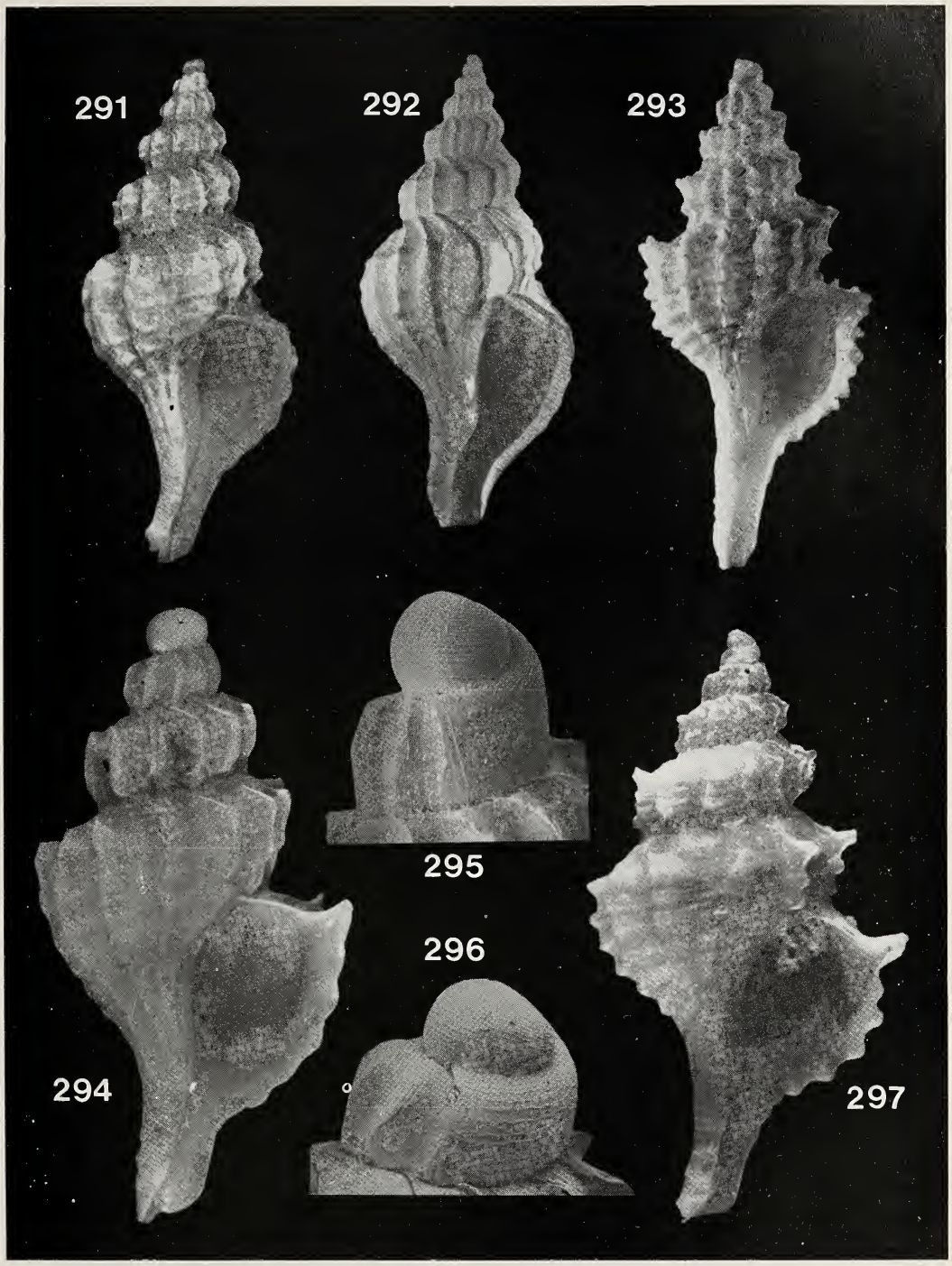
Trophon sp. Fig. 297

Material examined: BIACORES st 84,38°58 N, 28°03 W, 190 — 220 m, 2 spms; st 90, 39°04 N, 28°07 W, 205 — 210 m, 1 sh; st 159, 37°26 N, 25°51 W, 525 — 600 m, 1 spm.

Remarks: We have only seen four specimens of this form of *Trophon,* all from the Azores. It differs from *T. droueti,* which occurs in the same area and the same depths, by being more slender and having stronger projecting spines on the shoulder of the whorls. We have not seen any intermediates between the two. There is a possibility that this is a form of *barvicensis,* but as nothing is known about the occurrence of *barvicensis* on the sea-mounts between the Azores and Europe, it cannot be discussed.



Figs 282-290. Genus *Trophon*. 282, *T. truncatus,* Tromsö area, 8 m, 10.2 mm. 283, *T. truncatus,* Godhavn, Greenland, 50-100 m, apex 1.3 mm. 284, *T. clathratus,* Tromsö area, 8 m, 6.8 mm. 285, same sample, apex 1.1 mm. 286, *T. clavatus,* THOR 1904 st 99 (61°15 N, 09°35 W, 900 m), 11.2 mm. 287, *T. clavatus,* off Korsfjorden, Bergen area, 240-250 m, 7.8 mm. 288, *T. clavatus,* Säcken, Swedish west coast, 13.9 mm. 289 and 290, *T. clavatus,* Bergen area, 285-290 m, apex 0.9 mm.



Figs 291-297. Genus *Trophon*. 291, *T. barvicensis*, Sacken, Swedish west coast, 10.9 mm. 292, *T. barvicensis*, THALASSA st Z428 (48°27 N, 10°50 W, 850 m), 17.1 mm. 293, *T. barvicensis*, THALASSA st Y378 (41°31 N, 09°16 W, 1000 m), 9.05 mm. 294, *T. barvicensis*, Bergen area, 240-250 m, 4.7 mm. 295 and 296, *T. barvicensis*, Bergen area, 322-330 m, apex 0.6 mm. 297, *T.* sp., BIACORES st 84, 9.5 mm.

Trophon muricatus (Montagu, 1803) Figs 298-301, 342

Murex muricatus Montagu, 1803:262.
Fusus asperrimus Leach in Brown, 1827: pl. 47, fig. 2.
Fusus cancellatus Bivona, 1838:14 (not Sowerby, 1826 or Valenciennes, 1832).
Trophon muricatus var. *lactea* Jeffreys, 1867:317.
Fusus longurio Weinkauff, 1866:244, pl. 5, fig. 4.
Trophon breviatus Jeffreys, 1882:426.
Trophon muricatus var. *aspera* Monterosato MS, Bucquoy, Dautzenberg & Dollfus, 1882:40.
Trophonopsis curta Locard, 1892:109 (partim).
Trophonopsis muricatus var. *minor* Locard, 1897:349.
Trophon breviatus var. *striata* & var. *lactea* Milaschewitsch, 1916:105, pl. 3 figs 51-53.
Trophonopsis muricatus albinus Monterosato in Settepassi, 1977:7.
Trophonopsis muricatus major Monterosato in Settepassi, 1977:7.

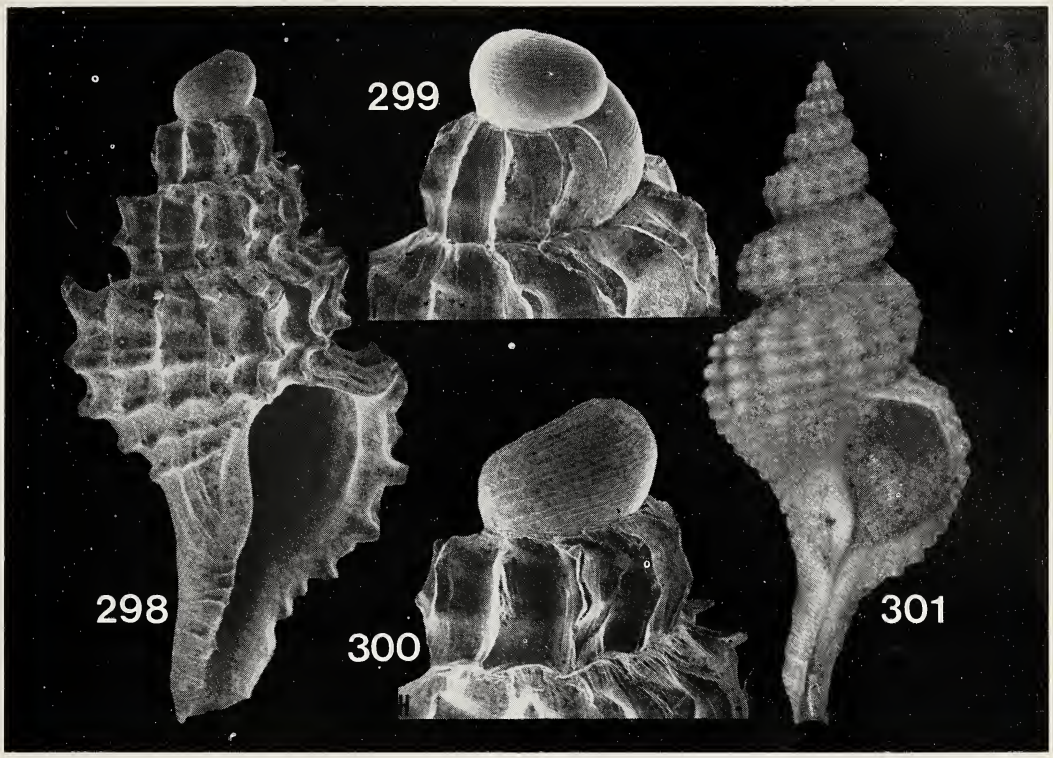
Type material: T. muricatus, not examined; *T. longurio,* holotype USNM 192693; *T. breviatus,* syntypes USNM 192695.
Type locality: T. muricatus, Salcombe Bay, G.B; *T. longurio,* Alger; *T. breviatus,* off the mouth of the Danube, Black Sea.

Material examined: The types ennumerated above and a few hundred shells from all parts of the distribution area USNM, BMNH, MNHN, coll. AW.

Distribution: European coastal areas, from Great Britain south to the Mediterranean and Morocco, in 20 — 300 m.
Remarks: Several authors (Franchini & Frilli, 1970; Houart, 1981) have recently synonymized *T. barvicensis* and *T. muricatus.* As we have discussed under *T. barvicensis* we do not find the evidence for this convincing enough. We have seen samples with the two forms occurring sympatrically, from the Bay of Biscay and N Morocco, from 120–200m. We have, however, also seen samples where it seems impossible to distinguish the two (e.g. from the Adriatic, coll. G. Spada, Bologna). The Mediterranean material we have seen has been insufficient to ascertain whether *barvicensis* really occurs in the Mediterranean and the problems are caused by a higher variability of *muricatus* there, or if they really integrade. The latter seems to be supported by Chaster's (1898) observation that they intergrade in the British Isles, but contradicted by our observations from other areas. Therefore we prefer to leave the question open and treat them as two species.

Jeffreys (1867), Lebour (1936) and Fioroni (1966) have described the egg capsules, which are lens-shaped and attached to some hard substratum.

The Black Sea form, *breviatus,* is probably worth subspecific status. It has been figured by Houart (1981) and Warén (1980).



Figs 298-301. *Trophon muricatus*. 298, Middle Adriatic, 100 m, 3.9 mm. 299 and 300 same sample, apices 870 μm and 970 μm. 301, Specimen figured by Jeffreys in British Conchology, 19.5 mm.

Trophon fabricii (Beck in Möller, 1842) Figs 302-303, 320-321, 332

Tritonium craticulatum Fabricius, 1780:401 (not Linné, 1767).
Trophon fabricii Beck in Möller, 1842:87.
Murex borealis Reeve, 1845: sp. 145.
Trophon heuglini Mörch, 1876:368.
Trophon interstriatus Sowerby, 1880:61, pl. 1, fig. 6.

Type material: T. fabricii, lectotype, here selected, in ZMC (Fig. 302); *T. borealis,* holotype in BMNH.
Type locality: S Greenland.
Material examined: The type material of *fabricii* and *borealis* and about 100 specimens and shells from all parts of the distribution area.

Distribution: NE America from Maine and northwards (Abbott, 1974), E and W Greenland (Thorson, 1944, 1951), Iceland (Thorson, 1944), Spitzbergen (Odhner, 1915) and possibly N Norway (Sars, 1878). It has been found in 6 — 160 m.

Remarks: T. fabricii is not a deep-water species, but has been included to complete the genus. It is the most characteristic of the species of *Trophon* discussed here and should not cause any problems with determination (cf. introduction to *Trophon*).

Trophon droueti Dautzenberg, 1889 Figs 306-307, 340

Trophon droueti Dautzenberg, 1889:37, pl. 2, fig. 1.
Trophon richardi Dautzenberg & Fischer, 1896:438, pl. 18, fig. 6.
Trophon droueti var. *elongata* Locard, 1897:351.

Type material: T. droueti, holotype, now partly destroyed by an acid glass tube in MOM; *T. richardi,* holotype in MOM.

Type locality: T. droueti, MONACO st 112, 38°34 N, 28°06 W, 1287 m; *T. richardi,* MONACO st 234, 39°02 N, 27°55 W, 454 m.

Material examined: The type material and MONACO st 198, 38°26 N, 28°39 W, 800 m, 1 sh; st 203, 39°27 N, 30°55 W, 1557 m, 1 sh; st 233, 38°33 N, 28°09 W, 1300 m, 18 shs; st 553, 37°43 N, 25°05 W, 1385 m, 3 shs; st 703, 39°21 N, 31°06 W, 1360 m, 2 shs; st 1349, 38°35 N, 28°06 W, 1250 m, 15 shs; st 2450 (probably erroneous st-number), 1 sh; TALISMAN dr 127, 38°38 N, 28°21 W, 1257 m, 4 shs; BIACORES st 46, 37°34 N, 28°54 W, 784 m, 1 spm; st 148, 37°34 N, 25°34 W, 870 m, 1 spm; st 157, 37°33 N, 25°43 W, 787-826 m, 1 spm; st 240, 37°35 N, 25°32 W, 810 m, 1 spm; st 241, 37°37 N, 25°32 W, 395-463 m, 1 sh.

Distribution: Endemic to the bathyal area of the Azores; known only from the material examined.

Remarks: As already noticed by Houart (1981) the name *richardi* (= *droueti*) has recently been used by Mediterranean authors for shelf populations of *T. muricatus* or *T. barvicensis. T. droueti* can be distinguished from these populations by its broader outlines and its aperture, furnished with denticles on the inside of the outer lip. The development of spines from the axial lamellae is variable in the two forms and cannot be used for separation.

There is, however, some possibility that *T. droueti* should be considered only an isolated population or subspecies of *barvicensis,* which certainly is its closest relative. At present nothing is known about the occurrence of *barvicensis* or *droueti* on the sea-mounts between the Azores and Europe, which prohibits further speculation on the relationship.

Trophon dabneyi Dautzenberg, 1889 Figs 304-305, 319, 334

Trophon dabneyi Dautzenberg, 1889:36, pl. 2, fig. 7.
Trophon decoratus Locard, 1897:340, pl. 17, fig. 5-11, and var. *minor* Locard, 1897:341; var. *lanceolata* Locard, 1897:345.

Type material: T. dabneyi, holotype in MOM; *T. decoratus,* syntypes in MNHN.

Type locality: T. dabneyi, MONACO st 112, 38°34 N, 28°06 W, 1287 m; *T. decoratus,* TALISMAN dr 127, 38°38 N, 28°21 W, 1257 m.

Material examined: The type material and MONACO st 184, 40°05 N, 27°28 W, 1850 m, 5 shs; st 213, 39°23 N, 31°25 W, 1384 m, 2 shs; st 224, 39°44 N, 31°06 W, 1213 m, 2 shs; st 233, 38°33 N, 28°09 W, 1300 m, 3 shs; st 624, 38°57 N, 28°19 W, 2102 m, 2 shs; st 684, 38°20 N, 28°05 W, 1550 m, 1 sh; st 698, 39°11 N, 30°45 W, 1846 m, 2 shs; st 702, 39°21 N, 31°06 W, 1360 m, 1 sh; st 719, 39°11 N, 30°24 W, 1600 m, 6 shs; st 738, 37°40 N, 26°26 W, 1919 m, 1 spm, 1 sh; st 1190, 15°14 N, 23°04 W, 628 m, 1 sh; st 1193, 15°17 N, 23°02 W, 1311 m, 1 sh; st 1209, 16°34 N, 23°03 W, 1447 m, 1 sh; st 1331, 38°40 N, 26°01 W, 1805 m, 4 shs; st 1344, 38°45 N, 28°08 W, 1095 m, 2 shs; st 1349, 38°35 N, 28°06 W, 1250 m, 2 shs; st 3150, 38°01 N, 25°21 W, 1740 m, 1 sh; NORATLANTE st B19, 47°28 N, 08°25 W, 2149 m, 1 spm; THALASSA st Z 453, 48°34 N, 10°51 W, 1975-2070 m, 2 spms; BIACORES st 36, 38°11 N, 29°39 W, 2670 m, 1 spm; st 66, 38°34 N, 28°19 W, 1225 m, 1 spm; st 95, 39°03 N, 28°25 W, 2440 m, 3 spms; st 179, 38°05 N, 25°46 W, 1590 m, 12 spms; st 191, 37°56 N, 24°49 W, 1650-1750 m, 2 spms; st 217, 37°05 N, 24°52 W, 1735 m, 2 spms; st 227, 37°10 N, 25°19 W, 2160 m, 1 spm; st 252, 47°35 N, 08°47 W, 2550-2700 m, 3 spms; BIOGAS st CV6, 47°31 N, 08°16 W, 2200 m, 3 spms; st CV9, 47°31 N, 08°44 W, 2199 m, 1 spm; st CV 10, 47°31 N, 08°41W, 2108 m, 2 spms; st CV 39, 47°33 N, 08°45 W, 2350 m, 2 spms; st CP 1, 47°35 N, 08°38 W, 2245 m, 4 spms; st CP 33, 47°43 N, 08°48 W, 2115 m, 1 spm; st CP 34, 47°32 N, 08°23 W, 1970 m, 1 spm; st DS 15, 47°35 N, 08°40 W, 2246 m, 1 spm; st DS 17, 47°32 N, 08°45 W, 2103 m, 2 shs; st DS 65, 47°36 N, 08°40 W, 2360 m, 2 spms; st DS 71, 47°34 N, 08°34 W, 2194 m, 2 shs; THOR, 49°27 N, 13°33 W, 2100 m, 2 shs, ZMC.

Distribution: The bathyal parts of the Eastern Atlantic, from the northern part of the Bay of Biscay to the Cape Verde Islands and Azores.

Remarks: T. dabneyi can be recognized from its multispiral, brownish larval shell which indicates planktotrophic larval development. It is the only species, in the area studied, with such larvae. The protoconch, however, is frequently corroded in adult specimens and the species becomes difficult to distinguish from *T. echinatus* (the *cossmanni* "form"). Distinctive characters then, are the more blunt spire, less distinct spiral sculpture and less shouldered axial lamellae in *T. dabneyi.*

Trophon echinatus (Kiener, 1840) Figs 308-318, 333, 335-338

Murex vaginatus of authors on Recent Mollusca, not de Cristofori & Jan, 1832:11 (fossil).
Murex carinatus of authors on Recent Mollusca, not Bivona, 1832:23, pl. 3, fig. 12 (fossil) (non *Murex carinatus* Pennant, 1777, or Fischer de Waldheim, 1807 or Laskey, 1811).
Fusus echinatus Kiener, 1840:19, pl. 2, fig. 27.
Murex multilamellosus of authors on Recent Mollusca, not Philippi, 1844:182, pl. 27, fig. 8 (fossil).
Trophon carinatus Jeffreys, 1883:395, pl. 44, fig. 4 (non *Murex carinatus* Bivona, 1832 which is a *Trophon*).
Trophon grimaldii Dautzenberg & Fischer, 1896:439, pl. 18, figs 1-2.
Pagodula carinata var. *tenuis* and var. *cinara* Monterosato, 1884:116.
Trophonopsis carinatus var. *major,* var. *elongata,* var. *depressa,* var. *spinosa* and var. *mutica* Locard, 1897:346.
Trophonopsis varicosissimus var. *major* Locard, 1897:350.
Trophon cossmani Locard, 1897:342, pl. 17, figs 12-14.
Trophon deversus Locard, 1897:343, pl. 17, figs 15-17.
Trophonopsis carinatus aculeatus Settepassi, 1977:4, pl. 3, figs 24-28.
Trophonopsis carinatus multiaculeatus Settepassi, 1977:4, pl. 3, fig. 41.
Trophonopsis carinatus hirtus Settepassi, 1977:4, pl. 2, figs 17-18.

Type material: F. echinatus, not found in MNHN; *T. carinatus,* holotype in USNM; *T. grimaldii,* holotype in MOM; *T. cossmanni* and *T. deversus,* holotypes in MNHN.
Type locality: F. echinatus, coasts of Sicily; *T. carinatus,* TRITON st 13, 59°51 N, 08°18 W, 1050 m; *T. cossmanni,* TALISMAN dr 99, 17°12 N, 17°07 W, 1617 m; *T. deversus,* TALISMAN dr 130, 37°55 N, 27°02 W, 2235 m.

Material examined: The type material mentioned and about one hundred specimens and shells from the Mediterranean (incl. 6 shs and spms from the Eastern Basins), from depths between 100 and 650 m. From the Atlantic we have seen about 80 specimens and shells from the Southern Bay of Biscay, Iberian Coasts and Morocco, from 175 — 1000 m. From greater depths we have examined:
TRAVAILLEUR 1880 dr 10, 43°39 N, 03°28 W, 1960 m, 1 sh; 1881 dr 31, 36°27 N, 08°03 W, 1383 m, 1 sh; 1882 dr 16, 42°48 N, 08°37 W, 627 m, 1 sh; dr 19, 41°32 N, 08°21 W, 1350 m, 2 spms; dr 40, 33°09N, 08°38 W, 1900 m, 4 spm + shs; TALISMAN dr 99, 1 spm; dr 130, 2 spms; NORATLANTE st B1, 55°08 N, 15°11 W, 2215-2233 m, 2 spms; st B12, 36°21 N, 08°43 W, 2875 m, 1 spm; st B16, 45°35 N, 03°51 W, 3950-4150 m, 2 spms; BIACORES st 202, 37°26 N, 25°00 W, 2900 m, 10 spms; st 206, 37°21 N, 25°28 W, 2090 m, 6 spms; st 235, 37°18 N, 25°32 W, 2085-2115 m, 5 spms; st 252, 47°35 N, 08°47 W, 2550-2700 m, 1 sh; BIOGAS st DS86, 44°05 N, 04°19 W, 1950 m, 1 sh; INCAL st DS01, 58°00 N, 10°40 W, 2091 m, 1 sh; st DS06, 56°26 N, 11°10 W, 2494 m, 1 sh; st CP01, 57°57 N, 10°55 W, 2068 m, 1 spm; st CP02, 57°58 N, 10°43 W, 2091 m, 1 spm; st CP03, 56°38 N, 11°06 W, 2466 m, 2 shs; st CP04, 56°33 N, 11°11 W, 2483 m, 2 spms; st CP07, 55°03 N, 12°46 W, 2895 m, 1 spm; THALASSA st X336, 44°11 N, 05°10 W, 1850-2050 m, 1 sh; st X339, 44°10 N, 04°30 W, 1520-1600 m, 1 spm, 2 shs; st X362, 44°06 N, 04°51 W, 585-600 m, 1 sh; st Y374, 41°31 N, 09°20 W, 1250 m, 2 shs; st Y401, 40°37 N, 09°21 W, 1040 m, 3 shs; st Z409, 47°43 N, 08°04 W, 1035-1080 m, 1 sh; st Z428, 48°27 N, 10°50 W, 850 m, 1 sh; st Z435, 48°40 N, 09°53 W, 1050 m, 2 shs; SARSIA st 7612, 43°44 N, 03°41 W, 1540-1570 m, 5 spms; st 7614, 43°43 N, 03°38 W, 1100 m, 1 sh; st 7622, 43°44 N, 03°43 W, 1600 m, 1 sh; st 7627, 43°47 N, 03°46 W, 1925-1990 m, 9 spm + shs; METEOR st 36/16-17-99, 21°37 N, 18°41 W, 2768-2971 m, 1 spm.

Distribution: The continental shelf of the Mediterranean and the E Atlantic north to the Bay of Biscay (typical *echinatus*), and the continental slopes of the same area and north to the Rockall Trough (Houart, 1981 as *T. cossmanni* and *Nodulotrophon scolopax*) (*cossmanni* "form"). Also present in the bathyal zone of the Azores (*cossmanni* "form").

Remarks on the nomenclature

The present species is usually known as *Trophon vaginatus* (De Cristofori & Jan, 1832), as far as specimens from the shelf are concerned. We have examined the lectotype in Museo Civico di Storia Naturale, Milano. It was described as a Pliocene fossil from Tabiano, N. Italy. It is certainly quite similar to the Recent Mediterranean form (Fig. 314 and Pinna, 1971, pl. 77, fig. 6), but there is a distinct difference in the larval shell, which in the Recent form consists of about 1.5 whorls (Fig. 316) while the Pliocene form has more than 2.5 whorls (Fig. 315), and possibly had planktotrophic larval development. This observation was confirmed by examining numerous specimens from other N Italian Pliocene deposits (in the rich collection of Della Bella). We therefore consider the Recent form specifically distinct from the Pliocene fossil.

The two subsequent names *Murex carinatus* Bivona, 1832 and *Murex calcar* Scacchi, 1836 which have been used for the Recent Mediterranean form, are both based on N Italian Pliocene specimens and also preoccupied, and thus not available.

Fusus echinatus Kiener, 1840 was based on Recent specimens and well figured. There are no doubts about its identity. The case is, however, complicated by Sowerby's (1818) use of the name *Murex echinatus.* Sowerby's species was transferred to *Fusus* by Fleming (1828) and Philippi (1836) and is in fact a synonym of *Trophon muricatus* (Montagu, 1803). In the description, however, Sowerby writes "Syn, *Murex echinatus* Brocchi, 2, 423, t. 8, f. 3". Rossi-Ronchetti (1955) considered *M. echinatus* Brocchi to be a species of *Philbertia* (Turridae) which probably is correct. Therefore Sowerby's use of the name is based on a misidentification and has no taxonomical status and does not make *Trophon echinatus* preoccupied.

Several later names reflect the high variability of *T. echinatus.*

Remarks on the variation

Trophon echinatus exhibits considerable variation, especially in relation to depth. The Mediterranean and the Atlantic shelf form do not differ very much. They have a porcellaneous, smooth, very slender and spiny shell (Figs 312-313), without spiral sculpture. Sometimes the Mediterranean form is a little more slender and spiny, but not enough to cause any problems with the identification. At the uppermost part of the continental slope there is a tendency to more numerous but less spiny axial lamellae. Typical specimens of this form have been called *grimaldii* Dautzenberg & Fischer in the Atlantic and *multilamellosa* Philippi in the Mediterranean. Still deeper, in the Atlantic in 600-1000 m, the spiral sculpture starts to become conspicuous and the spines are still less developed (Figs 308-309). This form is known as *cossmanni* Locard and has been found down to 3000 m.

Franchini & Frilli (1970) considered *grimaldii* a subspecies of "*carinata* de Cristofori & Jan" (= *T. echinatus*) (and considered "*multilamellosa* Philippi" a distinct species). To discuss this one has to keep in mind that the typical *T. echinatus* has a continuous distribution along the shelf, via the Straits of Gibraltar, and there exists one Atlantic and one Mediterranean deep-water outcrop of the species. The bathymetric variation in shell form of these two outcrops is identical, except that the *cossmanni* form is very scarce and perhaps extinct in the Mediterranean. Only a few old shells are known. Therefore we prefer to regard the variation not as a result of genetic isolation (subspecies), but as more directly influenced by the depth. It would be more than pure coincidence if the Atlantic and Mediterranean deep populations had diverged from the shallow-water form because of genetic isolation in exactly the same way in the two outcrops. Therefore we prefer to call them simply different "forms", viz. typical *echinatus* (Figs 312-313), the *grimaldii* "form" (Figs 310-311) and the *cossmanni* "form" (Figs 308-309).

Comparison with other Atlantic species of Trophon.

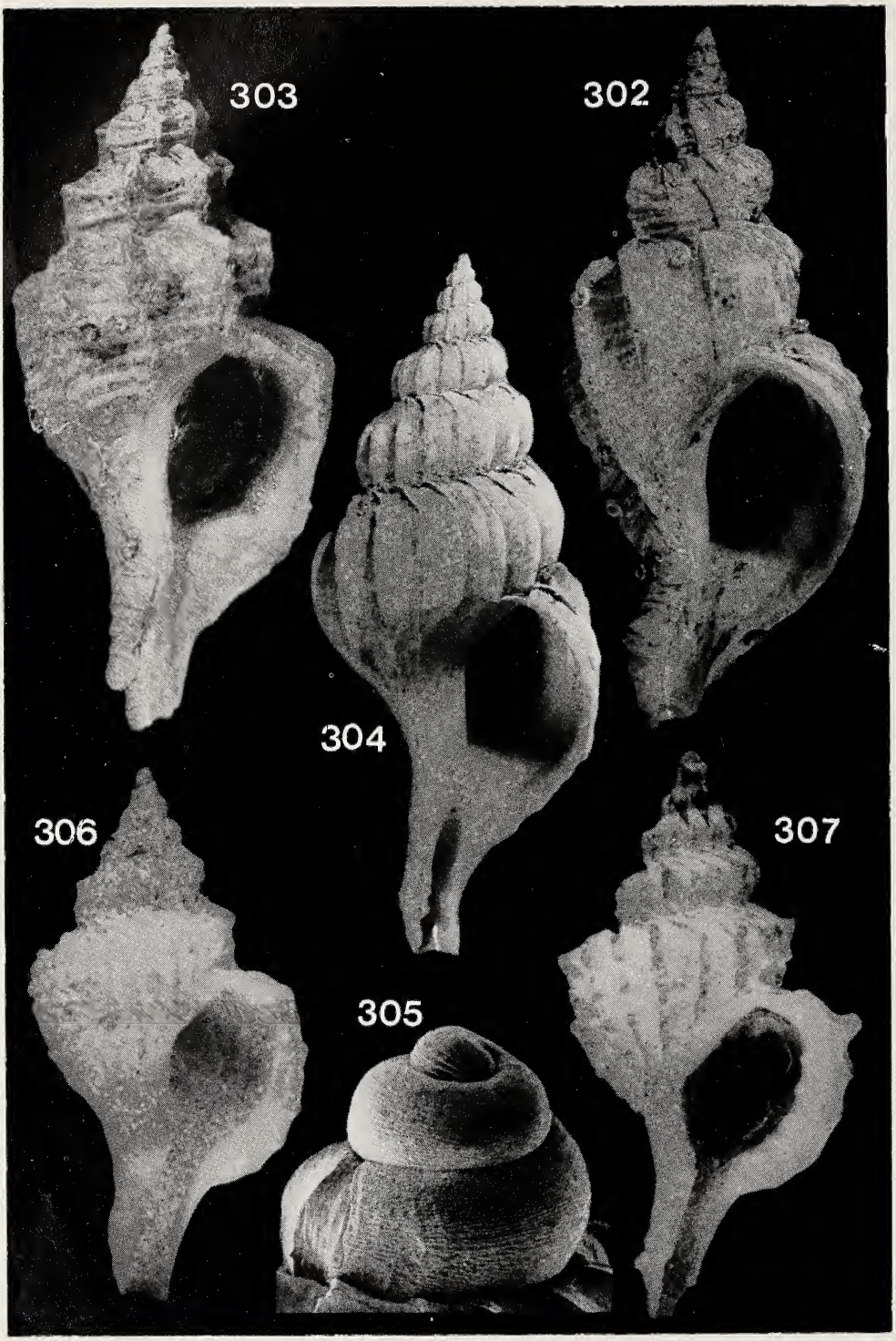
The sculpture of *T. echinatus* is variable and this does not facilitate identification. A few features are, however, quite constant: paucispiral larval shell, long slender siphonal canal and strongly-shouldered whorls. *T. dabneyi* has a larval shell of 2.5 brownish whorls while that of *echinatus* has 1.5 whorls and is colourless. It also has more rounded whorls and more solid, rib-like axial sculpture, not thin lamellae as *echinatus*. *T. droueti* has a shorter siphonal canal and more pronounced spiral sculpture, approximately as strong as the axial one. *T. barvicensis* has a shorter siphonal canal, stronger spiral sculpture and a higher shoulder of the whorls.

The Caribbean *T. aculeatus* Watson, 1883 (= *lacunella* Dall, 1889) resembles *T. echinatus*, especially specimens from intermediate depths, but is higher, more slender and has a deeper suture than *echinatus*. We have not seen specimens of *aculeatus* with spiral sculpture.

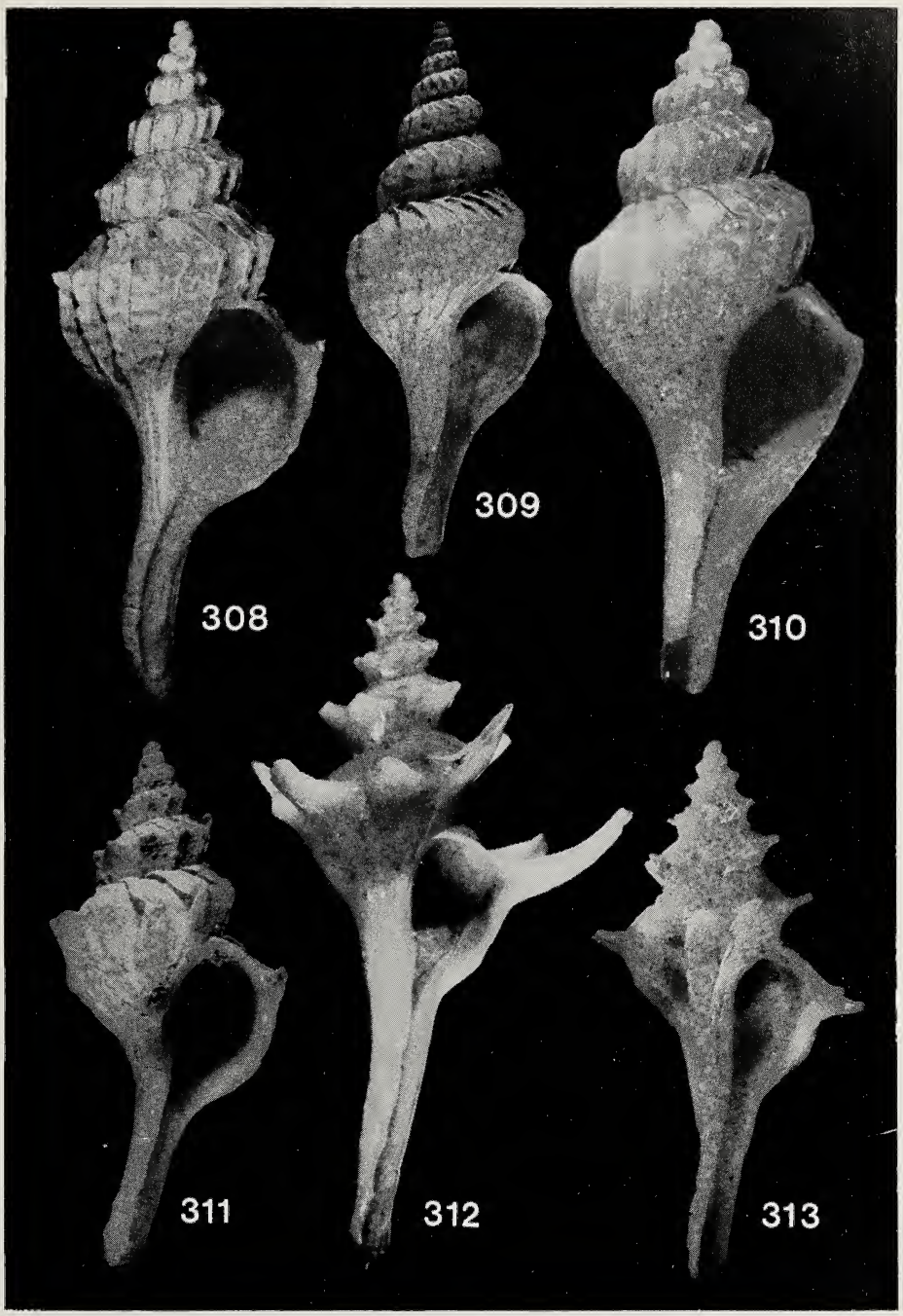
T. abyssorum Verrill, 1885 (? = *limicola* Dall, 1902) resembles the *cossmanni* "form", in the shape of the shell and the sculpture. It is known from off the NE U.S. from 1500 to 3500 m. The available material of that species, however, is scanty and there is a large gap in the distribution in the N Atlantic, from Rockall to U.S., where no *Trophon* species related to these species are known. Therefore we find it better to keep them separate.

More problems arise when going further south. *Trophon guineensis* Thiele was described from the Gulf of Guinea (03°10 N, 05°28 E, 2278 m). The larval shell is not known, but the postlarval shell can hardly be distinguished from the *cossmanni* "form". We have examined two specimens from off Angola (WALDA st CY15, 10°30 S, 11°55 E, 1756 m). The shell is identical, but the larval shell is destroyed. One of the specimens was a female and had a couple of egg clusters, 1100-1250 μm diameter and containing a few hundred eggs each, of a diameter of 120 μm. These egg clusters were kept in the pallial cavity. The diameter of the eggs indicates planktonic larval development, because the diameter of the eggs of species of *Trophon* with direct development is 230 — 500 μm (5 species known). This female also differed from *T. echinatus* in having unpigmented eyes, while *T. echinatus* has black eyes.

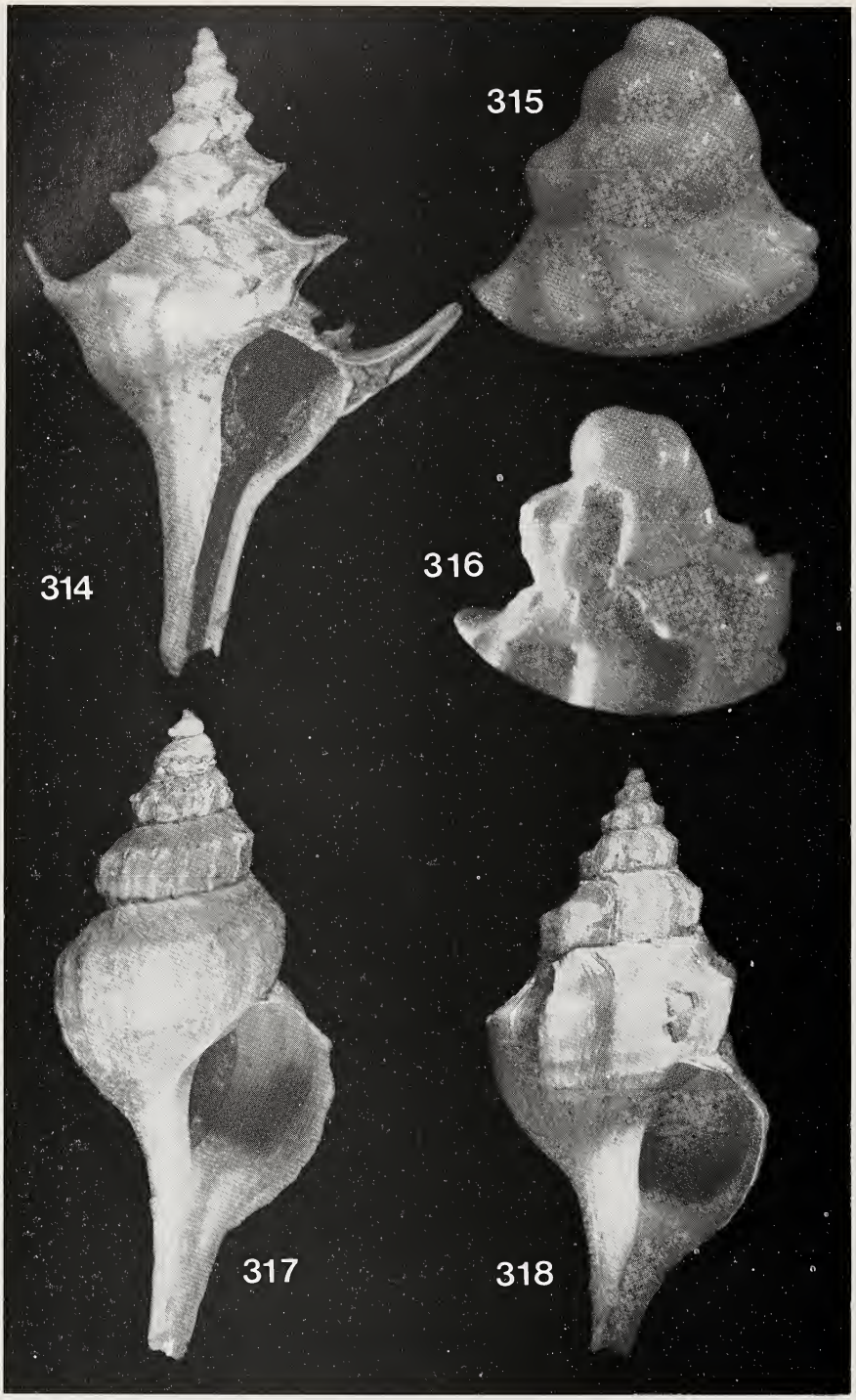
Further to the south we have examined many specimens from the sides of the Walvis Ridge (WALVIS st CP13, 32°18 S, 13°16 E, 3550 m and CP 14, 32°29 S, 13°25 E, 3675 m). They were all heavily encrusted by zoantharians and the larval shells were badly corroded. They had normal eyes, but no eggs were observed. They resemble *T. acceptans* Barnard, 1959 (see also 1963), described from 33°34 S, 1160 — 3275 m. Barnard (1963) doubted the validity of this species and said "I fully expect that *acceptans* will *not* be accepted when further material is obtained from the Atlantic trough along the west coast of Africa". It is still impossible to say anything about the validity of these two names, but the differences in the development of the eyes indicate that they may not be synonyms.



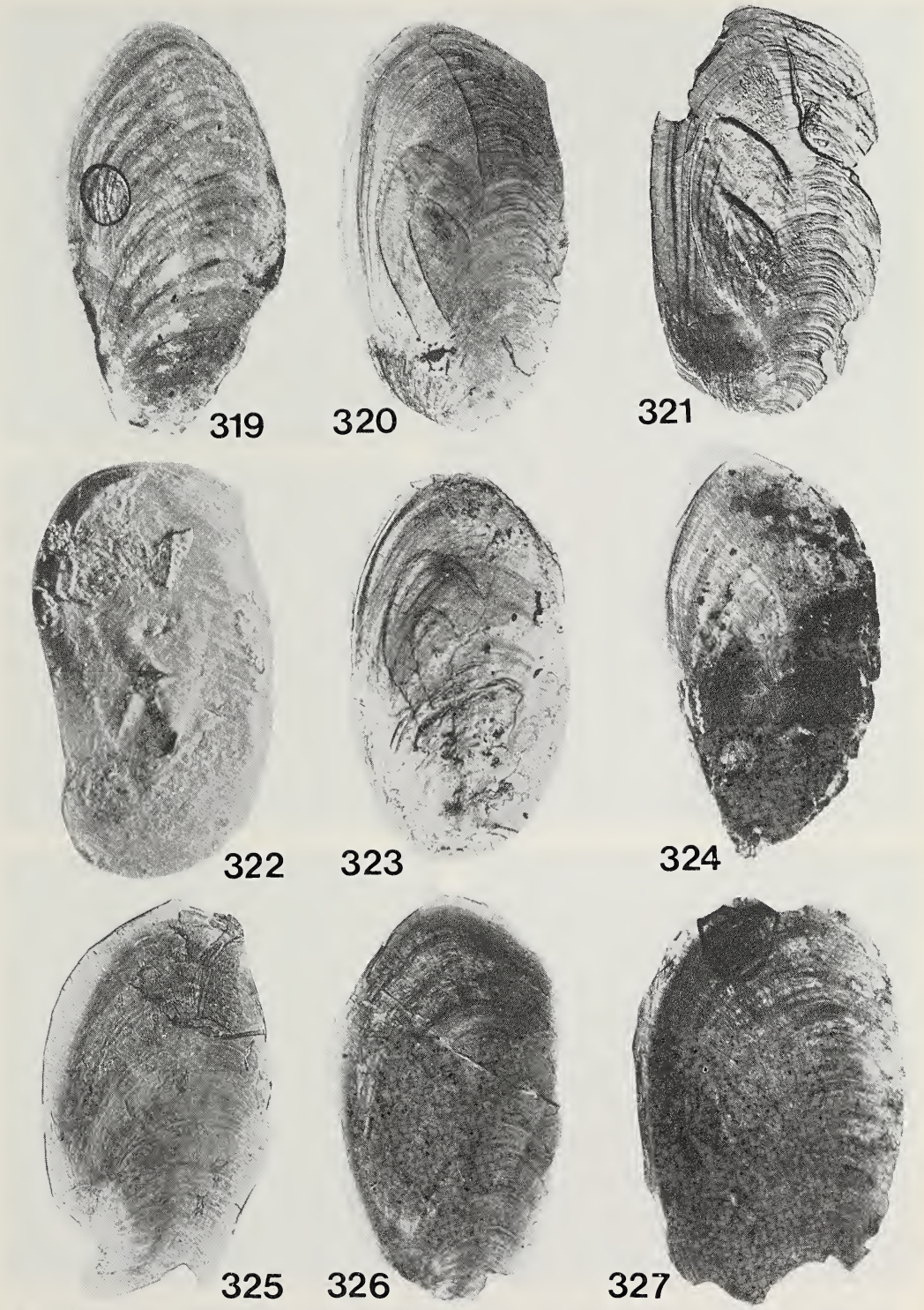
Figs 302-307. Genus *Trophon*. 302, *T. fabricii*, lectotype, 44 mm. 303, *T. fabricii*, Berufjord, Iceland, 40 mm. 304, *T. dabneyi*, BIOGAS st CV10, 37.2 mm. 305, *T. dabneyi*, larval shell, 850 μm. 306, *T. droueti*, BIACORES st 157, 14.0 mm. 307, *T. droueti*, holotype of *T. richardi*, 15.0 mm.



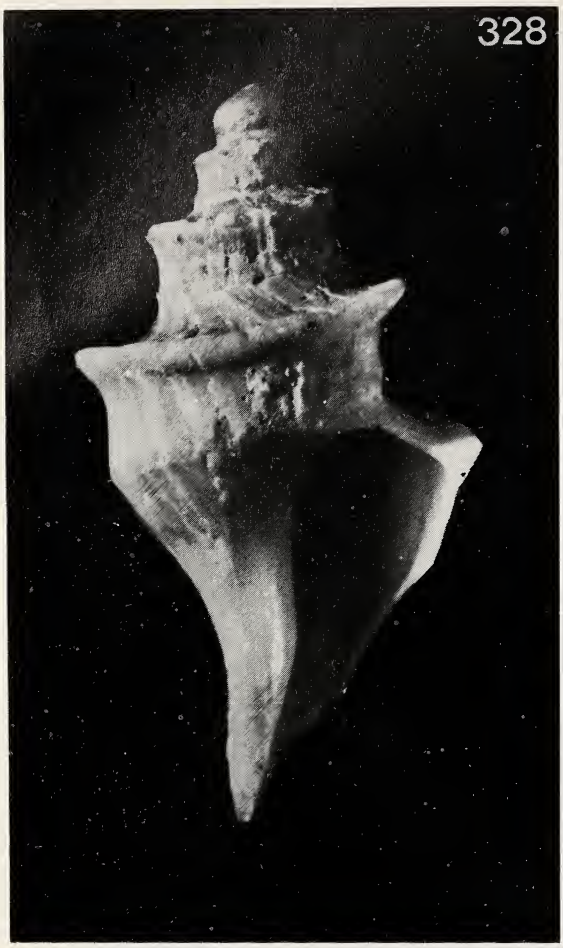
Figs 308-313. *Trophon echinatus.* 308, INCAL st CP4 (56°33 N, 11°11 W, 2483 m), 20.0 mm. 309, syntype of *T. cossmanni,* 26.0 mm. 310, WASHINGTON expedition, 370-420 m, 13.1 mm. 311, NORATLANTE st B1 (55°08 N, 15°11 W, 2215 m), 19.1 mm. 312, Gulf of Napoli, 19.0 mm. 313, TALISMAN dr 20 (33°43 N, 09°02 W, 1105 m), 15.8 mm.

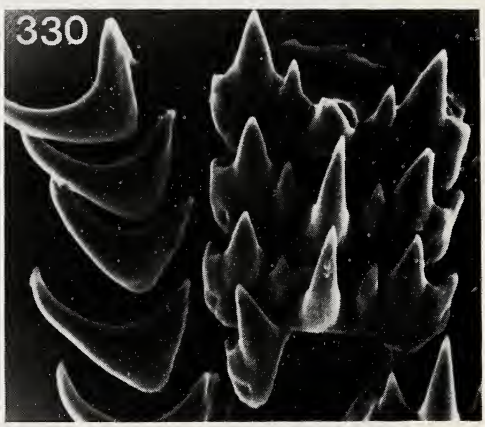


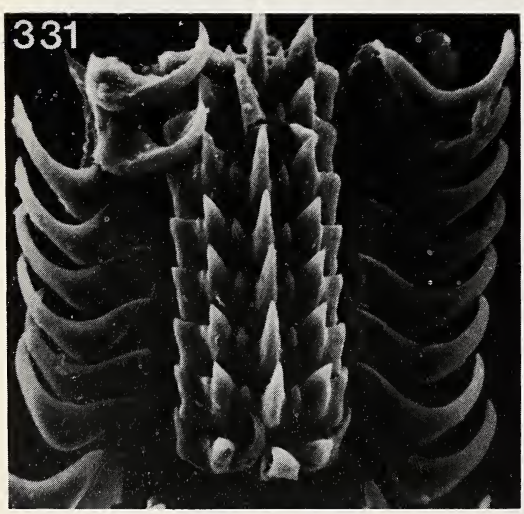
Figs 314-318. Genus *Trophon*. 314, *T. vaginatus,* upper Pliocene of Carignano, Imola, Bologna, 19.5 mm. 315, apex of a specimen from the same locality, 1.13 mm. 316, *T. echinatus,* apex of a Recent Mediterranean specimen, 1.07 mm. 317, *T.* sp., WALVIS st CP14, 33.3 mm. 318, *T.* sp., WALDA st CY15, 25.5 mm.

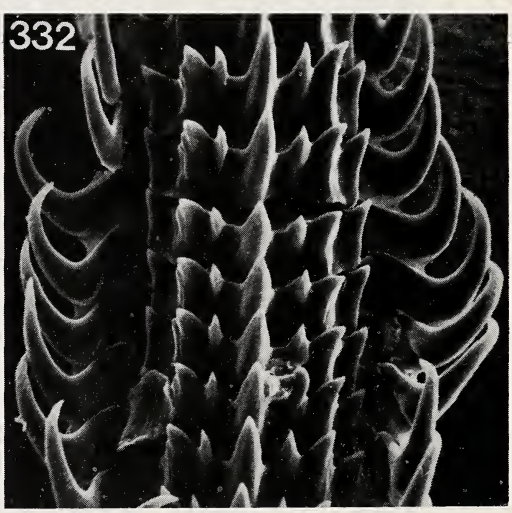


Figs 319-327. *Trophon* opercula. 319, *T. dabneyi*, Bay of Biscay, 10.9 mm. 320 and 321, *T. fabricii*, Berufjord, Iceland, 2.5 and 9.5 mm. 322, 323 and 324, *T. clavatus*, Koster area, Swedish west coast, 0.8 mm, 2.8 mm and 3.4 mm. 325 and 326, *T. clathratus*, Godhavn, Greenland, 1.4 mm and 4.6 mm. 327, *T. geversianus*, Magellan Strait, 11.2 mm.

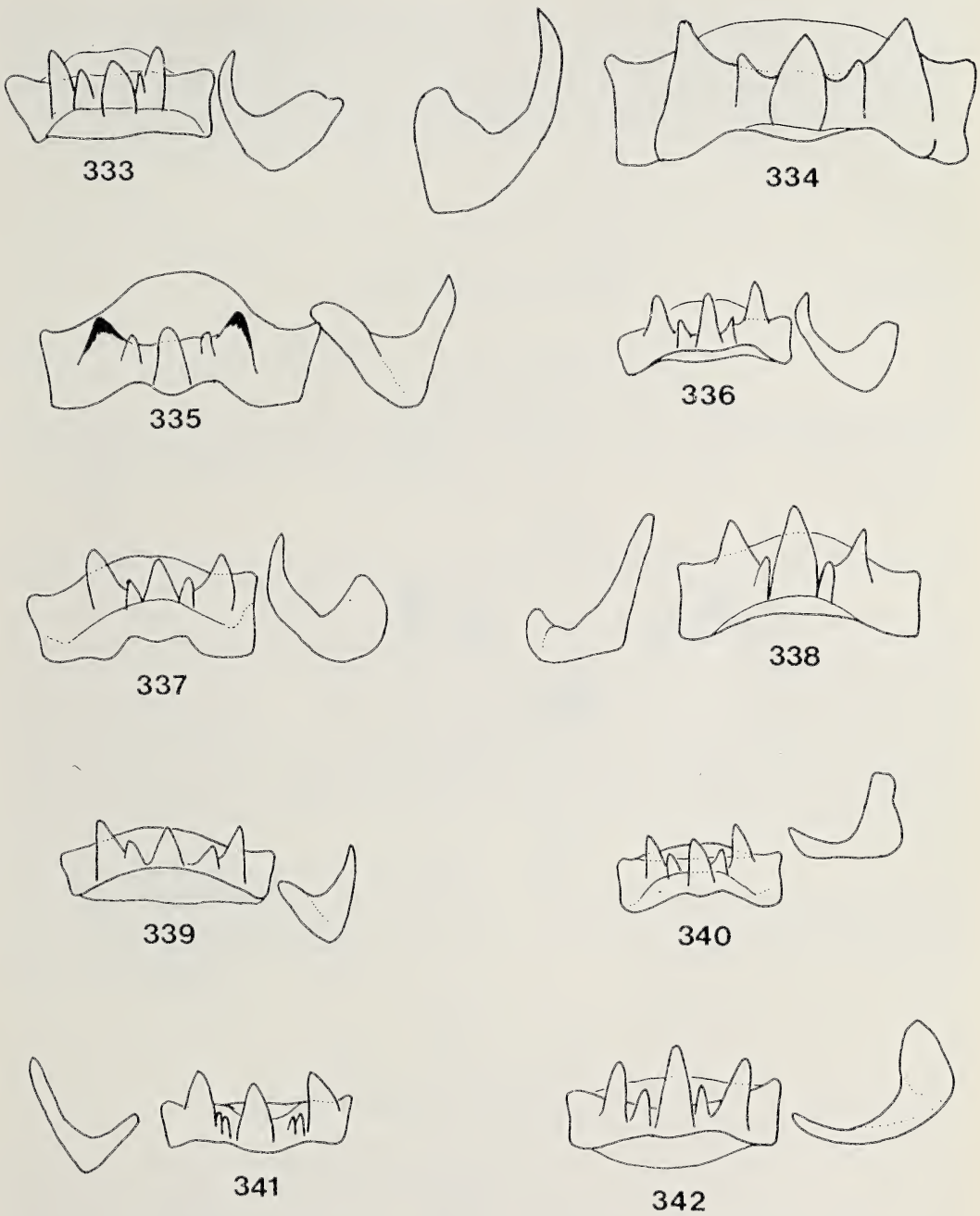




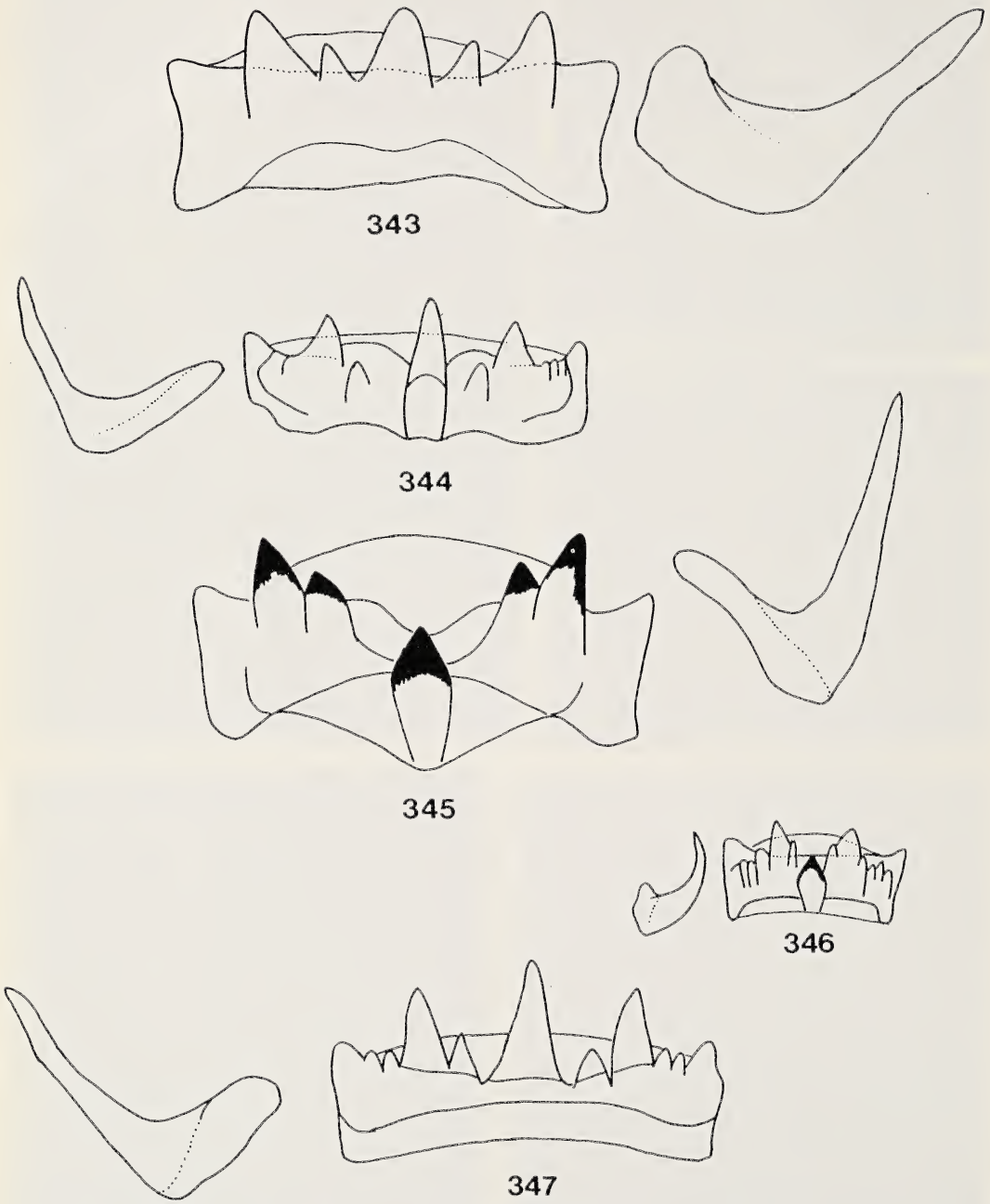




Figs 328-332. Genera *Tromina* and *Trophon*. 328, *Tromina unicarinata,* type species of *Tromina* Dall, 1918, Magellan Strait, 35 m, 7.4 mm. 329, *Trophon geversianus,* breadth of central tooth 167 μm. 330, *Tromina unicarinata,* breadth of central tooth 27 μm. 331, *Trophon clavatus,* 41 μm. 332, *Trophon fabricii,* 110 μm.



Figs 333-342. Radulae of *Trophon*. 333, *T. echinatus*, INCAL st CP2, breadth of central tooth 56 μm. 334, *T. dabneyi*, 94 μm. 335, *T. echinatus*, BIACORES st 202, 68 μm. 336, *T. echinatus*, spiny form, N. Spain 500-540 m, 51 μm. 337, *T.* sp., WALVIS st CP14, 60 μm. 338, *T.* sp., WALDA st CY15, 77 μm. 339, T. clavatus, 40 μm. 340, *T. droueti*, 47 μm. 341, *T. barvicensis*, 33 μm. 342, *T. muricatus*, 36 μm.



Figs 343-347. Muricid radulae. 343, *Pterynotus leucas,* breadth of central tooth 56 μm. 344, *Orania grayi,* 98 μm. 345, *Muricopsis blainvillei,* 41 μm. 346, *Ocinebrina aciculata* 43 μm. 347, *Orania fusulus,* 50 μm.

Genus *PTERYNOTUS* Swainson, 1833

Type species: Murex pinnatus Swainson, 1822, by original designation (pl. 122).
Remarks: The genus *Pterynotus* and its subgenera have been discussed by Ponder (1972) and the W Atlantic species were monographed by Harasewych & Jensen (1979). There are two species of the genus in the Central E and NE Atlantic, *P. leucas* Locard and *P. atlantideus* which is described here. They can easily be separated by the presence of intervarical nodes or bulges in *P. atlantideus*, easily seen in an apical view (cf. Figs 350, 353). These bulges are absent in *P. leucas*.

Pterynotus atlantideus **n.sp.** Figs 348-350

Type material: Holotype in MNHN.
Type locality: BIACORES st 186, 37°51 N, 25°40 W, 370-455 m.

Material examined: The type material and BIACORES st 38, 37°59 N, 29°16 W, 350-400 m, 1 spm; st 146, 37°39 N, 25°35 W, 330 m, 1 spm; st 41, 37°43 N, 29°04 W, 450-475 m, 2 shs; st 235, 37°18 N, 25° 32 W, 2085-2115 m, 1 sh; st 236, 37°21 N, 25°45 W, 470-500 m, 1 spm.

Distribution: In addition to the material from the Azores enumerated above, *P. atlantideus* is known from the Great Meteor Bank, in 295-343 m (Fechter, 1977 as *P. leucas*).

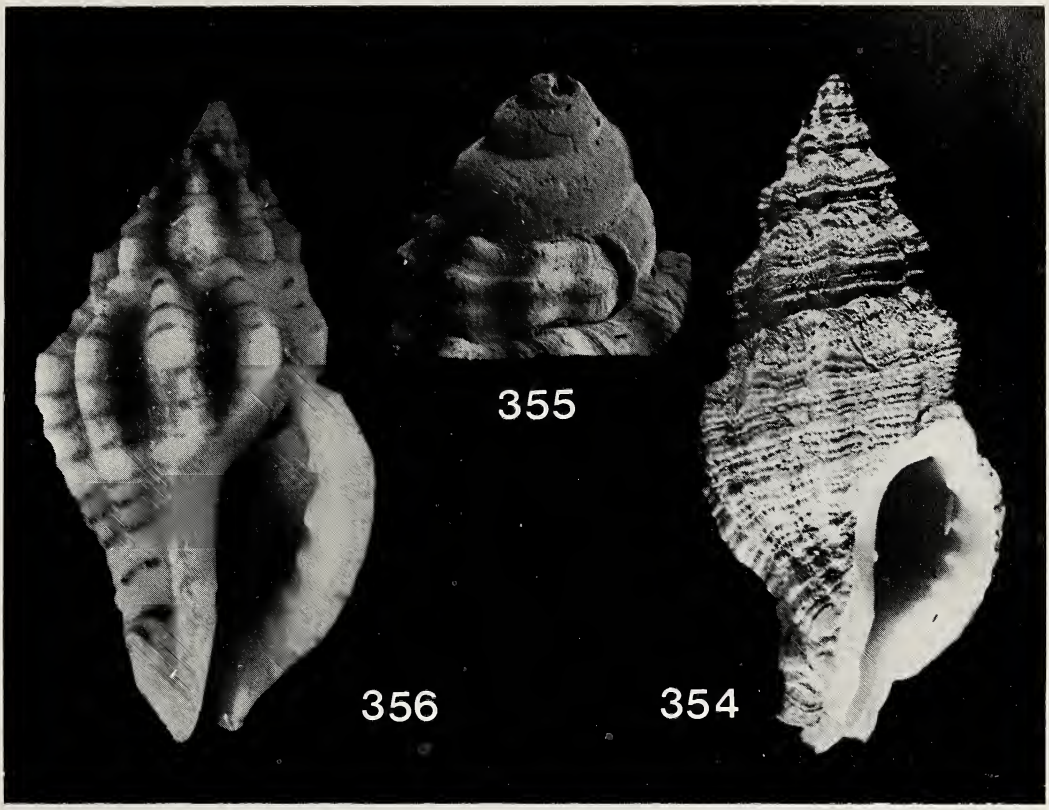
Description: Shell solid, fusiform, consisting of six postlarval whorls, larval shell white, consisting of one smooth whorl. The first postlarval whorl has 7 fragile foliaceous varices that adhere to the protoconch; there is no intervarical node between these early varices. The regular adult sculpture starts on the second whorl and there are 3 varices and 3 intervarical nodes per whorl. The spiral sculpture consists of spiral cords, of which a few stronger ones extend on to the varices where they tend to produce spines; there are also extremely fine spiral threads which, together with the fine axial sculpture present on some specimens (including the holotype), may give a reticulate appearance under high magnification. Aperture oval, outer lip with 7 denticles; siphonal canal of moderate length for the genus, open; colour light tan with a few brownish blotches on the varices or the nodes; aperture white.
Dimensions: Height of the shell 21 mm, breadth 11 mm.
Remarks: P. atlantideus differs from *P. leucas* in its smaller larval shell, by having intervarical nodes and by its coloured shell. In *P. leucas,* there are several postlarval whorls with numerous varices (Fechter, 1977: fig. 11), while there are only 1 to 1.5 such whorls in *P. atlantideus. P. leucas* also reaches a larger size.

Pterynotus leucas (P. Fischer in Locard, 1897) Figs 343, 351-353

Murex leucas P. Fischer in Locard, 1897:306, pl. 15, figs 10-13.
Type material: Lectotype (selected here) in MNHN.
Type locality: TALISMAN st 71, 25°39 N, 15°58 W, 640 m.
Material examined: The type material and 6 additional spms + shs from the type locality (paralectotypes).

Remarks: We have included *P. leucas* for comparison with *atlantideus* although it lives outside the area covered by this series. It has not been found since the original description. The record in Fechter (1977) is based on *P. atlantideus.*

Figs 348-353. Genus *Pterynotus*. 348 and 349, *P. atlantideus*, BIACORES st 186, 21.0 mm. 350, *P. atlantideus*, BIACORES st 41, 27.0 mm. 351, 352 and 353, *P. leucas*, lectotype, 40.5 mm.



Figs 354-356. Genus *Orania*. 354, *O. fusulus,* SE Bay of Biscay, 160 m, 23.0 mm. 355, *O. fusulus,* apex 1.0 mm. 356, *O. grayi,* MONACO st 1242, 18.7 mm.

Genus *ORANIA* Pallary, 1900

Type species: Murex spadae Libassi, 1859, by original designation.

Synonym: Nemofusus Cossmann, 1903. *Type species: Murex fusulus* Brocchi, 1814, by original designation.

Remarks: We have kept the generic name *Orania* for *Murex fusulus* Brocchi. This species has usually been referred to *Pseudomurex* or *Urosalpinx*. It also resembles *Ocinebrina* and *Muricopsis*. *Pseudomurex* belongs to Coralliophilidae and has no radula, while *fusulus* has one. *Urosalpinx* differs considerably in radular characters and shell characters. *Ocinebrina* and *Muricopsis* have quite similar shells, compared with *fusulus,* but have a very distinct radula (Figs 345-346). (It should here be pointed out that the radula of *Ocinebrina aciculata* Lamarck (type species of *Ocinebrina*) was figured by Radwin & D'Attilio 1976, but their figure differs considerably from what we have seen.) We know of no other genus in common use where *fusulus* fits, and have therefore kept Pallary's genus, which was not included by Radwin & D'Attilio (1976). Lack of any well-fitting genus has also induced us to place *grayi* here, although it also resembles *Cytharomorula* Kuroda, 1953.

Pallary (1900) designated *Murex spadae* Libassi as type species, when describing the new genus *Orania*. There exists some doubt about the identity of *spadae* which was described as a Pliocene fossil (Kobelt 1887), but evidently Pallary introduced the new generic name for the Recent form, which should be considered the type species if more than one species proves to be involved.

Orania fusulus (Brocchi, 1814) Figs 347, 354-355

Murex fusulus Brocchi, 1814:409, pl. 8, fig. 9.
Murex spadae Libassi, 1859:43, pl. 1, fig. 29.
Murex spadae var. *tiberianus* Brusina, 1871, *fide* Settepassi, 1977.
Murex pyrrhias Watson, 1883:603.
Pollia fusulus var. *major* Locard, 1897:325, pl. 16, figs 14-16.
Pseudomurex spadae var. *obesa* & var. *minor* Pallary, 1900:287.
Pseudomurex spadae robustus Settepassi, 1977:3, pl. 1, fig. 4.
Pseudomurex spadae elongatus Pallary in Settepassi, 1977:2, pl. 1, fig. 6.

Type material: M. fusulus, holotype in Museo Civico di Storia Naturale, Milano, figured by Pinna (1978, pl. 33, fig. 2); *M. pyrrhias,* BMNH.
Type locality: M. fusulus, Pliocene of Val d'Ancona, N. Italy; *M. pyrrhias,* CHALLENGER st. 75, 38°38 N, 28°28 W, 830-920 m.

Material examined: The types listed and about 75 specimens and shells from the Bay of Biscay (northernmost record 45°43 N, 02°14 W, 160 m, 2 spms) to the Cape Verde Peninsula (95 — 200 m) and Tristao (Guinea) in the south (MNHN), the Azores and the western Mediterranean, where it seems to be rather common off the N African coast.

Distribution: The western parts of the Mediterranean, from Sicily (Monterosato, 1890), Corsica (Locard & Caziot, 1901), Oran, Algeria (Pallary, 1900), westwards to the Atlantic, where the extremes are given in "Material examined". It is known from 35–440 m.

Remarks: Murex fusulus has often been placed in *Pseudomurex* (Coralliophilidae), but it has a radula so it fits better in the Muricidae. This was already noticed by Kobelt (1887), but has not been mentioned by most later authors.

Orania fusulus has a smooth, multispiral larval shell, which indicates planktotrophic larval development.

When this paper was in press, the work by Sabelli & Tommasini (1983) was published, with anatomical datas.

Orania grayi (Dall, 1889) Figs 344, 356

Nassarina grayi Dall, 1889:183, pl. 32, fig. 12a.
Trophon lowei Watson, 1897:244, pl. 19, fig. 12.
Cantharus (Tritonidea) laevis Smith, 1890:261, pl. 21, fig. 11.

Type material: N. grayi, holotype USNM: *C. laevis,* 5 syntypes BMNH 89.10.1.2362-7.
Type locality: N. grayi, off St Kitts, W Indies: *T. lowei,* Madeira; *C. laevis,* St Helena.
Material examined: The types of *N. grayi* and *C. laevis;* J. CHARCOT MADERE st 49, 32°27 N, 16°32 W, 450-500 m, 1 sh; MONACO st 1242, Seine Bank, 240 m, 1 spm, 1 sh; TRAVAILLEUR 1882, dr 52, 32°30 N, 16°31 W, 100 m, 4 shs; no st number, 6 spms + shs; TALISMAN 1883, dr 53, 28°35 N, 13°19 W, 905 m, 2 shs; La Palma, Dacia Bank, Tenerife (Canaries), from fishermen, MNHN and private collections.

Distribution: Known from the Caribbean area, 100 — 200 m (Abbott, 1974) and some sea mounts and islands in the E Atlantic. Not known from European or African coasts.

Remarks: O. grayi was transferred to Muricidae by Radwin & D'Attilio (1976) who placed it in *Evokesia* Radwin & D'Attilio, 1972. We have, however, preferred to place it in the same genus as *O. fusulus.*

The larval shell is multispiral and indicates a planktotrophic larval development, which possibly contributes to the scattered distribution.

Family CORALLIOPHILIDAE

The taxonomy of the family Coralliophilidae is at present in a state of confusion, presumably because attention has been focused on the many extreme-looking species that represent the most far-reaching sprouts of the evolutionary tree, and give the least information about relations within the family. We have therefore not made any attempts to divide the species treated here into different genera, but use the generic name *Coralliophila* for all. We shall, however, give some nomenclatorial remarks on the generic names that have been in use for the NE Atlantic species.

Pseudomurex Monterosato, 1872 is the most often used name. D'Attilio (1978) and other authors have considered *Murex bracteatus* Brocchi, 1814, to be the type species, but Monterosato only included two species in his genus, viz. *Murex lamellosus* Jan (sic!) and *Murex spadae* Libassi. Later he restricted the genus to include only *M. lamellosus* and transferred *M. spadae* to *Pollia. M. spadae* is a muricid and is discussed on p. 150. Therefore Dautzenberg (1927) was correct when he designated *Fusus lamellosus* Philippi as type species of *Pseudomurex.*
Aradomurex Coen, 1943. Type species, *Murex sofiae* Aradas & Benoit, 1876.
Babelomurex Coen, 1922. Type species, *Fusus babelis* Requien, 1849.
Fusomurex Coen, 1922. Type species, *Murex alucoides* de Blainville, 1829 (not Olivi, 1792). A synonym of *Pseudomurex.*
Hirtomurex Coen, 1922. Type species, *Fusus lamellosus* Philippi, 1836.
Latimurex Coen, 1922. Type species, *Murex meyendorffi* Calcara, 1845.
Lepadomurex Coen, 1922. Type species, *Purpura brevis* de Blainville, 1832.

The species of Coralliophilidae live as parasites or predators on anthozoans. *Coralliophila brevis* has been found on at least three species of gorgonian (*Paramuricea chamaeleon, Eunicella stricta* and *Lophogorgia sarmentosa*) and *C. meyendorffi* has been found on *Anemonia sulcata* and *Cladocora cespitosa* (G. Spada, pers. comm.), so evidently they are not very host specific.

The species are quite rare in deep water, below the continental shelf, which makes a treatment of these species more difficult. The Mediterranean shallow-water species were discussed by Sabelli & Spada (1980) in a very useful paper, and by Settepassi (1977) who lists 14 names of specific rank and a multitude of lower ranking names.

We have examined the larval shells of all species discussed here except *C. sentix.* They proved to have a multispiral larval shell, of very uniform shape and sculpture (Figs 370-371, also Richter & Thorson 1975, figs 70-71). Because of the uniformity and also because it is normally corroded, even in young specimens, the larval shell is of almost no use for taxonomical purposes.

Pleurotomoides obliquispira Nordsieck, 1977, is based on a juvenile of a species of Coralliophilidae, but we are not able to say which species.

Genus *CORALLIOPHILA* H. & A. Adams, 1853

Type species: *Fusus neritoideus* Lamarck, 1816, by subsequent designation (Iredale, 1912).

Coralliophila richardi (P. Fischer, 1882) Fig. 368

Murex richardi P. Fischer, 1882:49.
Coralliophila lactuca Dall, 1889:220, pl. 16, fig. 6.
Pseudomurex richardi P. Fischer, Locard 1897:316, pl. 16, figs 3-8.

Type material: M. richardi, holotype in MNHN; *C. lactuca,* syntypes in USNM.
Type locality: M. richardi, TRAVAILLEUR 1881 dr 42, 44°01 N, 07°05 W, 896 m; *C. lactuca,* USFC st 2669, off Fernandina, Florida, 635 m.

Material examined: The type material and TRAVAILLEUR 1881 dr 39,44°05 N, 07°06 W, 953-1226 m, 1 spm; off N. Spain, 496 m, 1 spm; TALISMAN dr 10,35°26 N, 06°49 W, 717 m, 1 spm; SARSIA st 7614, 43°43 N, 03°38 W, 1100 m, 1 sh; MONACO st 553, 37°43 N, 25°05 W, 1385 m, 1 sh; st 584, 38°30 N, 26°50 W, 845 m, 1 spm; 43°58 N, 02°06 W, 320 m, Lagardère coll., 1 sh; W of Tampa, Florida, 400 m, 1 sh; EOLIS st 128, off Fowey Light, Florida, 110 m, 1 spm; st 166, off Ragged Key, 120 m, 1 spm, USNM; and the material reported by Taviani & Colantoni (1979) and Sabelli & Spada (1980).

Distribution: Both sides of the subtropical North Atlantic, in the upper bathyal zone. The species has been reported in the Mediterranean by Monterosato (1890:23), Taviani & Colantoni (1979:141), and Sabelli & Spada (1980:2) from empty shells. The species probably lives associated with Cnidaria of the *Lophelia*-reefs and is possibly now extinct in the Mediterranean.

Remarks: C. richardi is the most characteristic of the NE Atlantic species of *Coralliophila.* The axial sculpture consists of lamellose varices instead of solid ribs as in the other species. These lamellae are given a slightly fringed appearance by the spiral sculpture. It lacks the fine, squamulose sculpture characteristic of many species of the family.

Coralliophila panormitana (Monterosato, 1869) Fig. 369

Pyrula panormitana Monterosato, 1869: 17, fig. 9.

Type material: Not seen.
Type locality: Palermo, Sicily.

Material examined: About 20 spms from the Western Mediterranean and TALISMAN dr 63-64, 26°17 N, 14°52 W, 355-640 m, 1 spm.

Remarks: We have seen only one specimen from the Atlantic, but that one is very large in comparison with W Mediterranean specimens. It closely resembles, however, an unusually large specimen from the continental shelf off Mdiq (S Alboran Sea, coll. S. Gofas).

C. panormitana can be distinguished from *C. squamosa* and *C. basileus* by having a more inflated body whorl.

Coralliophila squamosa (Bivona, 1838) Figs 357-361

Murex alucoides de Blainville, 1830:128, pl. 5B, fig. 1 (not *Murex alucoides* Olivi, 1792: 153).
Fusus lamellosus de Cristofori & Jan in Philippi, 1836:204, pl. 11, fig. 30 (not *Fusus lamellosus* Borson, 1821:317).
Fusus squamulosus Philippi, 1836:204, pl. 11, fig. 31 (not *Fusus squamulosus* Deshayes, 1835:540).
Fusus squamosus Bivona, 1838:14, fig. 22.
Pseudomurex perfectus P. Fischer, 1882:274 (nomen dubium).
Pseudomurex ruderatus Monterosato in Sturany, 1896:25, pl. 2, figs 42-43.
Pseudomurex monterosatoi Locard, 1897:315, pl. 15, figs 21-23.
In addition, the names *(Coralliophila) inflata, elongata, turris, longicauda, depressa, curta, squamulata, modesta* and *(Ocinebrina) pianosana* have been introduced by Settepassi (1977).

Type material: F. squamosus, neotype in MNHN; *P. ruderatus*, syntypes in NHMW; *P. monterosatoi*, syntypes in MNHN.
Type locality: F. squamosus, Palermo and Messina, Sicily; *P. ruderatus,* Corsica; *P. perfectus,* TRAVAILLEUR 1882, Atlantic (probably N. Spain), 400 m; *P. monterosatoi,* TRAVAILLEUR 1882, dr 1 & 2, 44°05—44°07 N, 05°35 W, 564-608 m.

Material examined: the type material listed; *c.* 250 spms and shs from shallow water (60-200m) in the Mediterranean; and TALISMAN dr 63-64, 26°18 N, 14°52 W, 640 m, 6 spms; MONACO st 503, 47°10 N, 05°48 W, 748-1262 m, 2 spms; st 684, 38°20 N, 28°05 W, 1550 m, 1 spm; st 2720, 36°42 N, 08°40 W, 310-749 m, 1 sh; THALASSA st W399, 43°48 N, 05°11 W, 165-210 m, 1 sh; st W424, 44°02 N, 07°09 W, 300-700 m, 1 sh; st Y377, 41°32 N, 09°14 W, 320 m, 1 sh; st Y383, 41°26 N, 09°12 W, 420 m, 2 shs; 45°43 N, 02°14 W, 78 m, 2 shs, Lagardère coll.; METEOR st 36-98, 25°31 N, 16°02 W, 700-900 m, 2 spms.

Distribution: From the bay of Biscay, along the Iberian peninsula, the Mediterranean, NW Africa to the Canaries and the Azores. It occurs mainly on the continental shelf and in coastal water, but has occasionally been found on the upper part of the continental slope. Possibly also in the Caribbean area (Bayer 1971).

Remarks: The present species has usually been known under the names *alucoides* de Blainville, 1830 and *lamellosus* de Cristofori & Jan in Philippi, 1836. Both these names are, however, preoccupied, as is also the third name suggested by Philippi (1836). The name *Fusus squamosus* Bivona, 1838 is not preoccupied, but the description and figure are not very good. To avoid this problem we have selected a neotype from Corsica that agrees fairly well with Bivona's figure. Another name that has been in use for the present species is *bracteatus* Brocchi, 1814. The name was based on a Pliocene fossil. The type has been figured by Rossi-Ronchetti (1955), Pinna & Spezia (1978) and we have personally examined it in Museo Civico di Storia Naturale, Milano; we find it more like the Recent W African *C. angolensis* Knudsen. We think that Knudsen's species is the Recent descendant of *C. bracteata,* as is the case for many other Italian Pliocene species, the descendants of which now live in W Africa.

The names introduced by Settepassi (1977) need no comments.

C. squamosa occurs in coastal waters and on the shelf in the Mediterranean (but seems to be absent from the continental slopes). Such specimens are characterized by having a strongly squamose sculpture, well-defined siphonal canal and a rather high spire. Atlantic specimens have a broader and more open siphonal canal and reach a larger size (50 mm instead of 40 mm maximum size). In these respects the Atlantic form approaches fossil shells from old coral associations in the Mediterranean, reported by Taviani & Colantoni (1979).

For a discussion of *basileus,* see that species, and for separation from the Mediterranean shallow-water species, see Sabelli & Spada (1980). Bayer (1971) reported *C. lamellosa* (= *squamosa*) from the Caribbean area and synonymized it with *Trophon lintoni* Verrill & Smith, 1882. We have examined this and additional material in USNM. We agree that there are specimens that closely resemble *squamosa,* although the specimen figured by Bayer (fig. 51) more closely resembles *basileus.* Other facts also, like the occurrence at the Azores and the presence of planktotrophic larvae, suggest an amphiatlantic distribution, but the chaotic state of the taxonomy of the Caribbean Coralliophilidae makes it impossible to coordinate the names of the species without a complete revision of the W Atlantic species.

Coralliophila basileus (Dautzenberg & H. Fischer, 1896) Figs 362-366

Pseudomurex basileus Dautzenberg & H. Fischer, 1896: 440, pl. 18, fig. 3.

Type material: Holotype in MOM.
Type locality: MONACO st 233, 38°33 N, 28°08 W, 1300 m.

Material examined: The type material and MONACO st 105, 38°23 N, 28°31 W, 927 m, 1 spm; st 247, 38°24 N, 28°01 W, 318 m, 1 spm; st 680, 38°19 N, 28°08 W, 1550 m, 1 sh; TALISMAN dr 53, 28°35 N, 13°09W, 905 m, 1 sh; dr 63-64, 26°18 N, 14°52 W, 640 m, 3 spms + shs; dr 122, 37°35 N, 29°26 W, 1440 m, 1 spm; BIACORES st 4, 38°11 N, 28°38 W, 1080-1200 m, 1 spm; st 148, 37°34 N, 25°34 W, 847-870 m, 5 spms; st 151, 37°37 N, 25°39 W, 780-788 m, 1 spm; st 180, 37°57 N, 25°33 W, 1069-1235 m, 2 spms; st 230, 36°54 N, 25°09 W, 665-712 m, 1 spm.

Distribution: The upper part of the continental slope around the Azores and the Canaries.

Remarks: We are not convinced that *basileus* is truly distinct from *squamosus,* but as we have no definite proof we have preferred to keep them distinct. There is a difference in shape, *basileus* having a broader siphonal canal that is less set off from the aperture, and in size, *basileus* barely exceeding half the size of *squamosus.* There is also a difference in distribution. *C. basileus* occurs only around the Azores and the Canaries, while it is not known from the E Atlantic coasts. *C. squamosus* also occurs around these islands, but its main distribution is Mediterranean and along the S European and N African coasts. The two forms thus occur sympatrically in the Atlantic islands, but we have not seen specimens of both forms in a single dredge haul (except a TALISMAN sample, from several stations), which indicates some degree of separation. The two forms are very variable and we have not examined very large numbers, so we prefer to leave the question of conspecificity unsettled.

A second possibility, although we find it less probable, is that *C. basileus* is a local form of *C. brevis* (de Blainville, 1826). That species, however, has a thinner shell and the aperture, at least in adult specimens, is deformed by its sessile life on gorgonians, which we never have seen in *basileus.*

Coralliophila sentix (Bayer, 1971) Fig. 367

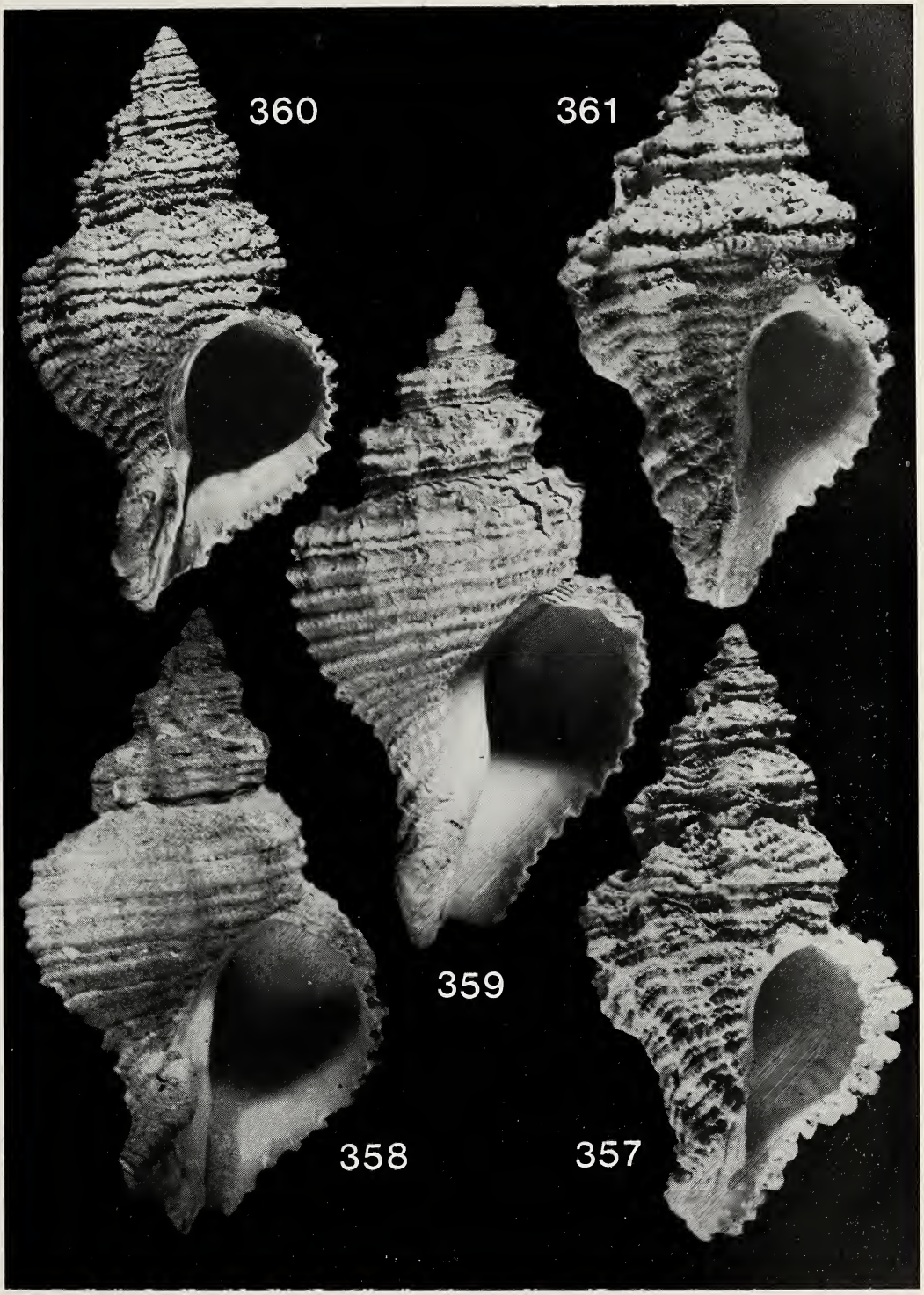
Coralliophila sentix Bayer, 1971: 189, fig. 49.

Type material: Holotype USNM 701155.
Type locality: PILLSBURY st P876, 13°14 N, 61°05 W, 231-258 m (Lesser Antilles).

Material examined: The type material and MONACO st 112, 38°34 N, 28°06 W, 1287 m, 1 sh; BIACORES st 41, 37°43 N, 29°04 W, 450-475 m, 1 spm; st 236, 37°21 N, 25°45 W, 470-500 m, 1 spm; Alboran Sea? (taken by fishermen), 2 shs, coll. G. Spada.

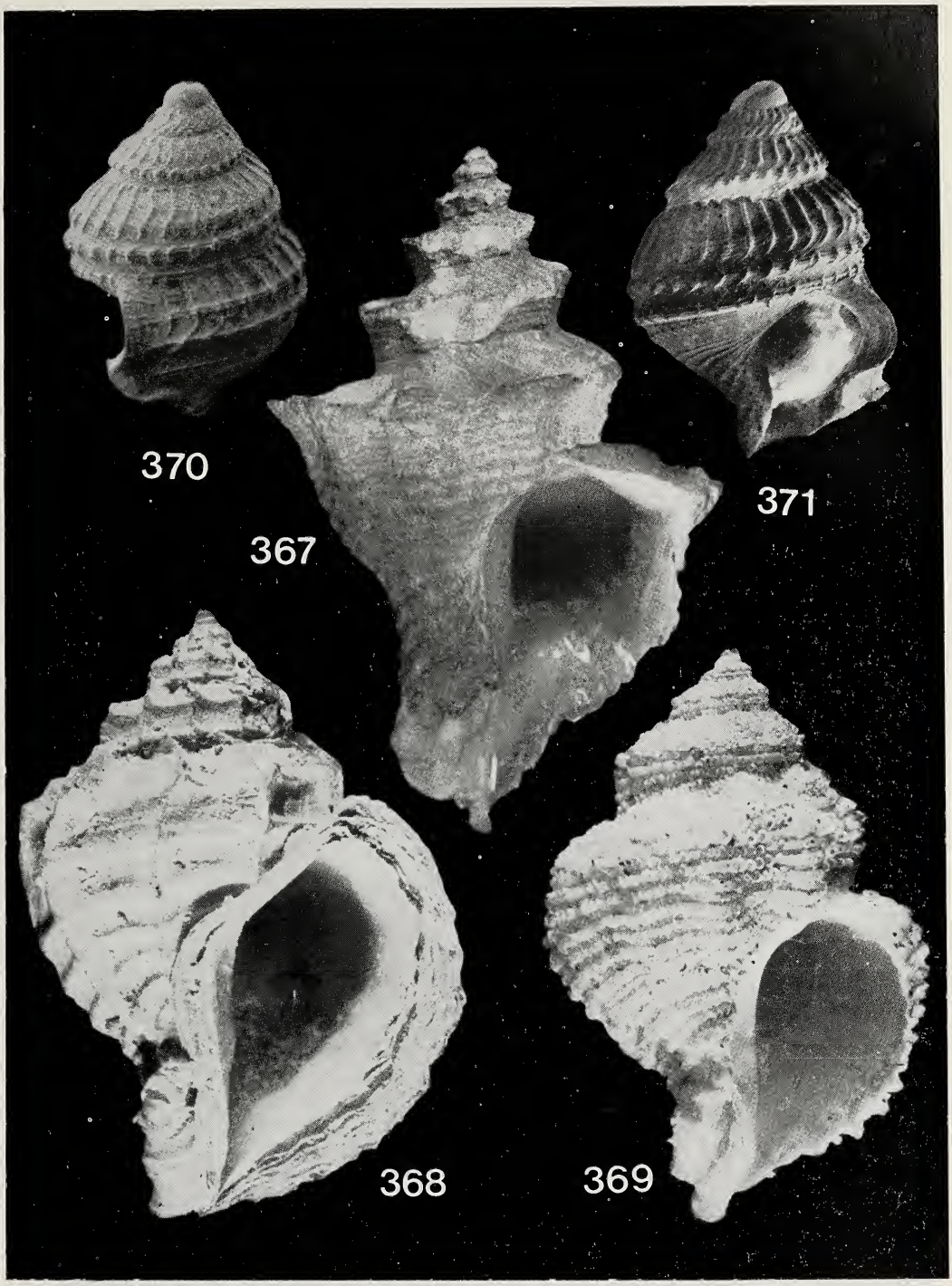
Distribution: The upper bathyal of the subtropical North Atlantic.

Remarks: Specimens from the W Atlantic have longer and more developed shoulder projections that join each other more extensively than those from the E Atlantic. We have, however, considered them conspecific. *C. fax* Bayer, 1971, from off Florida, has the same type of non-squamose sculpture as *C. sentix,* but has a broader shape, lower spire and a smoother shell. In the Atlantic only *C. juliae* Clench & Aguayo, 1939 shares the rather high spire and non-squamose sculpture, but it has more or less open coiling. No other Atlantic coralliophilid can be confused with them.



Figs 357-361. *Coralliophila squamosa*. 357, neotype, Calvi, 30.0 mm. 358, MONACO st 503, 49.3 mm. 359, MONACO st 54, 27.5 mm. 360, THALASSA st Y383, 40 mm. 361, syntype of *Pseudomurex ruderatus*, 23 mm.

Figs 362-366. *Coralliophila basileus*. 362, BIACORES st 4, 27.3 mm. 363, BIACORES st 180, 24 mm. 364, BIACORES st 148, 18.9 mm. 365, TALISMAN dr 53, 21.3 mm. 366, MONACO st 105, 18.7 mm.



Figs 367-371. Genus *Coralliophila*. 367, *C. sentix*, BIACORES st 236, 26.2 mm. 368, *C. richardi*, TRAVAILLEUR off NW Spain, 16.5 mm. 369, *C. panormitana*, TALISMAN dr 63-64, 24.7 mm. 370 and 371, *Coralliophila* larvae from plankton of Curaçao, 1.0 mm.

Family NASSARIIDAE

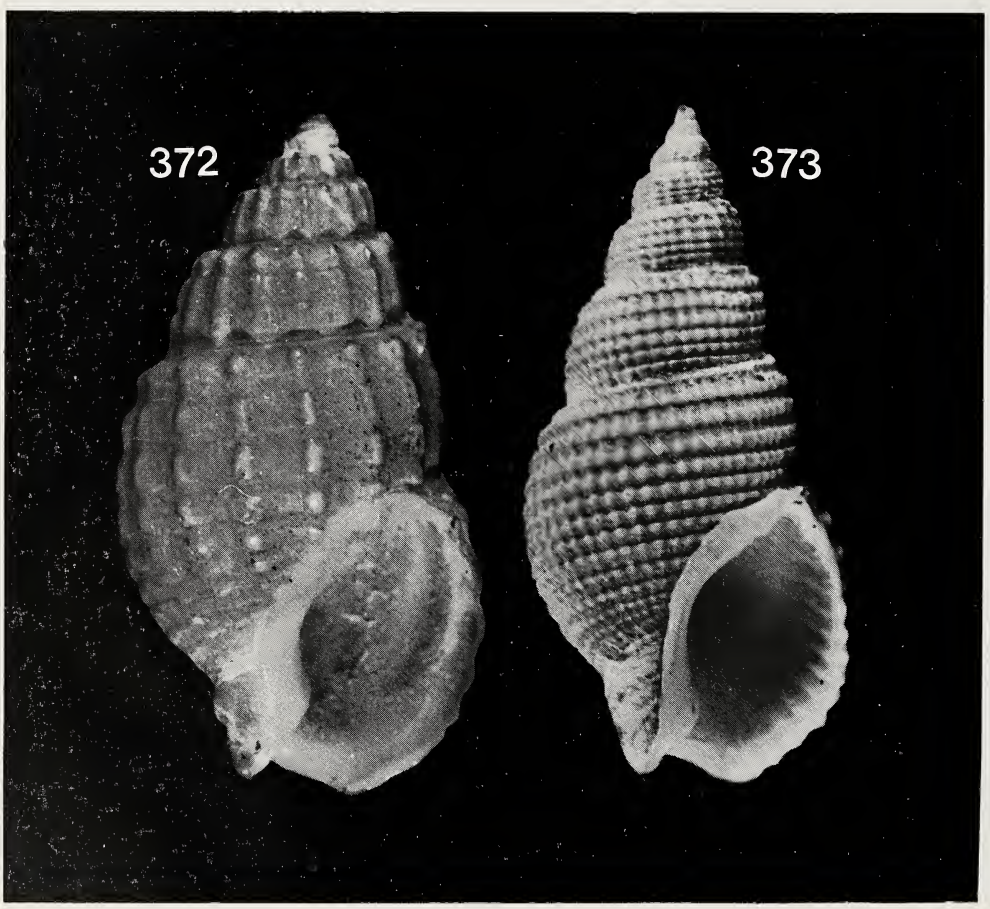
Genus *NASSARIUS* Duméril, 1806

Type species: Buccinum arcularia Linné, 1758.

Remarks: Only two nassariid species can be considered to belong to the deep sea fauna, and they occur in the uppermost bathyal zone and on the shelf. A few additional species are known from the NW African shelf and were treated by Adam & Glibert (1974, 1976).

Nassarius wolffi (Knudsen, 1956) Fig. 373

Nassa wolffi Knudsen, 1956:58, pl. 1, fig. 7.
Nassa sadurnii Bot, 1972:15.
Hinia frigens malacitanae Ghisotti & Spada in Maldonado, 1973:233, pl. 3.
Type material: N. wolffi, holotype in ZMC.



Figs 372-373. Genus *Nassarius.* 372, *N. frigens,* TALISMAN dr 82, 16.9 mm. 373, *N. wolffi.* Dakar, 200-300 m, 34.6 mm.

Type locality: N. wolffi, ATLANTIDE st 120, 02°09 N, 09°27 E, 260-650 m; *N. sadurnii,* off Huelva, Spain, 1500-2000 m; *H. frigens malacitanae,* triangle between Huelva, Casablanca and Gibraltar, 1400 m and the Alboran Sea, 500 m.

Material examined: The type material mentioned and Cabo Frio, SW Africa, 1 sh; WALDA st CM01, 20° 24 S, 12°31 E, 256 m, 8 spms; 05°00 S, 11°21 E, 296-308 m, 14 spms, 4 shs, Crosnier coll.; off Abidjan and Grand Bassam, Ivory Coast, 13 shs; W. of Jacqueville, 05°30 W, 200-400 m, 5 spms, Le Loeuff coll.; off Dakar, 200-300 m, 5 spms, Marche-Marchad coll.; PILLSBURY 1966, st 254, 03°50 N, 07°08 E, 148-174 m, 7 spms; st 255, 03°49 W, 07°38 E, 269-264 m, 9 spms. See also "Remarks".

Distribution: The upper bathyal of West Africa, from Namibia to Senegal at least; doubtful records further to the north (see below).

Remarks: Although the type material of *N. sadurnii* has never been figured and we have not examined it, there is no doubt that the name is a synonym of *wolffi.* In a letter of November 1975 Mr J. Bot informed us that his species is very close to *Nassa wolffi* Knudsen. He said he had seen material from Angola with all the characters of *sadurnii.* The same species was again described by Maldonado (1973) from specimens taken by shrimp trawlers. In the same paper, Ghisotti & Spada argued that the description of *Nassa sadurnii* Bot did not meet the requirements of ICZN because it was not accompanied by an illustration. At the same time (p. 234) they "provisionally name" Maldonado's material *Hinia frigens malacitanae* n.ssp. "until further material can be studied for a definitive identification". In fact Bot's description is perfectly valid, while Ghisotti & Spada do not fulfil the requirements of ICZN §15 which states that "after 1960, a new name proposed conditionally (...) is not available".

N. wolffi has been recorded a few times from the W Mediterranean, but all records are based on specimens with unreliable locality information, taken by fishing boats and said to come from the Alboran Sea and the fishing grounds off Catalonia. It is possible that the species occurs in the W Mediterranean, but the records need confirmation.

N. wolffi has a smooth larval shell of 2.5 whorls, which indicates planktotrophic larval development.

Nassarius frigens (von Martens, 1878) Figs 372, 387

Nassa frigens von Martens, 1878:134; 1881:14, pl. 22, figs 17-18.
Nassa brychia Watson, 1882:365; 1886:189, pl. 11, fig. 15.
Nassa brychia vars. *decorata, major* and *minor* Locard, 1897:274.

Type material: N. frigens, holotype in the ZMHU; *N. brychia,* holotype in BMNH (figured by Cernohorsky 1975:157, fig. 77).
Type locality: N. frigens, GAZELLE 10°13 N, 17°25 W, 650 m; *N. brychia,* CHALLENGER st 8, 28°03 N, 17°27 W, 1135 m.

Material examined: The type of *N. brychia* and TALISMAN dr 82, 23°00 N, 17°30 W, 932 m, 2 shs; dr 83 and 85 (mixed samples), 22°52-22°57 N, 17°23-17°30 W, 830 m, 9 spms+shs; dr 87, 22°03 N, 17°23 W, 1013-1113 m, 9 spms+shs; dr?, 820-860 m, 32 spms+shs; off Dakar, 150-250 m, 4 shs, Marche-Marchad coll.; off Abidjan, 1 sh, Le Loeuff coll.; PILLSBURY 1966 st P44, 05°05 N, 04°00 W, 586-403 m, 15 spms+shs; ATLANTIDE st 135, 07°55 S, 12°38 E, 235-460 m, 1 spm.

Distribution: Beside the material cited above, the species is known from Angola, in 225-750 m (Adam & Knudsen 1955:10).

Remarks: All the shells have corroded apices, so the type of larval development is not known. We have not examined the type of *N. frigens,* but our material fits with the specimens figured and described by Adam & Knudsen (1955) who had examined the type.

N. frigens bears some resemblance to *Profundinassa* Thiele, 1929 (type species *Nassa babylonica* Watson, from the bathyal zone of the Philippines). Typical species of *Profundinassa* are present in the Pliocene of Sicily (Moroni & Torre 1966:32, pl. 1, fig. 7).

Family FASCIOLARIIDAE

We follow Ponder (1973) and include the "fusinid" genera in Fasciolariidae. Several genera have been proposed for the shallow water species of S Europe:
Aptyxis Troschel, 1868. Type species *Fusus syracusanus* Linné.
Gracilipurpura Jousseaume, 1880. Type species *Fusus strigosus* Lamarck (= *rostratus* Olivi, 1792, not Solander in Brander, 1766).
Pseudofusus Monterosato, 1884. Type species *Murex rostratus* Olivi, 1792, here designated.
Sinistralia H. & A. Adams, 1853. Type species *Murex maroccensis* Gmelin.

We figure the radulae for the type species of these genera (figs 380, 381, 385). Of these it is only *Aptyxis* that shows any difference in the central tooth, which has longer and more slender cusps. This genus also differs in its shell characters and could probably be kept as a subgenus. We consider the other genera synonyms of *Fusinus* Rafinesque, 1815.

The family has very few species in deep water in the NE Atlantic. We recognize three species, but the names below need some comments.

Clathurella rugosissima Locard, 1897. The holotype in MNHN is an extremely worn old shell, probably a *Lathyrus,* but too poor to be identified. It is probably a shallow-water species.

Pseudofusus gigliolii Monterosato, 1890. The species was described from specimens taken by the WASHINGTON expedition, without any information about the locality, but the expedition dredged around Sardinia and Sicily. Nothing is mentioned about this name by D'Amico (1912), who prepared a report on the Mollusca. The type material could not be found in ZMR, although it was figured by Franchini & Zanca (1977). We have however examined specimens taken by the MONACO expeditions and the geological cruises of BANNOCK (in Istituto di Geologia, Bologna), that correspond with Monterosato's description and the figures of Franchini & Zanca. From this we conclude that *gigliolii* was based on the same white, slightly-keeled, deep-water form of *rostratus* as *bengasiensis.*

Fusus bengasiensis Sturany, 1896. We have examined the holotype in Naturhistorisches Museum, Wien. It is an old, broken specimen of a form of *Fusinus rostratus,* known as var. *carinata* Monterosato in Bucquoy, Dautzenberg & Dollfus, 1882.

Pseudofusus locardi Pallary, 1904, is based on Locard's figures (1897, pl. 16, figs 26-30) of "*Fusus rusticulus* Monterosato". The specimen came from 530 m, off Morocco. Examination of the specimen in question showed that it is a specimen of *F. rostratus.*

It may be mentioned here that the name *Murex rostratus* Olivi 1792 actually is preoccupied by Solander in Brander's use of the name (1766). The next name available seems to be *Murex sanctaeluciae* von Salis, 1793, but a change of name should not be done until the shallow-water species are carefully revised, to avoid unnecessary name changes.

The genus *Troschelia,* which usually has been placed in Fasciolariidae, is here regarded to belong to Buccinidae.

Genus *FUSINUS* Rafinesque, 1815

New name for *Fusus* Lamarck, 1799, not Helbling, 1779.
Type species: Murex colus Linné, 1758, subsequent designation by Schumacher, 1817.
Remarks. See remarks on the family.

Fusinus bocagei (P. Fischer, 1882) Figs 374-375, 383

Trophon rugosus Jeffreys, 1880:318 (nom. nud.).
Fusus bocagei P. Fischer, 1882:49.
Fusus azoricus Dautzenberg, 1889:32, pl. 2, fig. 3.
Fusus bocagei vars. *major, minor, ventricosa, longicaudata, ecaudata* Locard, 1897:329.

Type material: F. bocagei: lectotype in MNHN; *F. azoricus:* holotype in MOM.

Type locality: F. bocagei: TRAVAILLEUR 1881, dr 1 or dr 2, 43°01 N, 09°37 W, 2018 m or 41°43 N, 09°19 W, 1068 m (mixed labels); *F. azoricus:* MONACO st 112, 38°34 N, 28°06 W, 1287 m.

Material examined: The type material and many samples from MONACO, BIACORES and TALISMAN around the Azores; the shallowest record is from BIACORES st 168, 225-260 m, 12 spms; 18 samples with 173 spsm + shs in 250-500 m; 15 samples with 232 spms + shs in 500-750 m; 11 samples with 96 spms + shs in 750-1000 m; 3 samples with 7 spms + shs in 1000-1500 m; the deepest samples are BIACORES st 235, 2085-2115 m, 1 spm, 1 sh; BIACORES st 171, 3215 m, 1 spm. Material outside the Azores: TRAVAILLEUR 1882, dr 2, 44°05 N; 05°36 W, 608 m, 5 spms + shs; dr 3, 44°04 N, 05°34 W, 512 m, 2 spms; TALISMAN 1883, dr 90, 21°51 N, 17°28 W, 175 m, 1 sh; dr 111, 16°52 N, 25°10 W, 590 m, 32 spms; MONACO st 66, 43°12 N, 09°32 W, 363 m, 1 sh; st 475, 37°52 N, 09°16 W, 552 m, 2 shs; st 1190, 15°14 N, 23°04 W, 628 m, 2 spms; THALASSA st W401, 43°57 N, 05°29 W, 630-920 m, 1 sh; st W407, 43°54 N, 06°06 W, 960-1200 m, 1 sh; st W414, 43°51 N, 06°10 W, 520-625 m, 1 sh; st W415, 43°55 N, 06°11 W, 860-1150 m, 2 spms; st W423, 44°04 N, 07°07 W, 710-1070 m, 1 sh; st Y372, 41°34 N, 09°17 W, 800 m, 1 spm; st Y385, 41°19 N, 09°14 W, 810 m, 2 shs; st Y400, 40°46 N, 09°19 W, 800 m, 1 sh; st Z421, 48°22 N, 09°33 W, 950 m, 1 sh; CALYPSO, Gorringe Bank, 510 m, 3 shs; METEOR, st 36-98, 25°31 N, 16°02 W, 700-900 m, 1 sh.

Distribution: The upper part of the continental slope, from the Bay of Biscay, south to the Cape Verde Islands and the Azores. Unkown in the Mediterranean.

Remarks: Fusinus sectus (Locard, 1897) from 882 m, off Mauretania is probably a distinct species. The whorls increase their diameter more rapidly, there are more numerous axial ribs and the siphonal canal is distinctly curved in that species. It is known from the holotype only. Its larval shell is too corroded to allow examination.

The animal of *F. bocagei* has eyes. The larval shell consists of three whorls, the last with indistinct axial ribs, and indicates planktotrophic larval development.

The species here called *Fusinus* sp. and also *F. rostratus* can be distinguished from *F. bocagei* by having a paucispiral larval shell.

Fusinus amiantus (Dall, 1889) Figs 377-378, 386

Fusus amianta Dall, 1889:169, pl. 15, fig. 11.
Fusus grimaldii Dautzenberg & Fischer, 1896:434, pl. 18, figs 10-11.
Fusus grimaldii var. *major* Locard, 1897:330
Meyeria decorata Locard, 1897:337, pl. 16, figs 31-34.
Meyeria decorata var. *ecaudata* Locard, 1897:338.

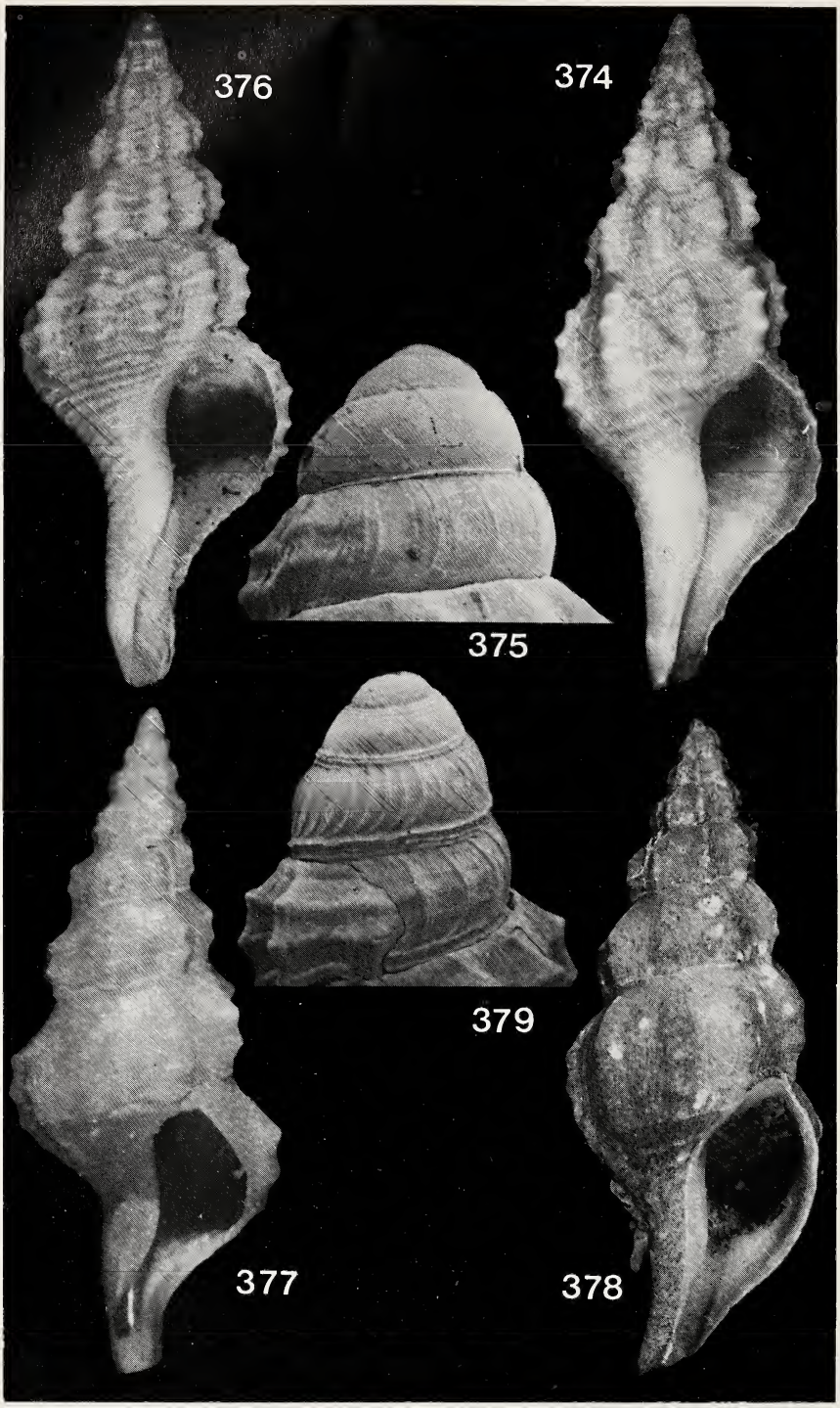
Type material: F. amiantus, holotype USNM 508726; *F. grimaldii,* holotype in MOM; *M. decorata,* 3 syntypes in MNHN.

Type localities: F. amiantus, off Havanna (Cuba), 1480 m; *F. grimaldii,* MONACO st 213, 39°23 N, 31°25 W, 1384 m; *M. decorata,* TALISMAN 1883 dr 127, 38°38 N, 28°21 W, 1257 m.

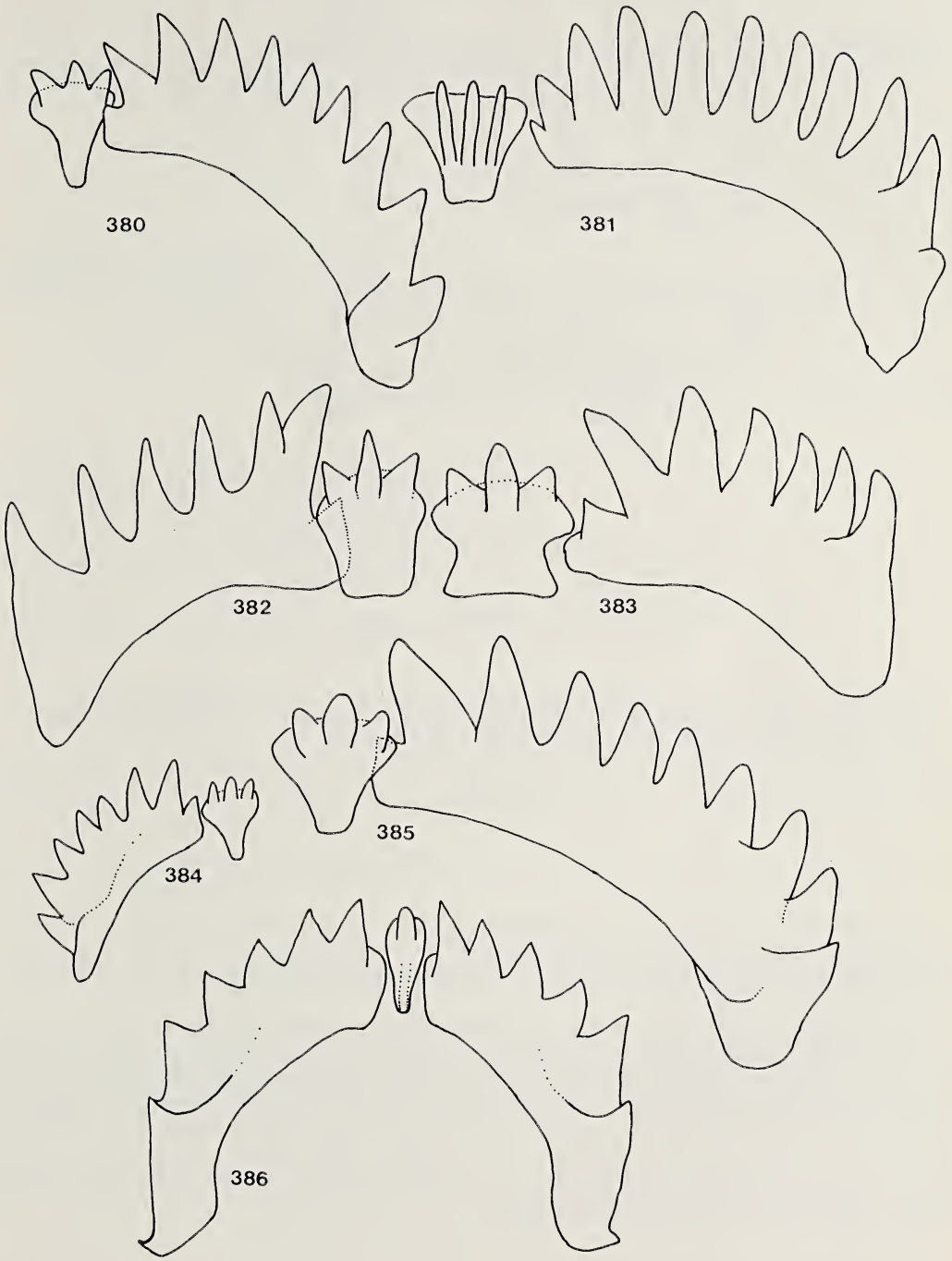
Material examined: The type material and MONACO st 703, 39°21 N, 31°06 W, 1360 m, 4 shs; st 719, 39°11 N, 30°24 W, 1600 m, 6 shs; st 743, 37°36 N, 25°17 W, 1494 m, 1 sh; st 1338, 38°41 N, 28°45 W, 950 m, 1 sh; st 1349, 38°35 N, 28°06 W, 1250 m, 1 sh; st 3293, 38°47 N, 30°16 W, 1331 m, 2 shs; TALISMAN dr 122, 37°35 N, 29°26 W, 1440 m, 4 spms; dr 127, 38°38 N, 28°21 W, 1257 m, 15 spms + shs; BIACORES st 66, 38°34 N, 28°19 W, 1225-1260 m, 1 spm; st 179, 38°05 N, 25°46 W, 1590-1665 m, 1 spm.

Distribution: The continental slopes of the Azores and the N Caribbean.

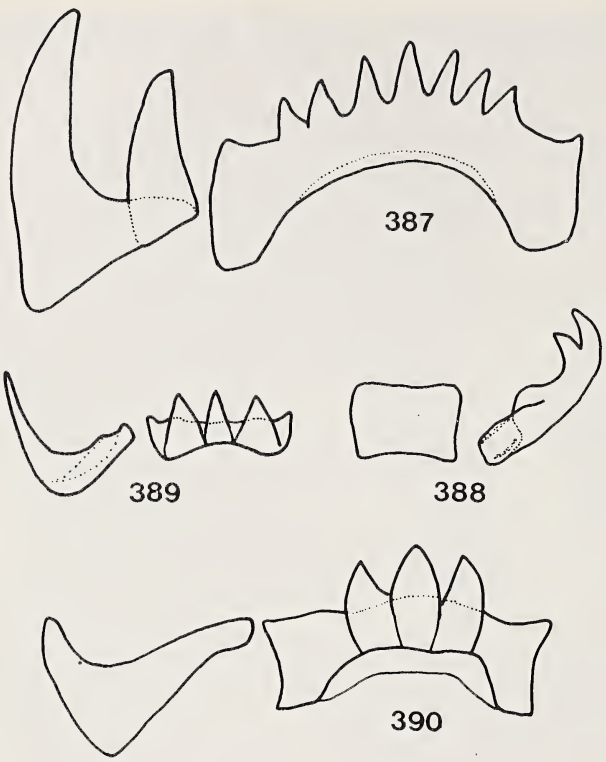
Remarks: F. amiantus can be distinguished from *F. bocagei,* by having much finer spiral sculpture and by having more pointed knobs on the axial ribs. Also the larval shells differ: *F. amiantus* has more distinct axial ribs and 2 or 3 spiral cords just above the suture, instead of a single cord as in *F. bocagei.*



Figs 374-379. Genus *Fusinus*. 374, *F. bocagei*, BIACORES st 212 (37°18 N, 24°45 W, 610 m), 26.0 mm. 375, *F. bocagei*, larval shell, 900 μm. 376, *F.* sp., TRAVAILLEUR 1882 dr 39, 16.5 mm. 377, *F. amiantus*, holotype, 15.6 mm. 378, *F. amiantus*, BIACORES st 66, 24.5 mm. 379, *F. amiantus*, larval shell. 1100 μm.



Figs 380-386. Fusinid radulae. 380, *Sinistralia elegans* (Reeve), height of central tooth 29 μm. 381, *Aptyxis syracusanus,* 28 μm. 382, *Granulifusus nipponicus,* 39 μm. 383, *Fusinus bocagei,* 35 μm. 384, *Fusinus pulchellus,* 19 μm. 385, *F. rostratus,* 32 μm. 386, *F. amiantus,* 25 μm.



Figs 387-390. Radulae. 387, *Nassarius frigens,* breadth of central tooth 110 μm. 388, *Mitrella nitidulina,* 30 μm. 389, *Metzgeria gagei,* 47 μm. 390, *Latiromitra barthelowi,* 80 μm.

Fusinus sp. Fig. 376

Fusinus gigliolii, Locard 1897:332, pl. 16, figs 21-25.
Material examined: TRAVAILLEUR 1882, dr 38, 34°13 N, 07°43 W, 636 m, 1 sh; dr 39, 34°11 N, 07°39 W, 530 m, 2 shs.

Remarks: Locard considered the specimens listed above to be *Fusinus gigliolii* (Monterosato). We consider *F. gigliolii* a deep-water form of *F. rostratus* (Olivi), but find Locard's specimens to differ from any *F. rostratus* we have examined, in having a larger larval shell and more regularly convex whorls, a more slender spire and a more curved siphonal canal. The specific distinction is supported by the fact that *F. rostratus* was found at st 39, (listed by Locard under the name *Fusus rusticulus* Monterosato and later named *Pseudofusus locardi* Pallary, 1904) together with *Fusinus* sp. The diameter of the larval shell of *Fusinus* sp. is 1.3—1.4 mm, while *F. rostratus* varies from normally 700 μm, up to 1.2 mm (in deep-water specimens).

We prefer to leave this form undescribed until more material is known.

Family COLUMBELLIDAE

The genera of W Atlantic Columbellidae are treated by Radwin (1977-1978), who however was concerned mainly with shallow-water species. We have transferred *Nassarina grayi* Dall from the Columbellidae to the muricid genus *Orania.*

Genus *AMPHISSA* H. & A. Adams, 1853

Type species: Buccinum corrugatum Reeve, 1847.
Remark: The type species lives on the continental shelf of the American North Pacific.

Amphissa acutecostata (Philippi, 1844) Figs 392, 395-398

Fusus costulatus Cantraine, 1835:393 (non *Fusus costulatus* Lamarck, 1822).
Buccinum acutecostatum Philippi, 1844:192, pl. 27, fig. 14.
Buccinum testae Aradas, 1847:84 (*fide* Monterosato 1878:104).
Columbella haliaeeti Jeffreys, 1867:356, pl. 6, fig. 5.
Columbella haliaeeti var. *albula* Jeffreys, 1869:219, pl. 88, fig. 3.
Bela grimaldii Dautzenberg, 1889:26, pl. 2, fig. 2.
Bela limatula Locard, 1896:141, pl. 5, fig. 3.
Anachis costulata vars. *major, minor, elongata, costulata* (all *nomina nuda*) Locard, 1897:145.
Anachis haliaeeti vars. *major, curta, costulatissima, attenuata* Locard, 1897:149.
Anachis nicolayi Nordsieck, 1974:12, fig. 14.

Type material: B. acutecostatum, not located; *C. haliaeeti,* lectotype USNM 191601; *B. grimaldii,* holotype in MOM; *B. limatula,* lost; *A. nicolayi,* holotype in coll. Giannini.

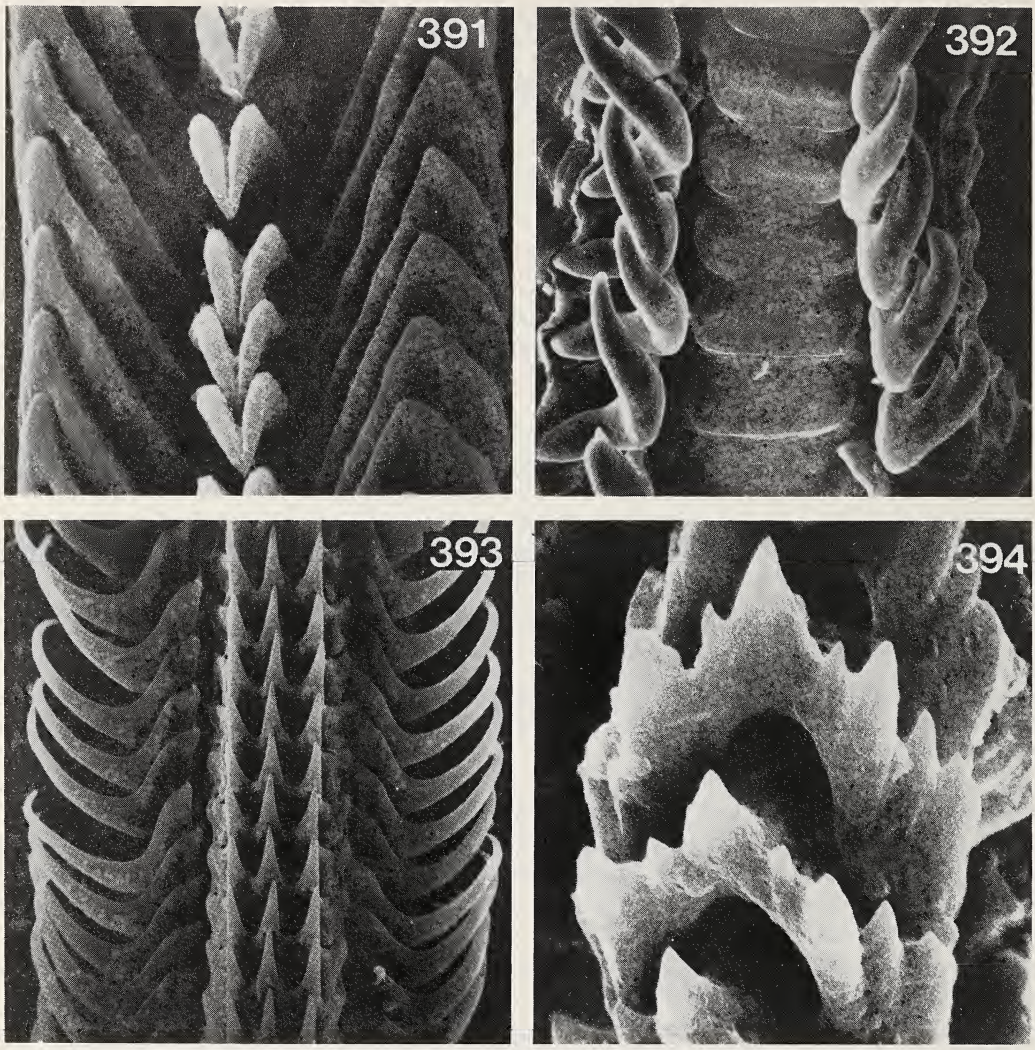
Type locality: F. costulatus, Pleistocene, Pelore, S. Italy; *B. acutecostatum,* fossil "in Calabria inter Stilo et Monasterace"; *C. haliaeeti,* 25 miles NNW of Unst, Shetland, 155-175 m; *B. grimaldii,* MONACO st 112, 38°34 N, 28°06 W, 1287 m; *B. limatula,* CAUDAN st 14, 44°05 N, 02°25 W, 960 m; *A. nicolayi,* Cape Comino, Corsica.

Material examined: The types of *haliaeeti, grimaldii* and *nicolayi;* over 1500 spms from all parts of the distribution area, USNM, MNHN, BMNH, ZMC.

Distribution: From the Lofoten Is. southwards on the outer banks off the Norwegian coast in 150-700 m; along the continental slope of the British Isles, the Bay of Biscay and south to 31°43 N (MONACO st 116); the bathyal of the Mediterranean and the Azores; S of Iceland (Thorson 1941:75, and INGOLF material in ZMC); also off northern N America south to North Carolina.

Remarks: The present species has usually been known under the name *Amphissa costulata* or *A. haliaeeti.* The name of Cantraine (1835) is however preoccupied by *Fusus costulatus* Lamarck, 1822. The second available name, *B. acutecostatum* was used by Locard (1897) without any comments, although Watson (1886) who had received specimens supposed to be *acutecostatum* from Seguenza, wrote that he had "no doubts that the *Buccinum acutecostatum* is *not* the *Columbella haliaeeti* Jeffreys". Dautzenberg (1927) on the contrary, said he could see no differences between Recent specimens and fossil *acutecostata* that he had received from Monterosato. He apparently used the name *costulata* because it escaped his notice that it was preoccupied. None of these authors figured any fossil specimens to support their conclusions.

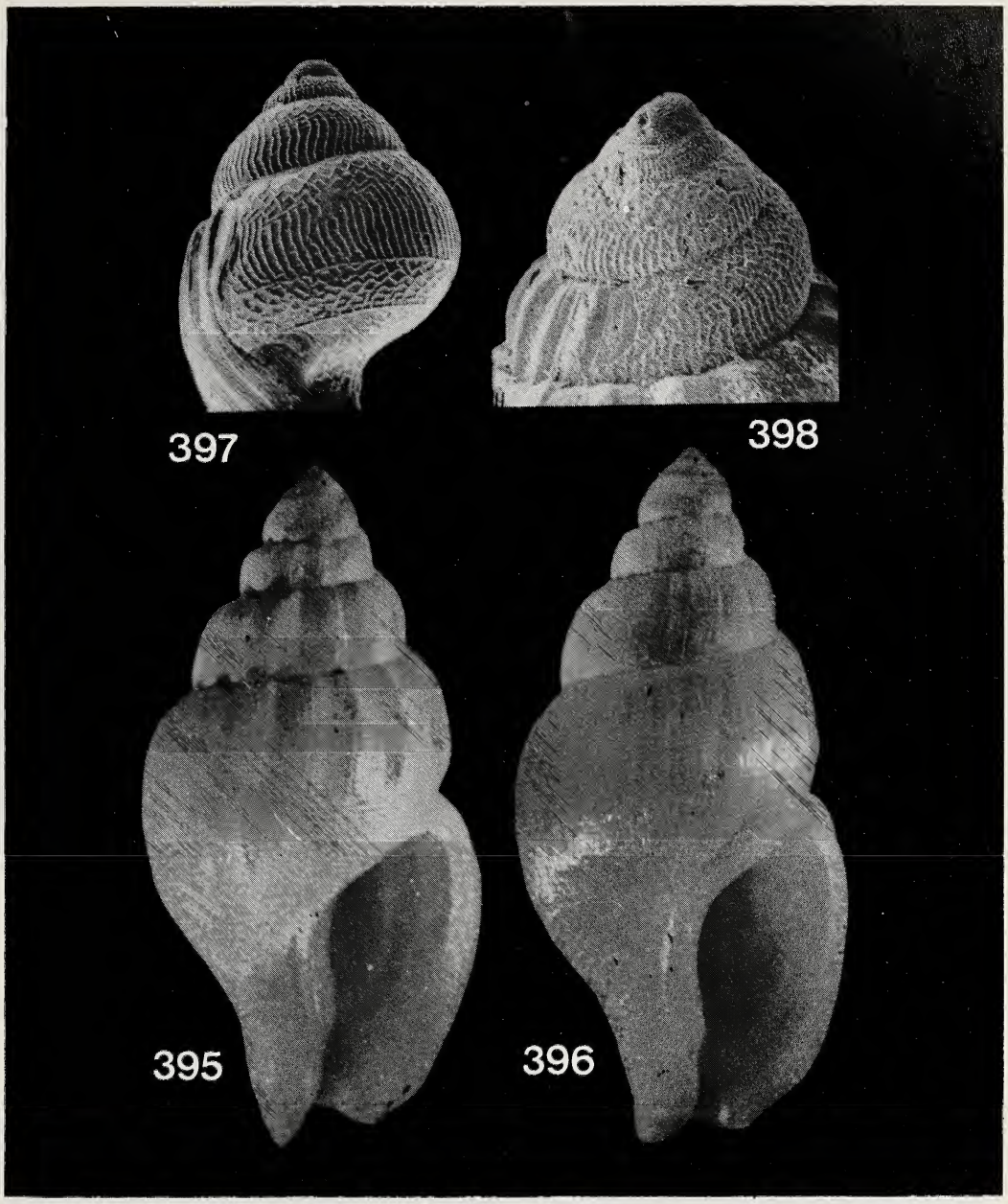
Through the kindness of S. Palazzi, we have been able to examine fossil specimens from S Italy (Boretto) that agree well with Philippi's description and occur in deposits having a similar fauna as Philippi's specimens. Fig. 398 shows the larval shell of such a specimen. We have not been able to find any difference from Recent specimens and conclude that *acutecostatum* is the correct name for the Recent species too.



Figs 391-394. Radulae. 391, *Volutomitra groenlandica,* breadth of (central) tooth 57 μm. 392, *Amphissa acutecostata,* 55 μm. 393, *Metzgeria alba,* 45 μm. 394, *Gibberula abyssicola,* 20 μm.

A. acutecostata is a rather variable species. Mediterranean specimens tend to be uniformly rather solid, in shallow water with blotches of light tan. Atlantic specimens are white or greyish and the solidity of the shell is variable. The development of the axial ribs is variable, even in a single population.

The larval shell is multispiral and has an elaborate sculpture (Fig. 397). It has been figured by Bouchet (1977) and Bouchet & Warén (1979) as *A. haliaeeti.* Simroth (1895) and Richter & Thorson (1975) obtained the larva in plankton (described as *C. haliaeeti* and species 4 respectively). Bouchet & Fontes (1981) examined the isotope composition of the larval shell and concluded that the larval shell had been formed in more shallow water than the postlarval shell.



Figs 395-398. *Amphissa acutecostata*. 395 and 396, THALASSA st Z442 (48°55 N, 11°02 W, 975 m), 7.0 and 6.1 mm. 397, larval shell of a recent specimen, 1025 μm. 398, larval shell of a Quaternary fossil from Boretto, 1050 μm.

Genus *MITRELLA* Risso, 1826

Type species: Mitrella flaminea Risso, 1826.

Mitrella nitidulina (Locard, 1897) Figs 388, 399-400

Columbella nitidulina Locard, 1897:143, pl. 14, fig. 10-13.

Type material: Lectotype (here selected) in MNHN.

Type locality: TALISMAN dr 76, 25°01 N, 16°55 W, 2638 m.

Material examined: The type material and TALISMAN dr 40, 30°03 N, 11°42 W, 2212 m, 1 sh; dr 131, 38°38 N, 25°06 W, 2995 m, 4 spms + shs; MONACO st 536, 37°54 N, 24°43 W, 2178 m, 1 spm; st 698, 39°11 N, 20°45 W, 1846 m, 26 shs; st 738, 37°40 N, 26°26 W, 1919 m, 7 spms + shs; st 1209, 16°34 N, 23°03 W, 1477 m, 1 spm, 1 sh; st 1334, 39°30 N, 29°02 W, 1900 m, 1 sh; st 1349, 38°35 N, 28°06 W, 1250 m, 1 sh; BIACORES st 126, 39°19 N, 33°47 W, 3360 m, 1 sh; st 173, 37°57 N, 26°08 W, 3225 m, 1 sh; BIOGAS st CV38, 47°31 N, 08°59 W, 2695 m, 1 spm; J. CHARCOT MADERE st 17, 32°58 N, 16°26 W, 1390-1630 m, 1 sh.

Distribution: The deep bathyal and upper abyssal parts of the NE Atlantic, from the Bay of Biscay and the Azores to Morocco. Only known from the material examined.

Remarks: M. nitidulina is closely related to *Astyris profundi* Dall, 1889 from the western Atlantic basin, but is broader, has smaller apertural teeth and coarser incremental lines. *M. nitidulina* also has a more inflated larval shell and lacks the characteristic axial and spiral microsculpture of *profundi.*

The protoconch is multispiral and has an elaborate sculpture, indicating planktotrophic larvae.

Mitrella sp. Fig. 402

A single worn shell of another *Mitrella* species was taken at BIACORES st 101, 39°23 N, 31°05 W, 843-900 m.

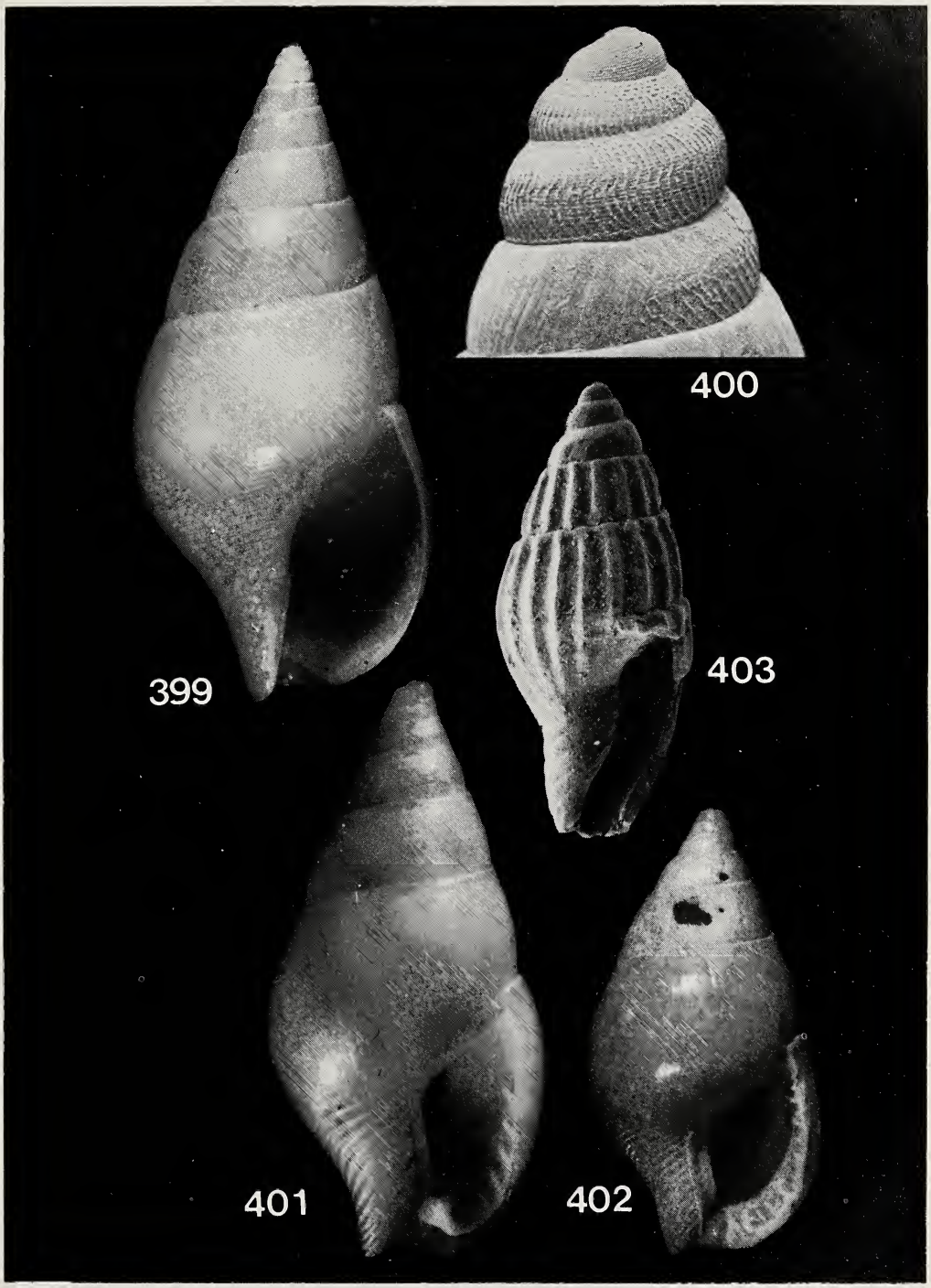
It is a broken shell in poor condition (Fig. 402) but shows some resemblance to *Astyris profundi* Dall, 1889 (Fig. 401). The specimens, however, are too few to allow certain identification because of the often very minute differences between columbellids.

Genus *ANACHIS* H. & A. Adams, 1853

Type species: Columbella scalarina Sowerby, 1832.

Anachis sp. Fig. 403

A single shell of a small *Anachis* was taken by INGOLF at 60°47 N, 04°00 E, in 350 m. It probably represents an undescribed species.



Figs 399-403. Columbellidae. 399, *Mitrella nitidulina,* TALISMAN dr 131, 11.6 mm. 400, *M. nitidulina,* MADERE st 17, larval shell, 820 μm. 401, *M. profundi,* holotype, 8.1 mm. 402, *M.* cf. *profundi,* BIACORES st 101, 8.5 mm. 403, *Anachis* sp., INGOLF, 2.4 mm.

Family BUCCINIDAE

Most previous workers on the family have divided it into several subfamilies or families (Cossmann, 1901; Wenz 1941; Golikov & Starobogatov, 1975; Habe & Sato, 1973; Kantor, 1981), while Ponder (1973) united Buccinidae, Fasciolariidae, Nassariidae, and Melongenidae to a single family, Buccinidae, and considered the former families subfamilies. Our experience from genera like *Kryptos, Troschelia* and *Belomitra* supports Ponder's view. We have, however, kept the old families for some genera of typical Fasciolariidae and Nassariidae, but placed the doubtful genera in Buccinidae.

The taxonomy of the N Atlantic buccinids has been found confused and in order to reduce the confusion we have included a number of shallow-water species and W Atlantic species from N Carolina and northwards.

Below we discuss some of the taxonomic criteria we have used and give a provisional key to the N Atlantic genera.

Larval shell. The larval development of *Buccinum undatum* and *Colus stimpsoni* has been described in detail (Portmann, 1925, 1930; West, 1973). Several hundred to several thousand eggs are laid in each capsule. A few of these develop to shell-less veligers. These ingest further eggs and store them in the digestive tract, which thus acts as a yolk sac. In *B. undatum* (Portmann, 1925) and *Colus gracilis* (own observations) the shell is formed rather late in the development and takes a shape according to the shape of the visceral sac, which varies depending on how many nurse eggs the larva has eaten. In some specimens of *C. gracilis* we noticed that the formation of the shell started with the lower parts and the apical part was the last to be formed. After the shell has been formed, normal "postlarval" growth starts, while the larva still lives in the egg capsule, feeding on less developed embryos. Fig. 588 shows larvae from capsules where these two stages can be seen.

In *C. stimpsoni* a larval shell is said to develop rather early, but the apical part is later thrown off, leaving a scar where it has been attached (West, 1973). We have not noticed this scar in perfect protoconchs of *C. stimpsoni.*

In other species the larva starts to form a shell at a very small size, presumably before it starts feeding by adelphophagy. We have observed this in *Mohnia mohni* and *M. danielsseni.* The two species hatch with a shell of three whorls, starting with a protoconch of a diameter of about 0.5 mm. In *M. abyssorum* we have observed veligers with a shell of 0.6 mm, consisting of slightly less than one whorl. (This species, however, seems not to have nurse eggs, because our preserved capsules are filled with a solid yolk mass.) Also *M. abyssorum* hatches at a size of three whorls (about 4 mm).

When the shells of embryos ready to hatch of these species of *Mohnia* are compared to those of embryos of *Buccinum,* the difference is striking (Figs 547, 590). The same applies when apices of the different groups are compared. We assume, however, that the difference does not mean as much systematically as one might believe, but that the development of *Buccinum* (and other genera with similar larval shell) represents a more advanced type, where the formation of the shell is delayed until shortly before the young leave the shelter of the capsule. Such an evolution, with delay of shell formation may have taken place several times and we do not assume that similar types of larval shell necessarily indicate relationship.

Operculum. Opercula of adult buccinids have often been divided into three groups: the *Buccinum* type with a central or subcentral nucleus, the normal type with an apical nucleus and the *Mohnia* type with a paucispiral operculum (Figs 442, 413, 431). As in most neogastropod species, the apical portion of the operculum gets eroded with increasing age and it is usually impossible to study the nucleus in adult specimens of Buccinidae. We have examined opercula of both young and adult specimens of almost all species treated in the revision and found opercula of recently hatched young to be much more informative than those of adult specimens.

Thus we have been able to distinguish the following types of opercula:

A. *Mohnia* type (Fig. 431). Paucispirál. Often this can be seen only in young specimens because the lower part of the operculum is lacking. Occurs in *Mohnia.*

B. *Buccinum* type (Fig. 442). Concentric growth. Occurs in *Buccinum.*

C. *Turrisipho* type (Fig. 407). The lower part of the larval operculum is very pointed. The axis of this point forms a small angle with later growth. Occurs in *Turrisipho,* possibly also in *Beringius.*

D. *Colus* type (Fig. 413). The operculum of the embryo is regularly ovate and it grows in an open spiral, so the axis of the adult operculum forms a more or less right angle with the length axis of the larval operculum. Occurs in *Colus.*

E. *Neptunea* type (Fig. 404). Similar to that of *Colus,* but the growth takes place in the same direction throughout the life of the snail, so the axis of the larval operculum is the same as that of the adult one. Occurs in *Neptunea.*

F. Some other types of opercula, that do not fit into any of these groups, occur in *Liomesus, Volutopsius* and *Kryptos.*

Radula. The radulae of N Atlantic buccinids have not been used very much for taxonomic purposes, presumably because of the large intraspecific variation reported by Friele (1879) and verified by later authors. We have, however, found the radula to be a useful accessory tool in the classification of the N Atlantic Buccinidae, and give figures of most of them. Two main types can be distinguished:

A. *Buccinum* type (Fig. 469) with a short, broad central tooth with 4-9 cusps with individual bases. Occurs in *Buccinum, Neptunea, Volutopsius.*

B. *Mohnia* type (Fig. 480) with a more or less square, often thin or reduced central plate with 0-3 cusps with fused bases, often appearing as processes from the anterior edge of the plate. Occurs in *Mohnia, Colus, Turrisipho.* In addition to these, there are a number of species that have more modified radulae: *Belomitra, Liomesus, Kryptos, Troschelia, Beringius.* The phylogenetic interpretation of these radulae is discussed under each genus, but our general impression is that they represent groups of low taxonomic level.

Among the genera here considered to be buccinids, *Belomitra* stands out by having a central tooth resembling that of Fasciolariidae. We do not know if this is convergence or indication of relationship: Similarities to Fasciolariidae in the radula are also found in *Troschelia.* Here, however, it is the lateral teeth that are similar (cf. Figs 484, 486), while the central teeth are of normal *Mohnia* type.

Concluding remarks. The N Atlantic species of Buccinidae may be distributed rather naturally into ten genera, with the exception of *Mohnia glypta, M. caelata* and *M. carolinensis* which do not fit very well into any described genus, when radula, operculum and shell shape are used in combination. The two last mentioned of these species show some resemblances to tropical deep-water buccinids of the genus *Manaria* E.A. Smith, 1906, which are very poorly known, the first mentioned species resembles no known buccinid. We have preferred to place these species provisionally in *Mohnia* until the tropical species are better known.

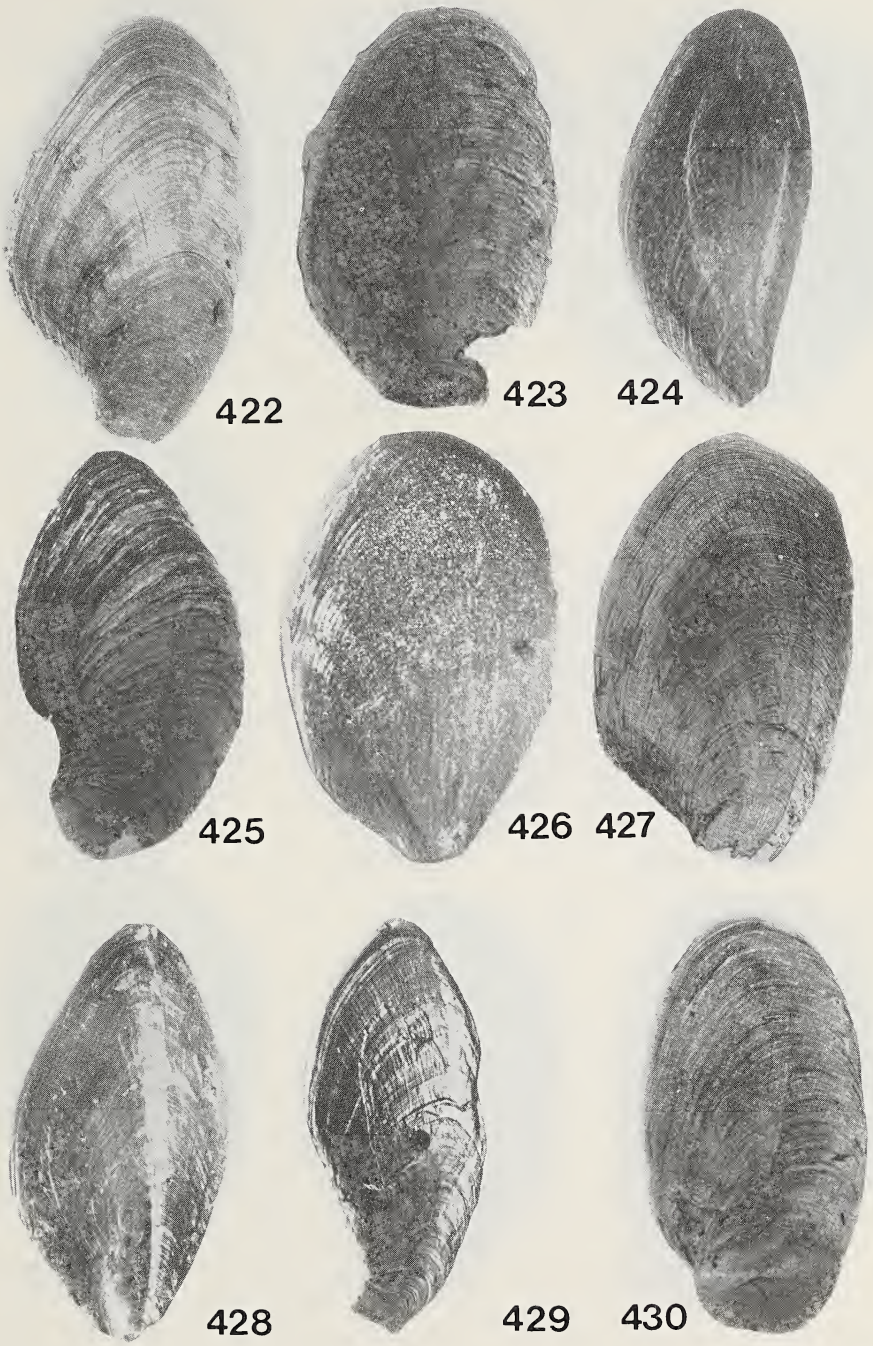
To test our generic concept, we have tried to classify the N Pacific species of which operculum and radula are known, which worked very well.

Key to the genera of N Atlantic Buccinidae

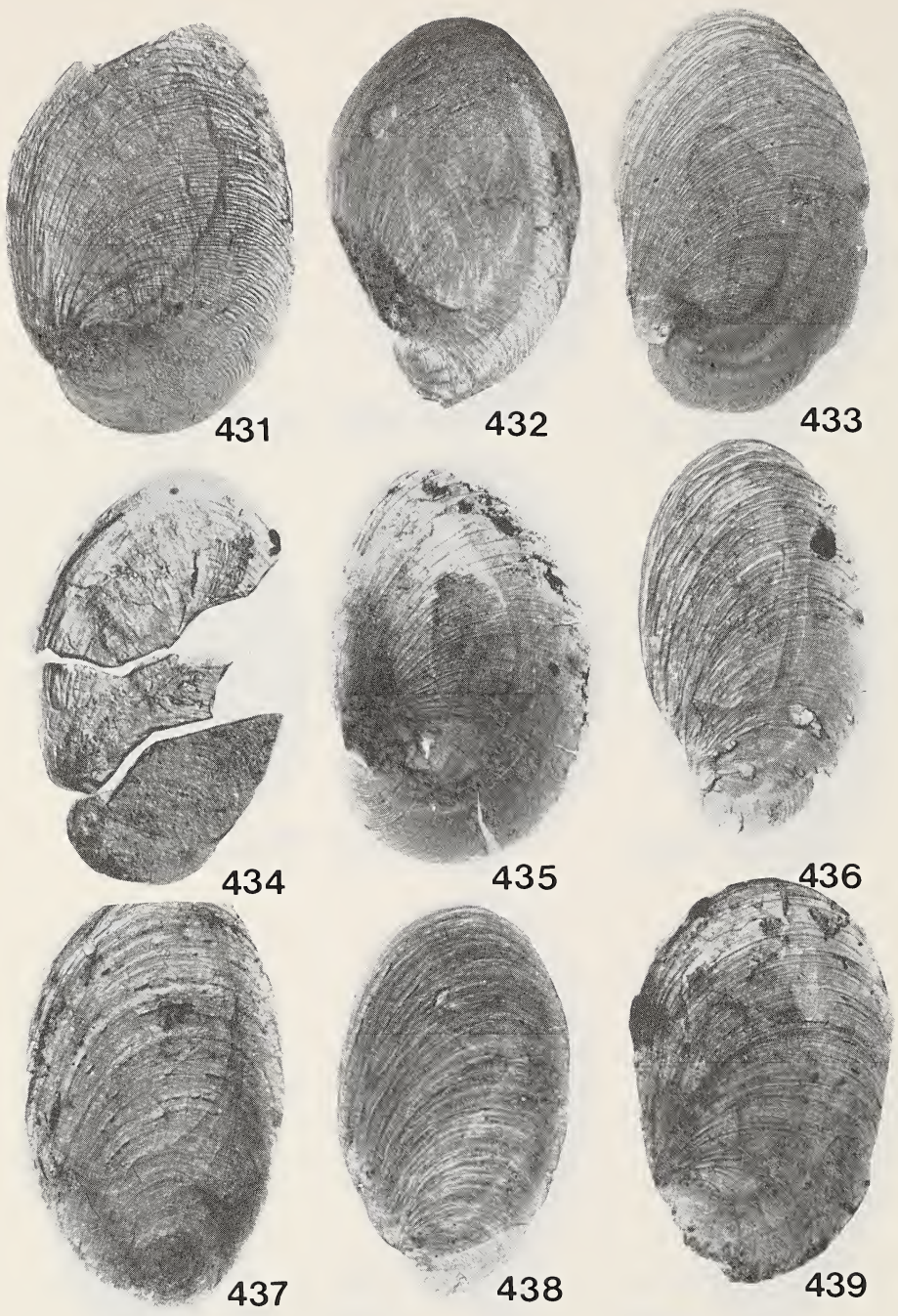
A. Operculum with central or subcentral nucleus (Figs 442, 445)	*Buccinum*
A. Operculum without central or subcentral nucleus	B
B. Operculum, at least in very young specimens, paucispiral	*Mohnia*
B. Operculum not paucispiral in young specimens	C
C. Whorls distinctly shouldered with angular axial ribs	*Kryptos*
C. Whorls rounded	D
D. Central teeth of the radula without cusps	E
D. Central teeth of the radula with cusps	F
E. Shell short, ovate, almost smooth	*Liomesus*
E. Shell tall, fusiform, with distinct spiral sculpture	*Beringius*
F. Lateral teeth with 5-10 cusps of equal size	*Troschelia*
F. Lateral teeth with 2-5 cusps of distinctly unequal size	G
G. Aperture very large, siphonal canal short, broad and open, only 2 large cusps on the lateral teeth	*Volutopsius*
G. Aperture constricted at the siphonal canal which is distinctly set off	H
H. Periostracum hardly visible	*Neptunea*
H. Periostracum usually well developed, always easily visible in specimens taken alive	I
I. Larval operculum pointed, periostracum with rows of bristles along the spiral ridges	*Turrisipho*
I. Larval operculum oval, periostracum smooth or with bristles along the incremental lines	*Colus*

Figs 404-412. Buccinid opercula. 404, *Neptunea brevicauda,* E. Canada, 6.6 mm. 405, *Neptunea antiqua,* off Korsfjorden, Bergen area, 300 m, 4.2 mm. 406, *Turrisipho fenestratus,* W of Korsfjorden, 280 m, 2.5 mm. 407, *Turrisipho moebii,* same locality, 3.9 mm. 408, *Turrisipho moebii,* off Reykjanes, Iceland, 19.2 mm. 409, *Turrisipho lachesis,* INGOLF st 28, 5.3 mm. 410 and 411, *Turrisipho voeringi,* INGOLF st 105, 6.5 mm and 14.4 mm. 412, *Troschelia berniciensis,* southern Bay of Biscay, 400-690 m, 15.7 mm.

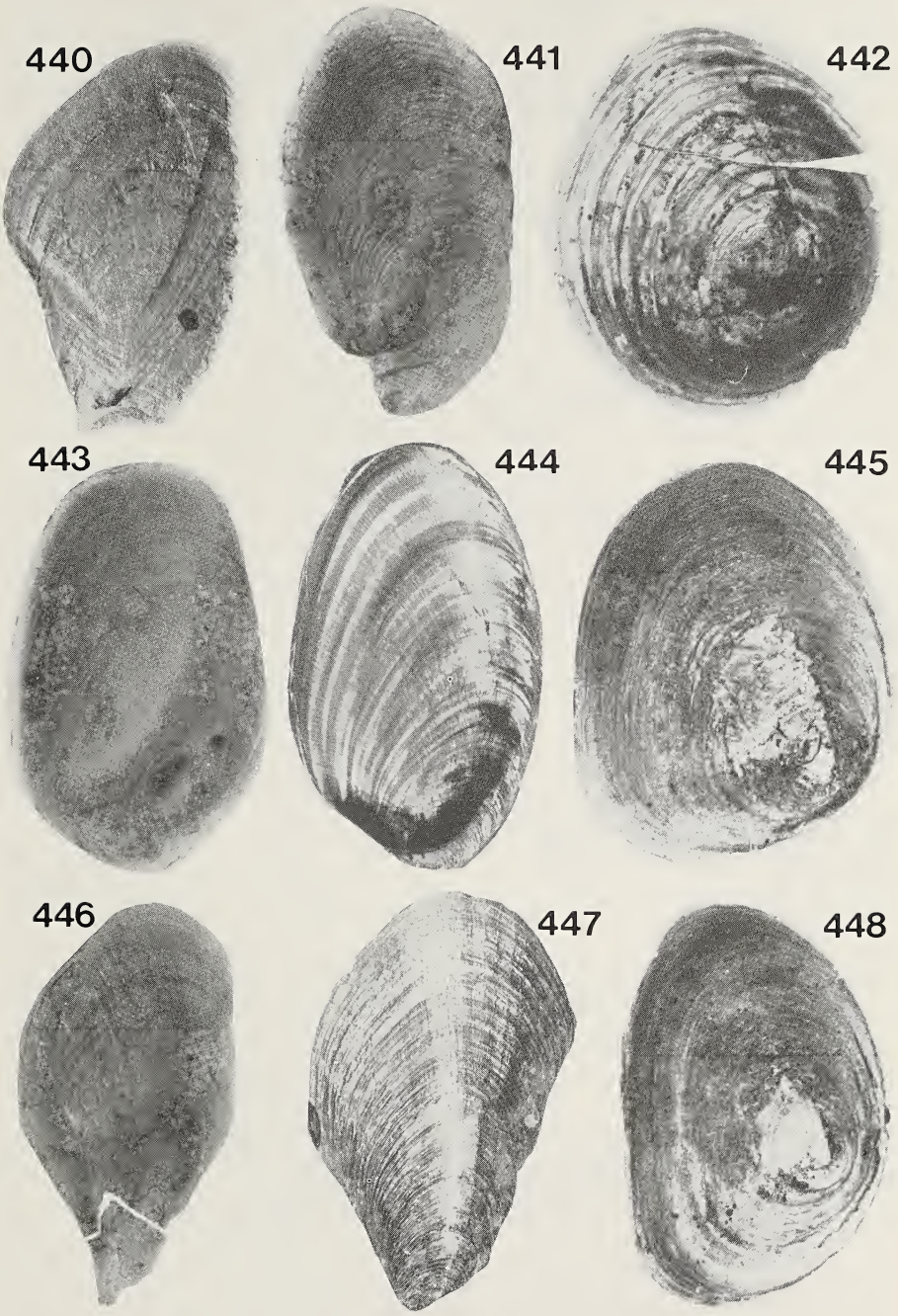
Figs 413-421. Buccinid opercula. 413, *Colus terraenovae,* Newfoundland Banks, 7.3 mm. 414 and 415, *Colus gracilis,* W Norway, 2.6 and 16.3 mm. 416, *Colus gracilis,* E Greenland, 10.0 mm. 417, *Colus turgidulus,* Norwegian Sea, 11.7 mm. 418, *Colus sabini,* Baffin Bay, 8.0 mm. 419 and 420, *Colus holboelli,* Greenland, 3.2 mm and 7.7 mm. 421, *Colus holboelli,* Baffin Bay, 12.1 mm.



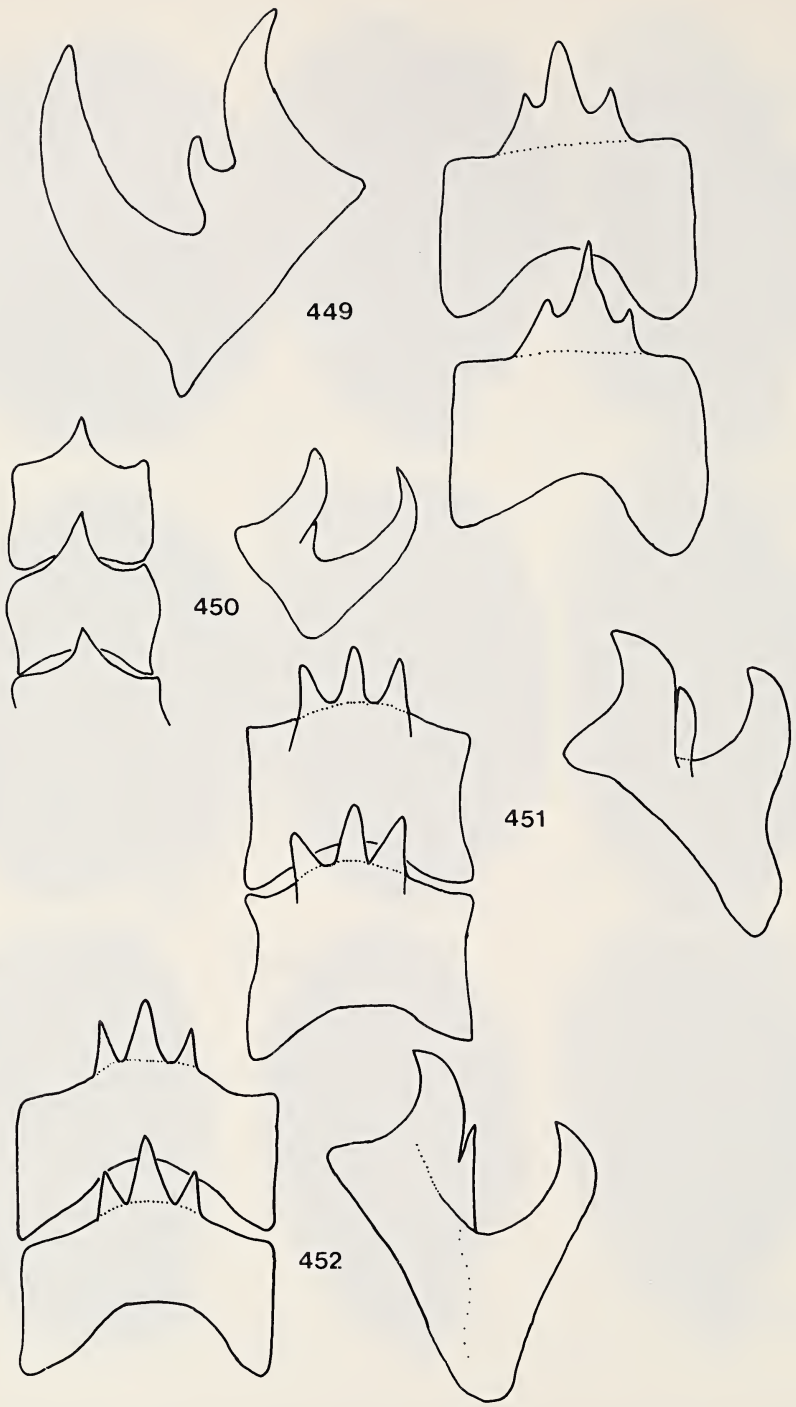
Figs 422-430. Buccinid opercula. 422, *Colus turgidulus,* Norwegian Sea, 11.7 mm. 423, *Colus latericeus,* Norway, 2.3 mm. 424, *Belomitra quadruplex,* INCAL st CP20, 7.9 mm. 425, *Mohnia krampi,* syntype, 7.5 mm. 426 and 427, *Mohnia abyssorum,* Bay of Biscay, 1.9 mm and 9.5 mm. 428, *Colus jeffreysianus,* Northumberland, UK, 7.3 mm. 429, *Colus jeffreysianus,* Bay of Biscay, 13.3 mm. 430, *Mohnia glyptus,* INGOLF st 32, 1.8 mm.



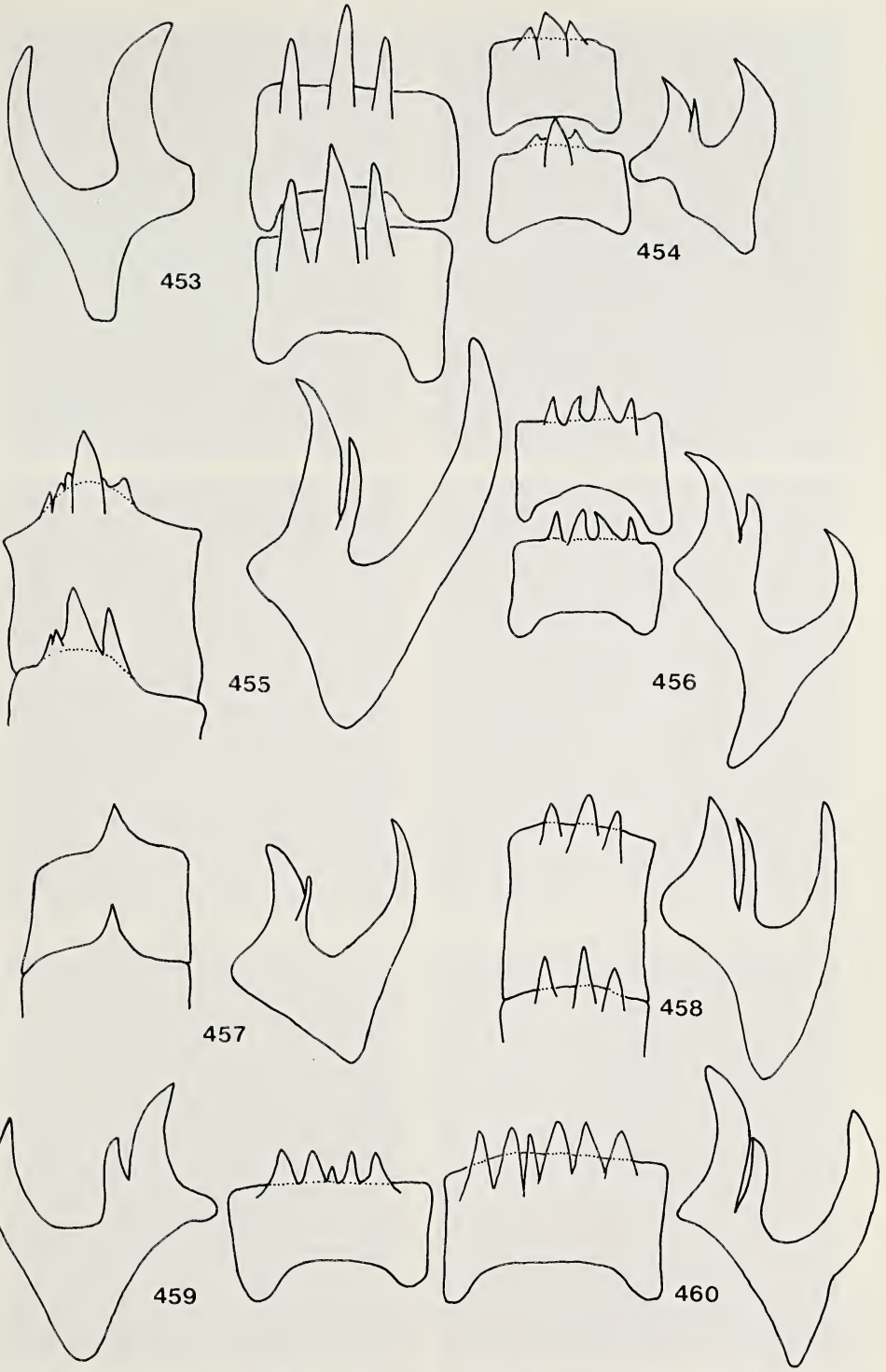
Figs 431-439. Buccinid opercula. 431 and 432, *Mohnia danielsseni,* Norwegian Sea 3.0 mm and 8.2 mm. 433, *Mohnia caelata,* off NE United States, 3.6 mm. 434, *Mohnia carolinensis,* off NE United States, 1.6 mm. 435, *Mohnia mohni,* N of Iceland, 7.1 mm. 436, *Mohnia parva,* off NE United States, 2.8 mm. 437 and 438, *Mohnia simplex,* INGOLF st 35, 3.6 mm and 3.4 mm. 439, *Mohnia blakei,* off NE United States, 3.7 mm.



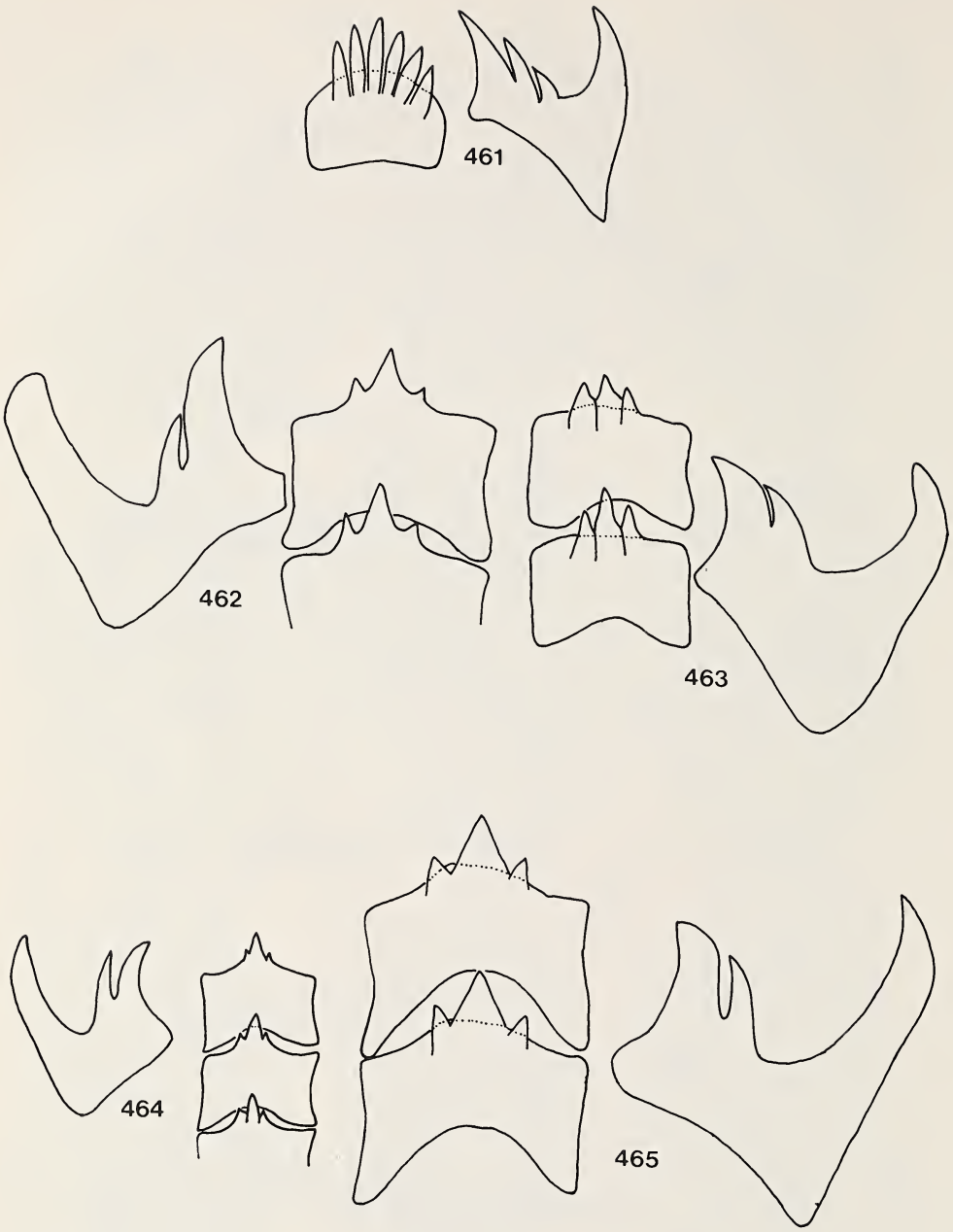
Figs 440-448. Buccinid opercula. 440, *Liomesus ovum,* W Norway, 5.1 mm. 441, *Kryptos koehleri,* off Portugal, 2.0 mm. 442, *Buccinum kjennerudae,* INGOLF st 28, 2.3 mm. 443, *Volutopsius norwegicus,* off E Canada, 3.0 mm. 444, *Volutopsius norwegicus,* Tromsö, N Norway, 20.8 mm. 445, *Buccinum abyssorum,* off NE United States, 7.6 mm. 446, *Beringius turtoni,* North Sea, 3.5 mm 447, *Beringius turtoni,* W Norway, 23.7 mm. 448, *Buccinum abyssorum,* off NE United States, 8.7 mm.



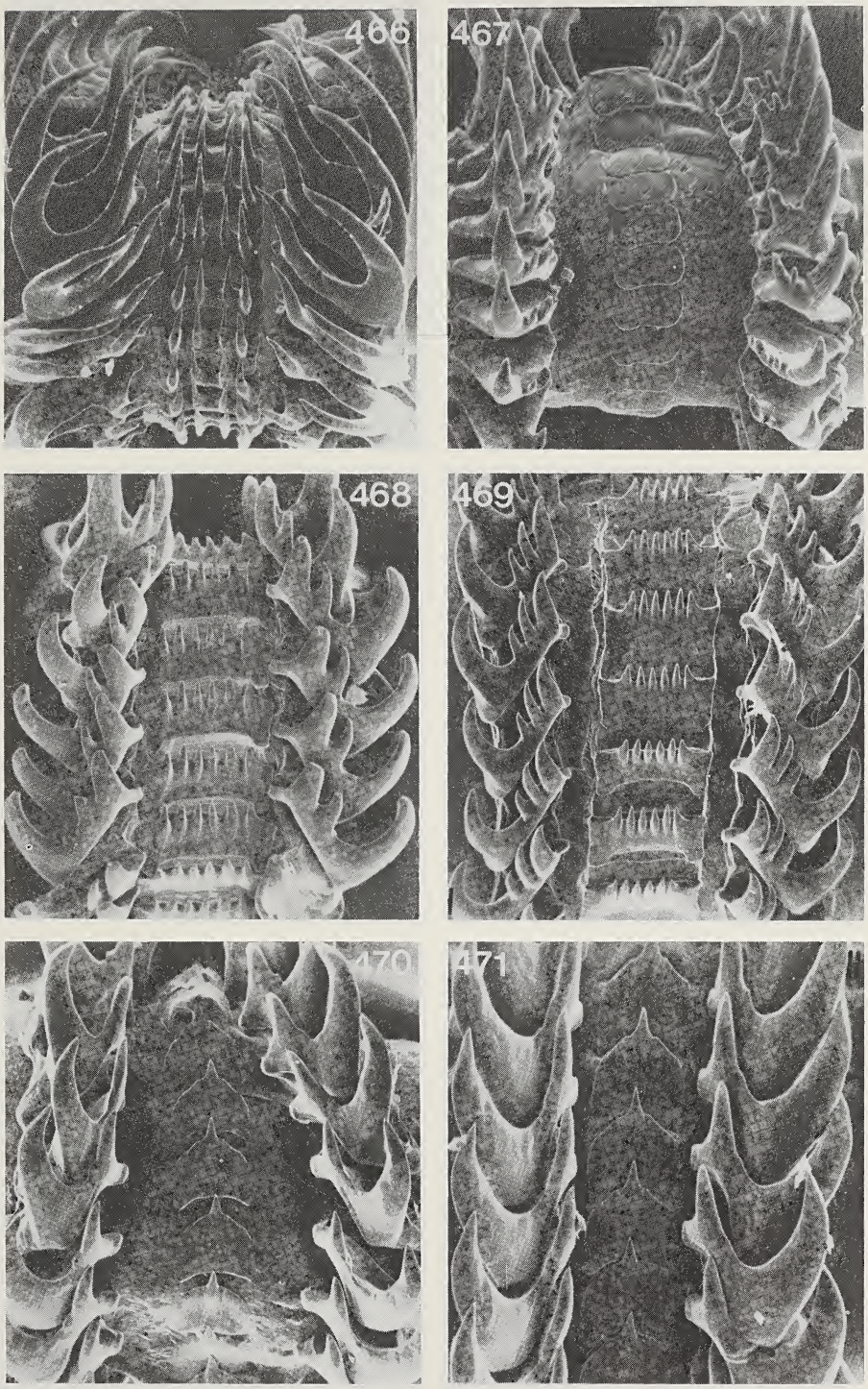
Figs 449-452. Radulae of *Mohnia*. 449, *M. krampi,* breadth of central tooth 112 μm. 450, *M. blakei,* 41 μm. 451, *M. parva,* 36 μm. 452, *M. simplex,* 50 μm.



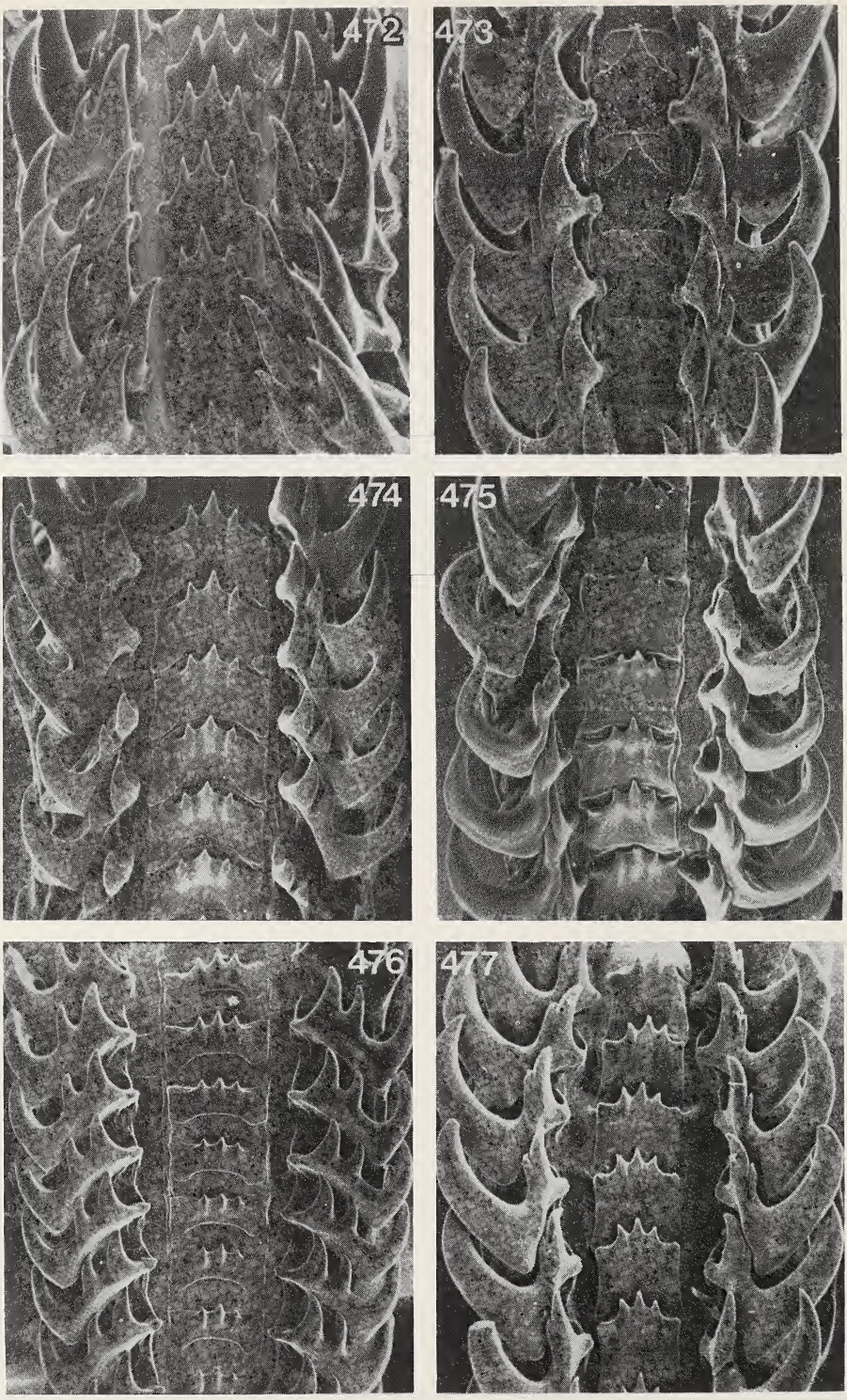
Figs 453-460. Buccinid radulae. 453, *Mohnia glyptus,* breadth of central tooth 30 μm. 454, *M. caelata,* 58 μm. 455, *Turrisipho moebii,* 38 μm. 456, *Neptunea brevicauda,* 64 μm. 457, *Mohnia carolinensis,* 19 μm. 458, *Turrisipho lachesis,* 19 μm. 459, *Buccinum abyssorum,* 223 μm. 460, *B. kjennerudae,* 81 μm.



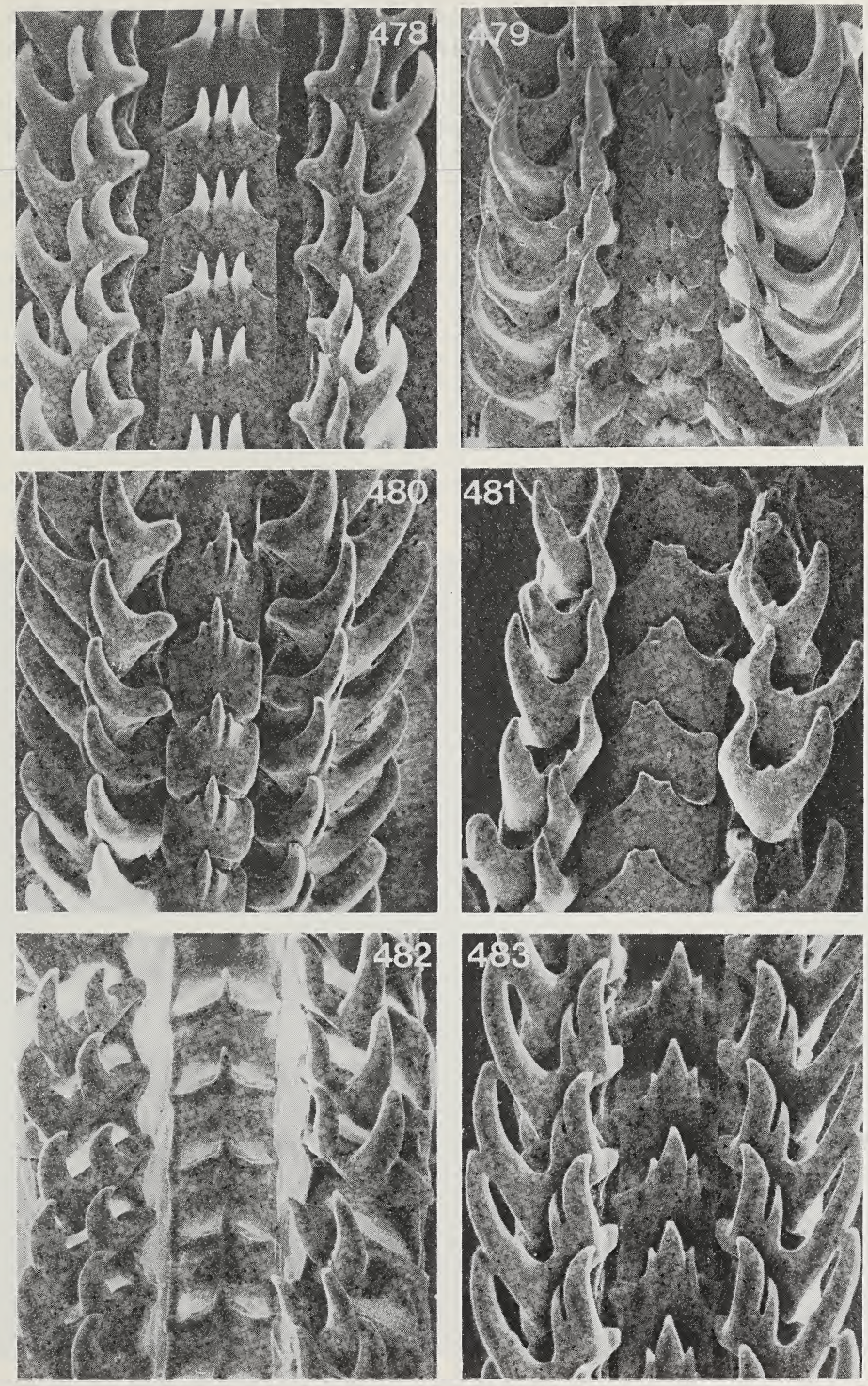
Figs 461-465. Buccinid radulae. 461, *Liomesus ovum* from egg capsule, breadth of central tooth, 46 μm. 462, *Colus terraenovae*, 67 μm. 463, *C. stimpsoni*, 69 μm. 464, *C. pygmaeus*, 49 μm. 465, *C. pubescens*, 94 μm.



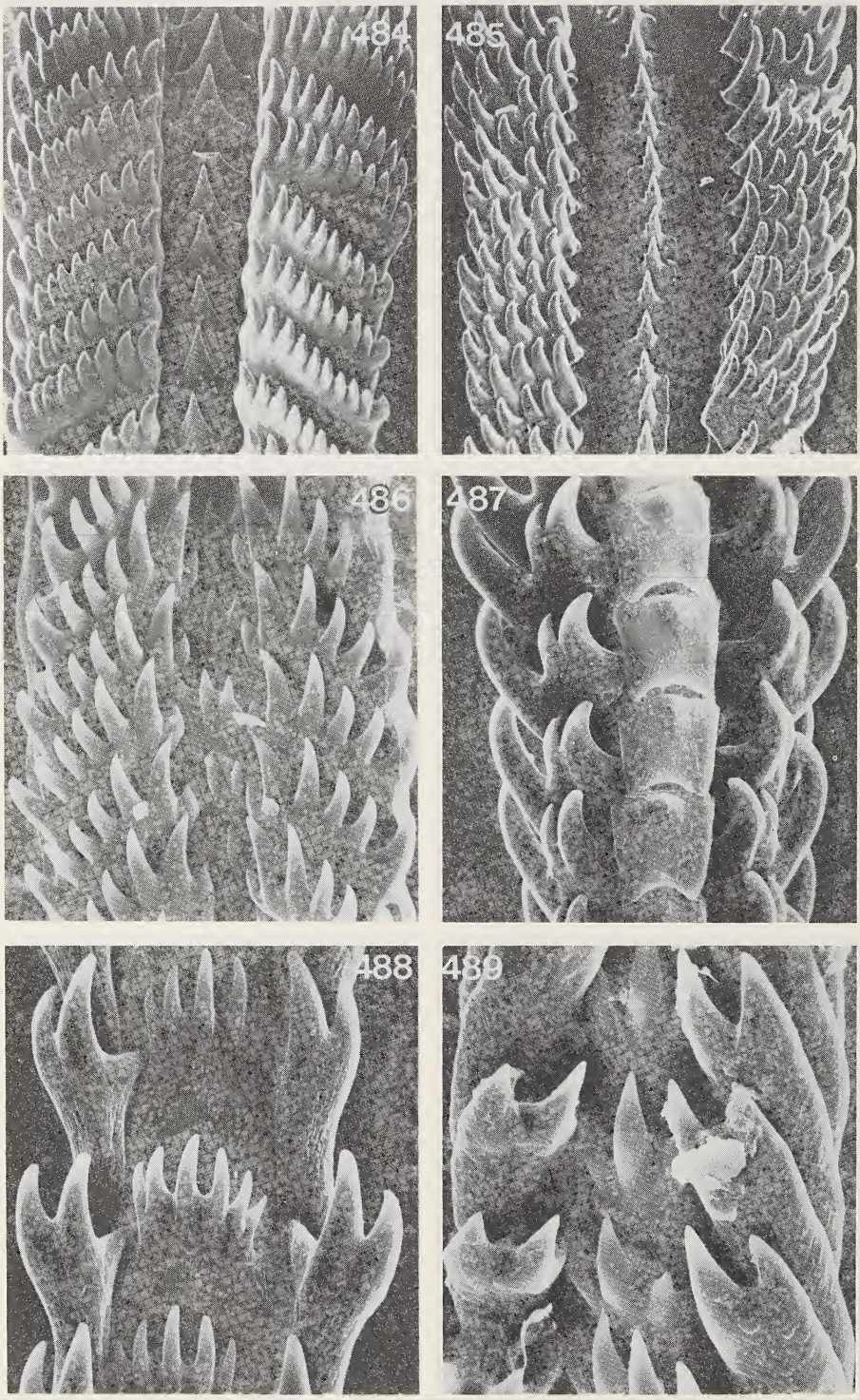
Figs 466-471. Buccinid radulae. 466, *Beringius turtoni*, breadth of central tooth 190 μm. 467, *Volutopsius norwegicus*, 112 μm. 468, *Buccinum humphreysianum*, 290 μm. 469, *Buccinum undatum*, 318 μm. 470, *Colus turgidulus*, 258 μm. 471, *Colus holboelli*, 155 μm.



Figs 472-477. Buccinid radulae. 472, *Colus sabini,* breadth of central tooth 169 μm. 473, *Colus gracilis,* 164 μm. 474, *C. jeffreysianus,* Bergen, S. Norway, 106 μm. 475, *C. jeffreysianus,* N Bay of Biscay, older part of the ribbon, 131 μm. 476, *Neptunea antiqua,* 312 μm. 477, *C. jeffreysianus,* same specimen as Fig. 475, younger part of the ribbon, 114 μm.



Figs 478-483. Buccinid radulae. 478, *Colus latericeus,* breadth of central tooth 32 μm. 479, *Colus islandicus,* 238 μm. 480, *Mohnia danielsseni,* 81 μm. 481, *Mohnia abyssorum,* 97 μm. 482, *Mohnia mohni,* 68 μm. 483, *Turrisipho fenestratus,* 48 μm.



Figs 484-489. Buccinid and fusinid radulae. 484, *Troschelia berniciensis,* Bergen, S Norway, breadth of central tooth 102 μm. 485, *Troschelia berniciensis,* N Bay of Biscay, 68 μm. 486, *Fusinus bocagei,* 19 μm. 487, *Kryptos koehleri,* 17 μm. 488 and 489, *Belomitra quadrup'ex,* 23 μm.

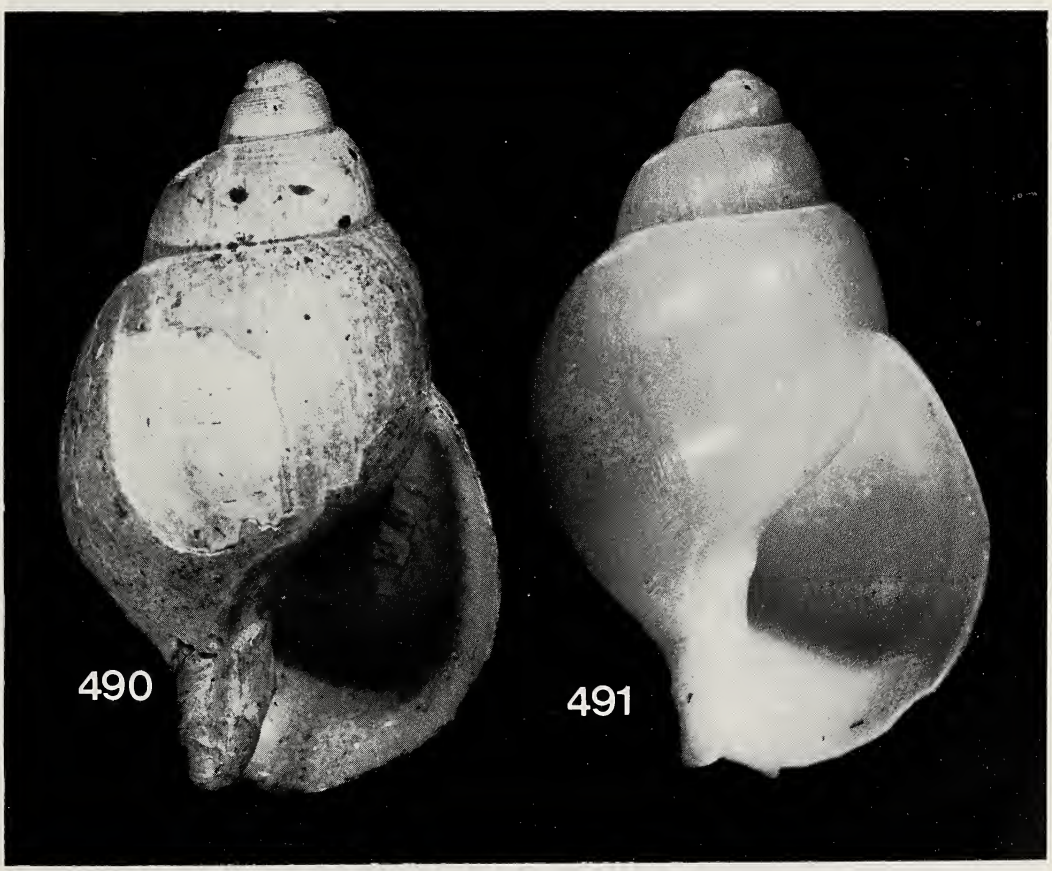
Genus *LIOMESUS* Stimpson, 1865

Type species: Buccinum dalei Sowerby, 1825, by monotypy (Fig. 490).

Synonym: Buccinopsis Jeffreys, 1867 is an absolute junior synonym. Type species *Buccinum dalei* Sowerby. (Not *Buccinopsis* Conrad, 1856).

Remarks: There is some doubt about the identity of the type species. We have examined fossil specimens agreeing perfectly with Sowerby's original description, both from Belgian and British localities and found them to differ from the Recent form by having a larger, more solid shell, blunter and more rounded spire, and coarser striation. Nowhere in the present distribution can populations be found that agree in these respects with the Crag fossil. We have, therefore, preferred to use the specific name *ovum* Turton, 1825, which is a few months younger than Sowerby's name and based on the Recent form. The same opinion was expressed by Dall (1916).

The genus *Liomesus* has been separated from *Buccinum* because of its radula (with a single large lateral cusp and a cusp-less rounded central plate (Sars, 1878)) and an operculum without central or subcentral nucleus. The North Pacific species previously referred to *Liomesus* have proved to have a more normal buccinid radula and were referred to *Pseudoliomesus* by Habe & Sato (1973). *Liomesus*



Figs 490-491. Genus *Liomesus*. 490, *L. dalei*, upper Pliocene of Orford, 40 mm. 491, *L. ovum*, off Ireland, 36 mm.

stimpsoni Dall, 1889 has a bicuspid lateral tooth of normal buccinid shape and a monocuspidate central (Weber, 1959). Therefore *L. ovum* is the single remaining species of the genus. Young specimens of *L. ovum* have a lateral tooth with two large and two smaller cusps and a central plate with several cusps (Fig. 461) and we question if the peculiar radula of *L. ovum* should not be considered a specific adaptation and the classification of these species should be reconsidered.

Liomesus ovum (Turton, 1825) Figs 440, 461, 490-491

Buccinum ovum Turton, 1825:366
Halia flemingiana Macgillivray, 1843:189.
Tritonium eburneum M. Sars, 1851:192 (not Lowe 1846).
Buccinopsis dalei of authors on Recent molluscs, not Sowerby, 1825.

Type material: B. ovum, holotype USNM 192257; *T. eburneum:* holotype ZMO D. 25954.

Type locality: B. ovum, off Plymouth, Great Britain; *T. eburneum,* Vestfjorden, N. Norway, 75-90 m. 75-90 m.

Material examined: About 50 shells and specimens from all parts of the distributional area, BMNH, MNHN, ZMO, ZMC, USNM, SMNH.

Distribution: From Lofoten (NW Norway) and W and NW of Iceland (Oskarsson, 1966) along the European shelf south to the extreme north of the Bay of Biscay (THALASSA st Z422, 48°21 N, 09°39 W, 1175 m, 1 fresh shell). Normally it is a shelf species, occurring in 100-300 m but sometimes it is found on the upper part of the continental slope (several records from the Porcupine Expedition 1869 from off Ireland and the *Thalassa* station above).

Remarks: Jeffreys (1867) suspected the type locality given by Turton to be wrong and that it actually came from Co. Cork, Ireland. He also figured and described the animal and the egg capsules. M. Sars (1851) described the animal.

Except for the synonymy with *B. dalei* there are no taxonomical problems with *L. ovum.* It is easily recognized by the almost perfectly smooth, ovate shell of a *Buccinum*-like shape, but without a central or subcentral nucleus in the operculum.

Genus *BUCCINUM* Linné, 1758

Type species: Buccinum undatum Linné, 1758, subsequent designation De Montfort (1810).
Synonyms: Tritonellium Valenciennes, 1858. Type species *T. barthae* Valenciennes, 1858, by monotypy.
Mada Jeffreys, 1867 (not Mulsant, 1850). Type species *B. humphreysianum* Bennett, 1824, by monotypy.
Mala Cossmann, 1901 (not Distant, 1854). Replacement name for *Mada* Jeffreys.
Madiella Wenz, 1943. Replacement name for *Mada* Jeffreys.

Remarks: We can see no reason for separating *Madiella* as a distinct genus. The only character ever given for this is the fine, regular, incised sculpture of *B. humphreysianum,* but this occurs in other species (e.g. *B. meridionale* Harmer, from Newfoundland), often in combination with a coarser sculpture.

There are some problems with the type designation of *Buccinum*. Lamarck (1799) cited *B. undatum* as an example of the genus "pour se faire mieux entendre", but this can hardly be considered a type designation (R.V. Melville, pers. comm.), although the intention was the same. It will, however, in this case make no difference, because De Montfort designated the same species as Lamarck as type species.

The northern species of *Buccinum,* both of the Atlantic and the Pacific are highly variable and hundreds of different species and forms have been described. We do not intend to make a revision of all these forms, and we have included only the species restricted to deep water, S of the Iceland-Faroe Ridge. N of this ridge, there are some species in bathyal depths, but they normally occur more shallowly and there are no species of *Buccinum* in the arctic, abyssal fauna (Bouchet & Warén, 1979; Friele & Grieg, 1901).

The more southern species of *Buccinum* are less variable and may be separated by the following characters:

A. Axial sculpture dominating	*B. undatum*
A. Axial sculpture absent or weak	B
B. Only a very fine and regular sculpture of equal sized, incised spiral lines present	*B. humphreysianum*
B. Spiral sculpture consisting of larger and smaller raised ribs	C
C. Some spiral ridges with knobs, apertural height greater than spire height	*B. oblitum*
C. No spiral ribs with knobs, apertural height less than spire height	D
D. Two or three sharp spiral keels much larger than the others, animal without eyes	*B. abyssorum*
D. Several equal sized, rounded spiral keels present, animal with eyes	*B. kjennerudae*

A revision of *Buccinum* was recently published by Golikov (1980), who recognized about 90 species, but synonymized *B. oblitum* and *kjennerudae* with arctic shallow-water species.

Buccinum undatum Linné, 1758 — Figs 469, 492-493, 590

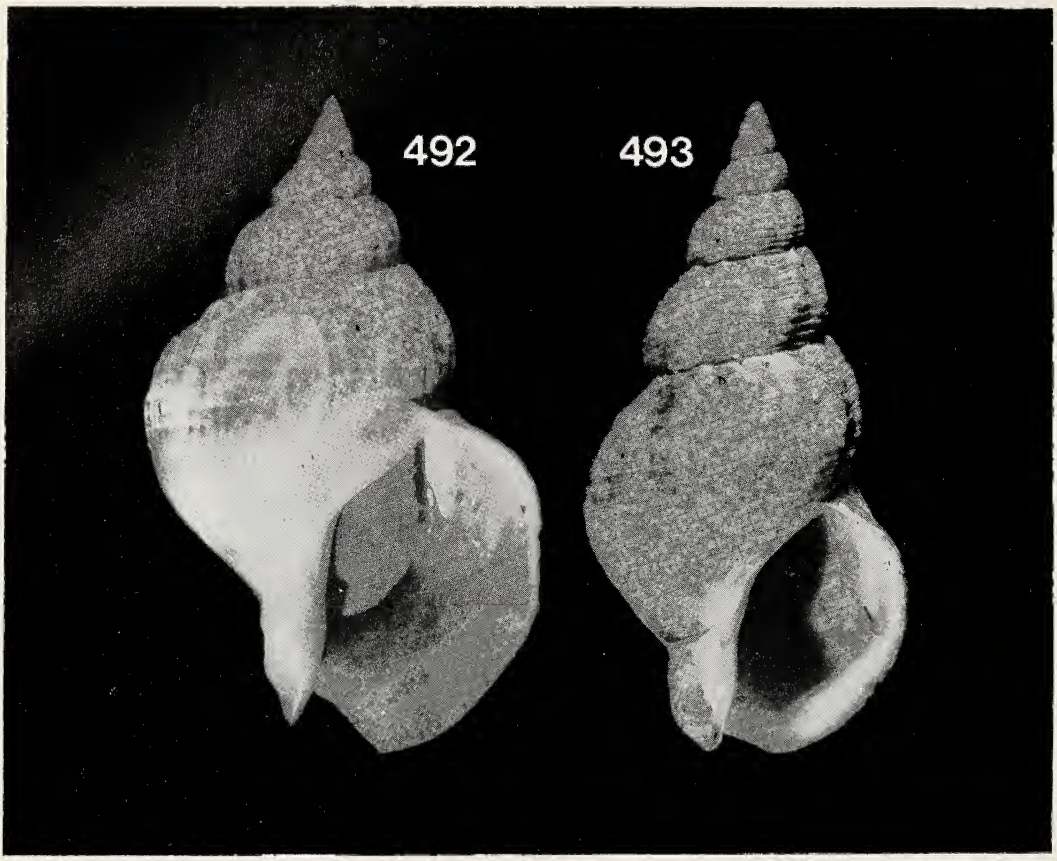
Buccinum undatum Linné, 1758:740.

Type locality: "O. Europaeo".

Type material: Four syntypes in the Linnean Society, London.

Distribution: Along the North Atlantic shores, from New Jersey, U.S.A. (Abbott, 1974), north to Greenland (Thorson 1951) (70° N), Spitzbergen (Odhner, 1915), N Norway (Sars, 1878) and S to N Spain (Bay of Biscay, Ortea, 1977), Portugal (Hidalgo, 1917) and possibly the W Mediterranean (Altimira, 1975, Ghisotti, 1974, Jeffreys, 1867, *et al.*). Normally it occurs in shallow water, 0-100 m, but it has been recorded from bathyal depths (Friele & Grieg, 1901, 1500 m; Sykes 1911, 1450 m, etc.). We have, however, not seen specimens taken alive from depths greater than 500 m (Korsfjorden, W. Norway, coll. AW, cf. Fig. 492).

Remarks: B. undatum has been included here only to exclude it from the bathyal fauna. It was not represented by a single shell in the collections made by Travailleur, Talisman, Thalassa, Biacores, Monaco Expeditions, etc., from deep water in the Bay of Biscay, where it is scarce along the S coast. Scattered empty shells occur off Ireland and Scotland (Sykes, 1911) where it is common at the coast and the shelf (Massy, 1930). Therefore we suspect shells to have been carried out by fish, many species of which are known to eat *Buccinum.*



Figs 492-493. *Buccinum undatum*. 492, Korsfjord, Bergen area, 150-500 m, 71.3 mm. 493, Lieholmsrännan, Bergen area, 70-73 m, 34 mm.

Buccinum humphreysianum Bennett, 1824 Figs 468, 494-496

Buccinum humphreysianum Bennett, 1824:398.
Buccinum fusiforme Kiener, 1834:5 (not Borson, 1820).
Buccinum ventricosum Kiener, 1834:4 (not Grateloup, 1827).
Buccinum striatum Philippi, 1844:193 (not Pennant, 1777).
Buccinum puxleianum Leach, 1847:270 (nom. nud.).
Buccinum humphreysianum var. *lactea* Jeffreys, 1867:294 (not Kiener, 1834).
Buccinum inflatum Aradas & Benoit, 1876:287 (not Shaw, 1811).
Buccinum kieneri Monterosato, 1872:32 (new name for *B. fusiforme* Kiener, 1834, not Broderip, 1830).
Buccinum atractodeum Locard, 1886:107.
Buccinum monterosatoi Locard, 1886:109.
Buccinum monterosatoi var. *flammulata* Locard, 1886:110.
Buccinum monterosatoi var. *minor* Locard, 1897:280.
Buccinum humphreysianum var. *azonata* Locard, 1886:106.
Buccinum liocephalum Pallary, 1931:9.
Buccinum lusitanicum Pallary, 1931:7.
Buccinum humphreysianum var. *euthriaeformis* Paulus & Mars, 1942:73.
Buccinum inflatum panormitanum Settepassi, 1977, app.:6.
Buccinum inflatum partenopaeum Settepassi, 1977, app.:6.
Buccinum gracile Monterosato in Settepassi, 1977, app.:6 (not Reeve, 1846).

Type material: B. humphreysianum: not known.
Type locality: B. humphreysianum: Cork, Ireland.
Material examined: About 150 specimens from all parts of the distribution area, USNM, MNHN, ZMC, SMNH, ZMB, coll. AW.

Distribution: Along the European shelf and the uppermost continental slope, from Finmark (N Norway) (Sars, 1878) and E of Iceland (Oskarsson, 1977) to W Morocco (Locard, 1897) and the western part of the Mediterranean (Settepassi, 1977; Casamor & Ghisotti, 1968). The depth distribution is 15 m (Kattegat, ZMC) — 360 m (W Norway, coll. AW) in the northern part and 70 m (Casamor & Ghisotti, 1968) — 1190 m (Locard, 1897) in the southern part of the range.

Remarks: The rich synonymy of *B. humphreysianum* is not the result of a high intraspecific variation, but more the result of vain splitting by "la nouvelle école" and its recent representatives.

We have examined Pleistocene specimens from Sicily (*B. striatum* Philippi) and found them to fall well inside the variation of Recent *B. humphreysianum.*

B. humphreysianum has often (the last occasion by Abbott, 1974) been recorded from the W Atlantic and the Arctic, but we have seen no such specimens, despite searching many collections.

The egg capsules are hemispherical and are laid singly (Jeffreys, 1867).

Buccinum abyssorum Verrill & Smith, 1884 Figs 445, 448, 459, 497-499

Buccinum abyssorum Verrill & Smith in Verrill, 1884:167, pl. 31, fig. 11.
Type material: 2 syntypes USNM 35644.
Type locality: USFC st. 2111, off North Carolina, 1700 m.

Material examined: 24 samples with about 80 specimens from the W Atlantic; INGOLF st 65, 61°33 N, 19°00 W, 2051 m, 2 spms; st 95, 65°14 N, 30°39 W, 1416 m, 2 shs; INCAL CP 05, 55°00 N, 12°30 W, 2884 m, 5 spms; CHALLENGER II, the Rockall Trough, *c.* 2000 m, several specimens.
Distribution: On the lower part of the continental slope, from N Carolina to SW Greenland (Thorson, 1951), SW of Iceland and W of Ireland. Depth range 1400—2900 m.

Remarks: There is some degree of variation in the proportions of the shell, but the absence of eyes is a good character distinguishing *B. abyssorum* from *B. kjennerudae.* The sculpture is also different in the two species. *B. kjennerudae* lacks the strong, sharp spiral keels characteristic of *B. abyssorum* and has evenly rounded ridges instead.

Buccinum oblitum Sykes, 1911 Figs 500-501

Buccinopsis striata Jeffreys in Wyville-Thomson, 1873: fig. 76 (not *Buccinum striatum* Müller, 1774 or any of the other ten *B. striatum* that have been described).
Buccinum oblitum Sykes, 1911:342, Fig. unnumbered
Buccinum perexiguum Dautzenberg, 1925:5, fig. 1.

Type material: B. oblitum, lectotype (Warén 1980) USNM 191839; *B. perexiguum,* holotype in MOM.
Type localities: B. oblitum, PORCUPINE 1869, st 55, 60°04 N, 06°19 W, 1100 m; *B. perexiguum* MONACO st 1096, 36°07 N, 08°03 W, 1440 m.

Material examined: The types and 5 shs from the type locality of *B. oblitum,* USNM and BMNH; 1 sh, off Korsfjorden, W Norway, coll. AW; THOR st 164, S of Iceland, 1900 m, 1 sh; INGOLF st 90, 64°45 N, 29°06 W, 1070 m, 2 shs.

Distribution: Only known from the material examined, from the shelf and upper continental slope, from Iceland to S of Portugal.

Remarks: B. oblitum can always be recognized by its small size combined with a thickened outer lip, large aperture and spiral ribs with small knobs. The animal is not known, but the shell agrees in all details with that of *Buccinum* while the sculpture is quite different from the smooth shell of *Liomesus.* We have therefore preferred to place *oblitum* in *Buccinum,* as did Sykes (1911) and Dautzenberg (1925).

Buccinum kjennerudae **nom. nov.** Figs 442, 460, 502-504

Buccinum sulcatum Friele, 1882:32, pl. 3, fig. 18 (not Born, 1778, Meuschen, 1787, Bruguiere, 1792, Sowerby, 1822, Kiener, 1834).

Type material: Holotype ZMB 22917.

Type locality: Norwegian North Atlantic Expedition st 192, N of Lofoten, 1150 m.

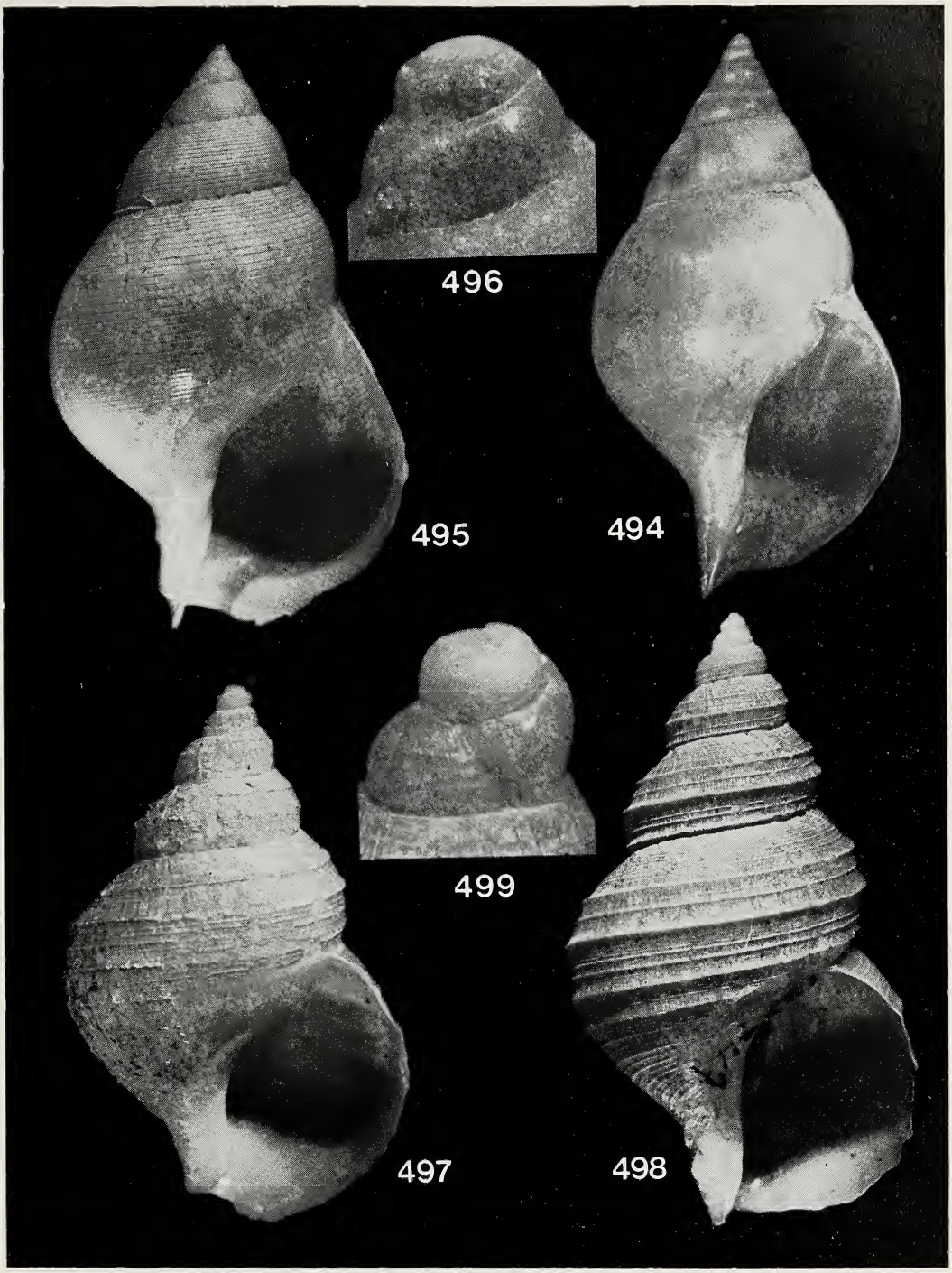
Material examined: The holotype and INGOLF st 28, 65°14 N, 55°42 W, 791 m, 2 spms; st 35, 65°16 N, 55°05 W, 682 m, 2 shs; TJALFE st 367, 66°22 N, 57° 16 W, 686 m, 1 spm.

Distribution: Only known from the material examined, from N Norway, to Davis Strait, in 600—1100 m.

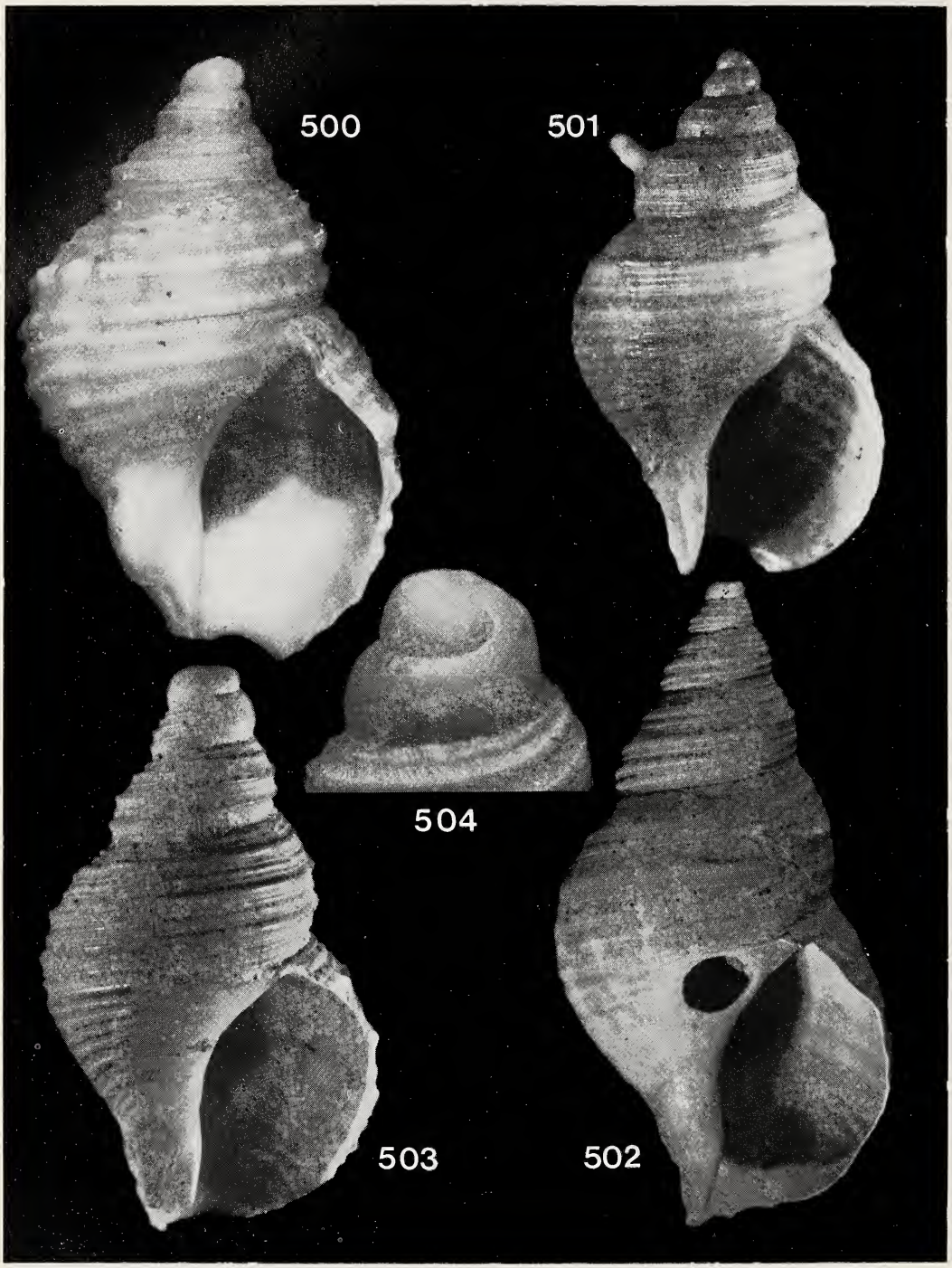
Remarks: The present species has never been recognized as a good species, probably because of its rarity. Golikov (1980) synonymized it with *B. polare,* a high arctic shallow-water species with distinct axial sculpture.

The differences from *B. abyssorum* are listed under that species. An additional difference is the shape of the spire, which is more convex in *B. abyssorum.*

The name *B. sulcatum* which was suggested by Friele is preoccupied several times, so we found it appropriate to name it after Miss Johanne Kjennerud, curator at ZMB, who has been of great help in our work.



Figs 494-499. Genus *Buccinum*. 494, *B. humphreysianum,* syntype of *B. monterosatoi,* off St Henri, SE France, 41 mm. 495, *B. humphreysianum,* 35°31 N, 06°35 W, 535 m, 68.9 mm. 496, *B. humphreysianum,* Bergen area 55-65 m, apex 1.3 mm. 497, *B. abyssorum,* INCAL st CP5, 30.1 mm. 498 and 499, *B. abyssorum,* off Nova Scotia, ca. 40 mm and apex 1.3 mm.



Figs 500-504. Genus *Buccinum*. 500, *B. oblitum,* N. Marsteinen, Bergen area, 300-330 m, 14.7 mm. 501, INGOLF st 90, 16.6 mm. 502, *B. kjennerudae,* holotype of *B. sulcatum,* 26 mm. 503 and 504, INGOLF st 28, 11.0 mm and apex 1.9 mm.

Genus *TROSCHELIA* Mörch, 1876

Type species: Fusus berniciensis King, 1846, by monotypy.
Remarks: Boreofusus G.O. Sars, 1878 has the same type species and is an objective junior synonym. *Buccinofusus* Conrad, 1868 was synonymized with *Troschelia* by Tryon (1881) and several later authors, but we find that genus more similar to typical species of *Fusinus,* as did Dall (1909).

We do not know any additional species of *Troschelia. Troschelia (Thalassoplanes) moerchi* Dall, 1908 (figured by Kosuge, 1975) has almost no siphonal canal and quite a different operculum, which is very slender. *Fusus perminutus* Dall, 1927 from off Florida, resembles the young of *Troschelia berniciensis,* but was described from immature specimens with no animal, so its systematic position remains uncertain.

The radula of *Troschelia berniciensis* made G.O. Sars (1878) place the genus in Fasciolariidae. *Thalassoplanes* Dall, 1908 has a similar radula, but the central tooth of *Thalassoplanes moerchi* (which possibly is a synonym of *Brevisiphonia circumreta* Lus, 1973) is quite reduced and only a small plate remains. *Costaria borealis* Golikov, 1977 has lateral teeth with 7 cusps of equal size and a typical buccinid central tooth. *Calliloconcha solida* Lus, 1978 has the same kind of central tooth as *C. borealis* but lateral teeth with only three cusps of equal size. We therefore suppose that these groups represent a trend in the Buccinidae, of reduction of the central tooth and a corresponding increase in the number of cusps on the lateral teeth and we prefer to place *Troschelia* in the Buccinidae.

Troschelia berniciensis (King, 1846) Figs 412, 484-485, 505-510.

Fusus berniciensis King, 1846:246.
Fusus berniciensis var. *elegans* Jeffreys, 1867:342.
Fusus berniciensis var. *inflata* Jeffreys, 1877:327.
Boreofusus berniciensis var. *solida* Jeffreys in G.O. Sars, 1878: 279.
Fusus (Siphonorbis) amblyterus Watson, 1886:205.
Neptunia aquitanica Locard, 1897:356.
Neptunia berniciensis vars *carinata, major, minor, ventricosa, elongata* Locard, 1897:354.

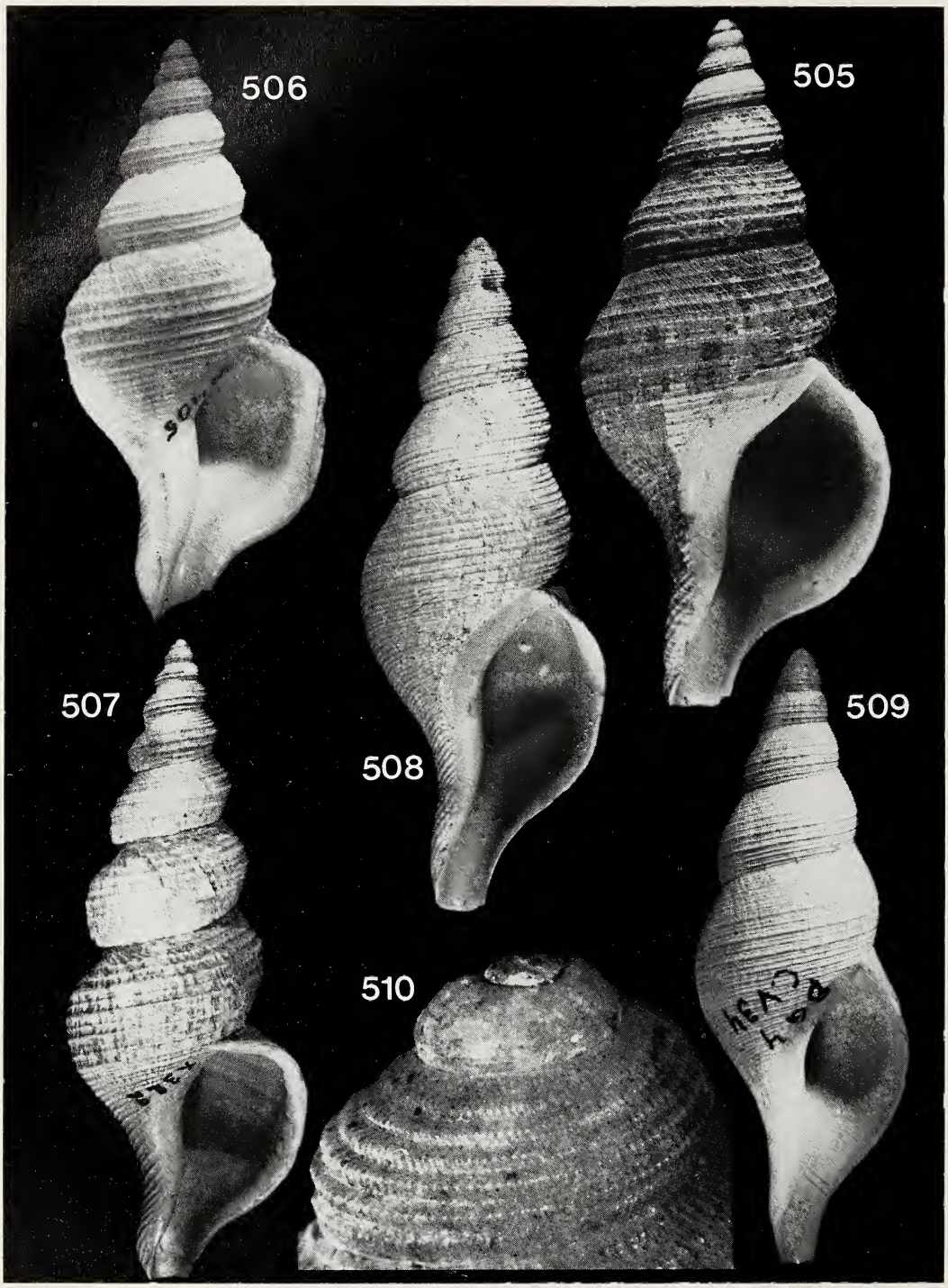
Type material: F. berniciensis, not known.
Type locality: F. berniciensis, deep water off Northumberland (North Sea).

Material examined: About 250 shells and specimens from all parts of the distributional area (MNHN, USNM, ZMC, coll. AW).

Distribution: Along the NE Atlantic continental shelves and upper slopes, from 56°01 N, 32°42 W, 1200 m (Jeffreys, 1877) (between Iceland and Greenland) to NW Norway (Sars, 1878) and southwards to 25°N (Locard, 1897). It is not known from the Mediterranean. In Norway it has been found from 90 m (Sars, 1878) down to 600 m on the continental slope (Friele & Grieg, 1901), but occurs deeper (1000 m) in the fjords (AW). Off North-West Africa it occurs in depths between 600 and 2000 m (Locard, 1897). The deepest occurrence is BIACORES stn 252, 47°35 N, 08°47 W, 2700 m, where empty but fresh shells were found.

Remarks: T. berniciensis is a rather variable species. Northern specimens are rather broad (Fig. 505), southern specimens more slender (Locard's *N. aquitanica,* Fig. 507), and specimens from the deepest part of the distribution are smaller and slender (Watson's *F. amblyterus,* Fig. 509).

There is also a variation in the number of cusps of the lateral teeth, from 8-10 in northern specimens from shallow water, to about 5 in southern specimens from deep waters (Figs 484-485). Specimens from intermediate localities have intermediate numbers of cusps.



Figs 505-510. *Troschelia berniciensis*. 505, Akrafjord, Norway, 620 m, 97.4 mm. 506, THALASSA st W405 (43°56 N, 05°44 W, 400-690 m), 64.4 mm. 507, THALASSA st X322 (44°00 N, 04°45 W, 980-1080 m), 90.4 mm. 508, BIOGAS st CV39 (47°33 N, 08°45 W, 2350 m), 61.4 mm. 509, Bay of Biscay, deep water form, 61.2 mm. 510, off Korsfjorden, Bergen area, apex 1.8 mm.

Genus *KRYPTOS* Jeffreys in Dautzenberg & Fischer, 1896

Type species: Kryptos koehleri (Locard, 1896) (= *Kryptos elegans* Jeffreys, 1896), by monotypy.

Remarks: This genus was placed in Fasciolariidae by Dautzenberg & Fischer (1896), Thiele (1931) and Wenz (1943) while Locard (1897) considered it to belong to Turridae. For reasons given in the introduction to Buccinidae, we prefer to place it in Buccinidae.

We do not know of any additional species from the Atlantic which should be classified in *Kryptos.*

Kryptos koehleri (Locard, 1896) Figs 441, 487, 511-513

Pleurotomella koehleri Locard, 1896 (June): 208.
Pleurotomella koehleri Locard, 1896:137, pl. 5, fig. 1.
Kryptos elegans Jeffreys in Dautzenberg & Fischer, 1896:435, pl. 15, fig. 20.
Pleurotomella atlantica Locard, 1897:240, pl. 12, figs 1-8.
Pleurotomella demulcata Locard, 1897:243, pl. 12, figs 9-13.

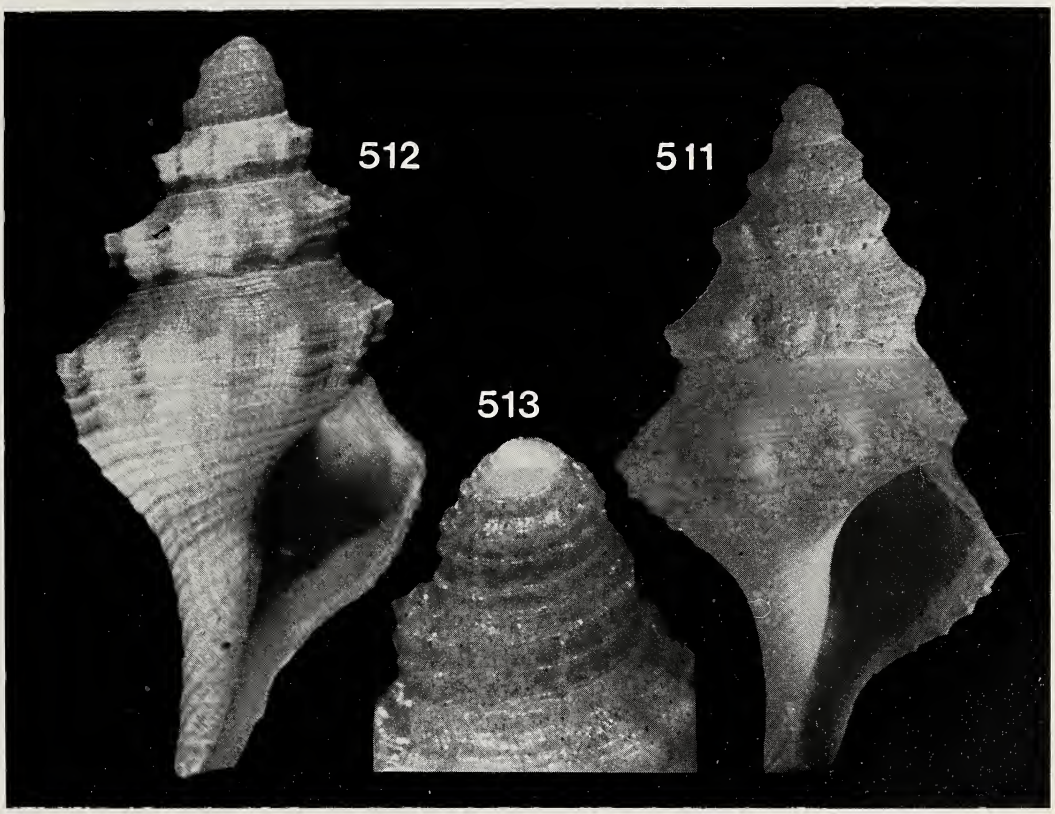


Fig 511-513. *Kryptos koehleri.* 511, BIOGAS st CP25, 21.8 mm. 512 and 513, off Portugal, 11.4 mm and apex 1.6 mm.

Type material: P. koehleri; lost; *K. elegans,* holotype in MNHN; *P. atlantica* and *P. demulcata,* syntypes in MNHN.
Type localities: P. koehleri, N of Spain, 44°02 N, 07°42 W, 1300 m; *K. elegans,* bathyal, W of Spain (here designated).

Material examined: The type material and PORCUPINE st 16, 17, 17a, 24, 30, off Spain and Portugal, 500—2000 m, several shs; TRAVAILLEUR 1881, drag 1, 43°01 N, 09°37 W, 2018 m, 1 spm; drag 34, 38°18 N, 09°24 W, 1226 m, 1 spm; 1882, drag 19, 41°32 N, 09°21 W, 1350 m, 2 shs; drag 40, 33°09 N, 09°38 W, 1340 m, 2 shs; drag 70, 43°59 N, 05°35 W, 1000 m, 1 sh; TALISMAN drag 20, 33°43 N, 09°02 W, 1105 m, 1 sh; drag 22, 33°47 N, 09°02 W, 1635 m, 1 spm; drag 31, 32°40 N, 09°50 W, 1917 m, 5 spms; drag 37, 31°34 N, 10°21 W, 900 m, 1 spm; THALASSA W415, 43°53 N, 06°11 W, 860-1150 m, 1 spm; X339, 44°10 N, 04°30 W, 1560 m, 3 spms; Y373, 41°35 N, 09°19 W, 1200 m, 3 shs; Y374, 41°31 N, 09°20 W, 1250 m, 1 sh; Y395, 41°19 N, 09°14 W, 810 m, 1 sh; Y401, 40°37 N, 09°22 W, 1040 m, 1 sh; POLYGAS CV16, 44°07 N, 04°17 W, 1909 m, 1 spm; BIOGAS DS40, 47°36 N, 09°04 W, 3345 m, 1 spm; DS86, 44°09 N, 04°19 W, 1950 m, 1 sh; CP07, 44°10 N, 04°16 W, 2170 m, 1 sh; CP23, 44°05 N, 04°21 W, 1980 m, 1 spm; CP25, 44°05 N, 04°17 W, 1894 m, 1 sh.

Distribution: The continental slope from the N parts of the Bay of Biscay to S Morocco, 800—2000 m normally.

Remarks: K. koehleri is not very variable and no species from the Atlantic can be confused with it except young specimens of *Mohnia abyssorum,* which resemble the young of *K. koehleri.*

We have not been able to find a precise date of publication of Dautzenberg & Fischer's (1896) description of *K. elegans,* but in the same paper (page 434), they refer to Locard (1896), which therefore must be older.

The rectum of a specimen soaked for radula preparation was filled with detritus and numerous polychaete bristles. The animal has very small tentacles and lacks eyes.

Genus *BERINGIUS* Dall, 1887

Type species: Chrysodomus crebricostatus Dall, 1877, by original designation.
Synonyms: Jumala Friele, 1882:6. Type species *Fusus turtoni* Bean, 1834, by original designation.
Ukko Friele in Norman, 1893:352. New name for *Jumala* Friele, 1882.

Remarks: The genus is characterized by its short, indistinct siphonal canal, small aperture and the radula with a cuspless central and claw-like, bicuspidate lateral teeth. There is a single N Atlantic and a few N Pacific species. *B. crebricostatus* is quite similar to *B. turtoni* in the shell characters, but the sculpture of *crebricostatus* consists of very strong spiral ribs.

Friele's name was rejected by ICZN (Opinion 469, 1957) because it was supposed to be blasphemous. *Jumala* was a lappish name for the Christian god. At this decision the older and available name *Brongus* De Gregorio, 1885 was overlooked, but we have selected a type species for *Brongus* so it becomes a junior synonym of *Colus* to keep stability in the nomenclature.

Beringius brychius (Verrill & Smith, 1885) is here referred to *Belomitra* (see that genus).

The radula of *Beringius* was the reason why Habe & Sato (1973) placed the genus in the subfamily Liomesusinae (sic!). *Japelion* Dall, 1916 and the questionable genus *Noeberingius* Habe & Ito, 1965 have a radula very similar to *Beringius* and are probably closely related, as the shells also indicate. *Liomesus* on the contrary has quite a different shell, and the similarities in the radula are caused by enlargement of the base of a normal buccinid lateral tooth in *Beringius* while in *Liomesus* there is reduction of the inner cusps of the same tooth. When drawings of the teeth are compared, this difference is not evident, but in SEM pictures it is.

Beringius turtoni (Bean, 1834) Figs 446-447, 466, 514-516, 519

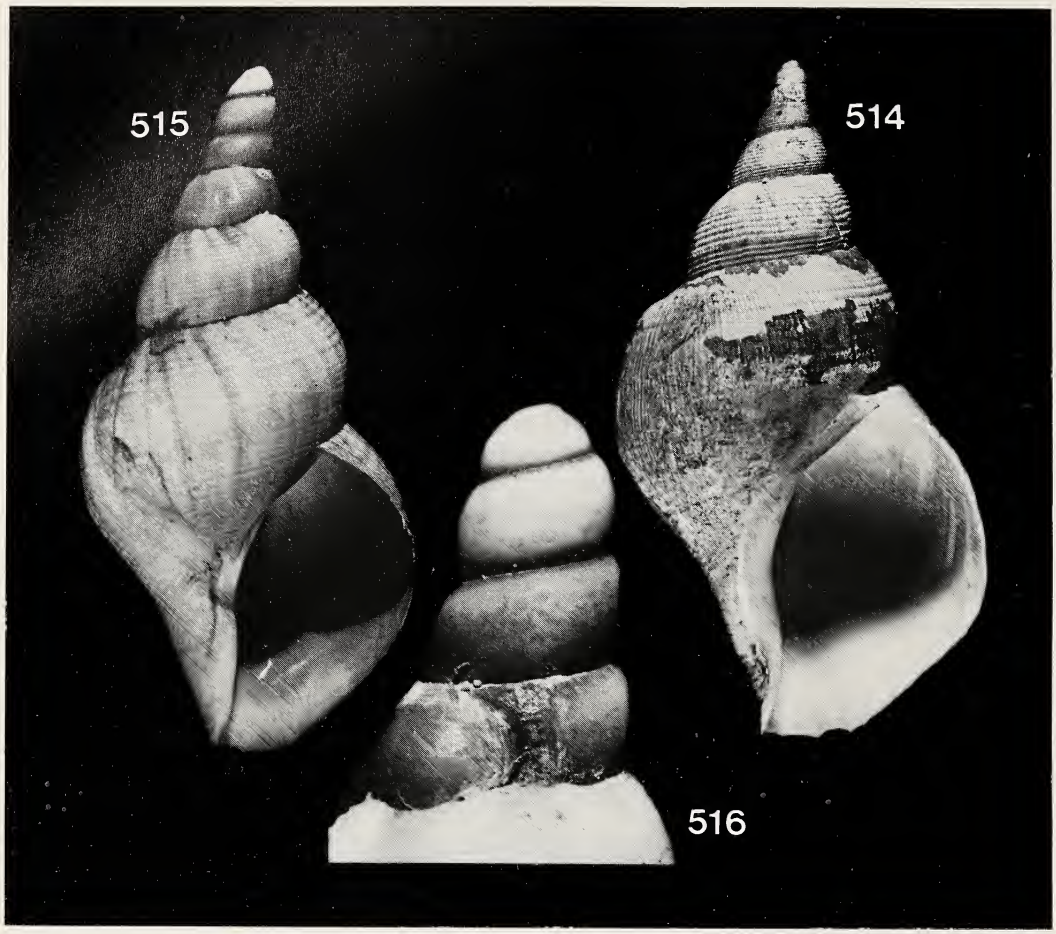
Fusus turtoni Bean, 1834:493, fig. 62.
Tritonium schantaricum Middendorff, 1849:475.
Neptunea ossiania Friele, 1879:279.
Fusus turtoni var. *brevispira* Norman, 1893:352.
Fusus turtoni var. *tumida* Norman, 1893:352.
Fusus turtoni var. *attenuata* Simpson in Marshall, 1902:41. (See also Simpson, 1903:83.)

Type locality: Off Scarborough, North Sea.
Type material: Not known.

Material examined: About 75 specimens from all parts of the distributional area (MNHN, USNM, ZMC, SMNH, ZMB, coll AW).

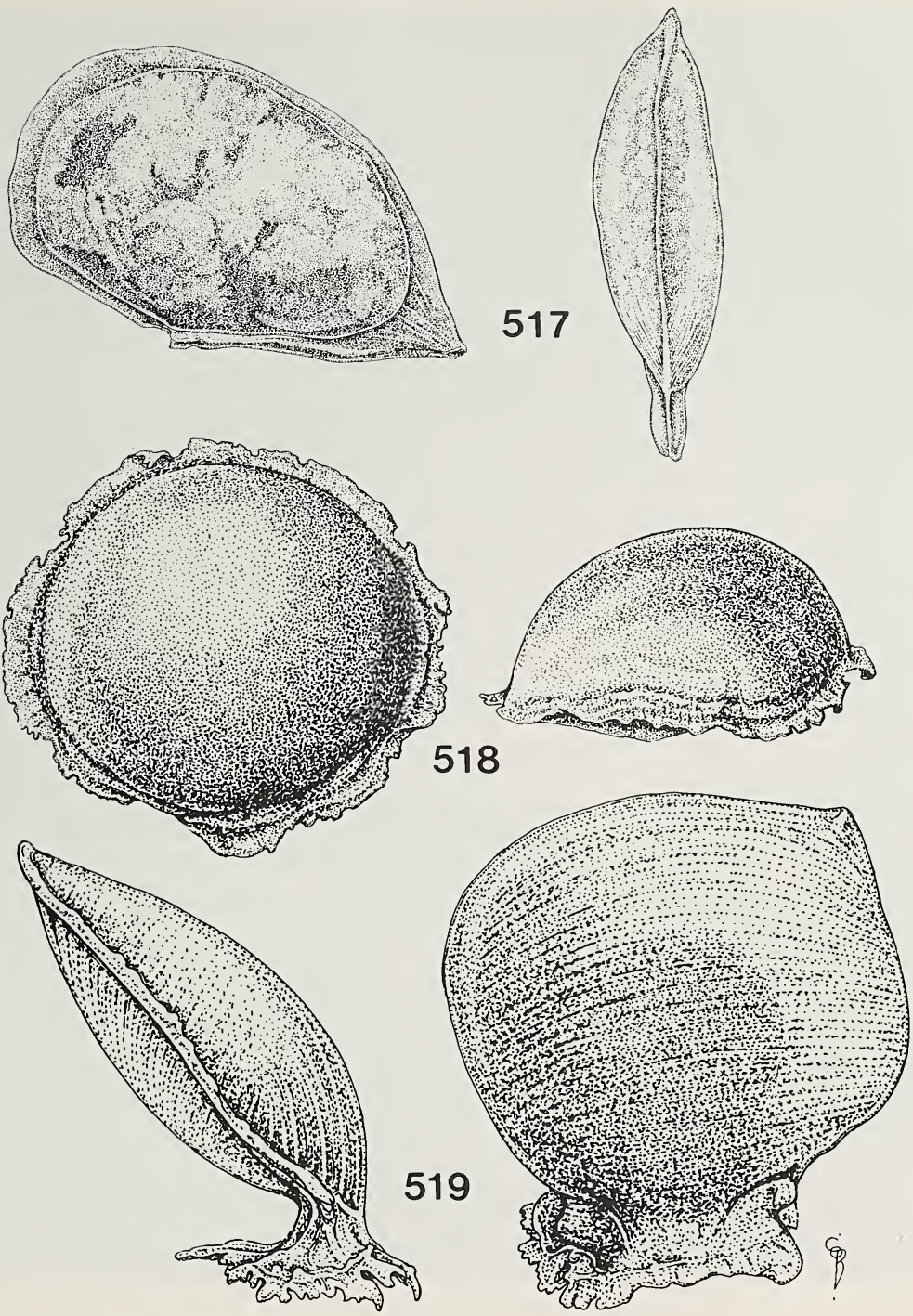
Distribution: From 80° N, between Spitzbergen and Greenland and N of Franz Joseph's Land (Friele, 1882, Gorbunov, 1946), on the continental shelves southwards to NE Norway (Verkrüzen, 1875), along the Norwegian coast (Sars, 1878), the North Sea (numerous records), Shetland (numerous records), the Faroes (unpublished in ZMC), Iceland (Thorson, 1941; Oskarsson, 1962), E, S, W Greenland (Thorson, 1944; Clarke, 1974; unpublished in ZMC), Arctic Canada from 95° W (McPherson, 1971), S to 150 miles S of Cape Race, Newfoundland (unpublished, in USNM). In Greenland it is known from 25 m, in other places the normal upper limit is about 100 m and it is known down to 1447 m (Golikov, 1964) although the lower limit usually is 600 m.

Remarks: Several attempts have been made to distinguish two species, *B. turtoni* and *B. ossiania* (Friele, 1882; McPherson, 1971; Thorson, 1935). We have examined the types of *B. ossiania* and the differences from the typical form in the North Sea were noticed, but most specimens we have seen are intermediate and there is no difference in the distribution of the forms, so the names should not even be used for subspecific separation.



Figs 514-516. *Beringius turtoni*. 514, NW of Disco, W Greenland, 202 m, 121 mm. 515 and 516, off Korsfjorden, Bergen area, 240-250 m, 62.8 mm.

The differences in the egg capsules mentioned by Friele (1882) are probably the result of variation because his description of the egg capsules of *B. ossiania* agrees very well with Jeffreys' description (1867) which was based on typical *B. turtoni*. Jeffreys described the colour of the capsules as "pale orange", Friele (1882) said that the capsules of *B. ossiania* were "citron-yellow" while Thorson (1935) said that the capsules of *B. turtoni* were more yellow than those of *B. ossiania*. Howse (1847) figured in the capsules and described them as "pale yellow".



Figs 517-519. Egg capsules. 517, Unknown (buccinid?) egg capsule, WALDA st DS7 (19°57 S, 11°02 E, 1227 m), length 7.0 mm. Side and top views. 518, *Volutopsius norwegicus,* off NE United States, diameter 32 mm. Top and side views. 519, *Beringius turtoni,* Dogger Bank, 75 m, diameter 28 mm. Side views.

Genus VOLUTOPSIUS Mörch, 1857

Type species: Fusus largillierti Petit de la Saussaye, 1851, by original designation.

Synonym: Strombella Gray, 1857:13 (not Schlüter, 1838). Type species *Strombus norwegicus* Gmelin, 1790 by monotypy.

Remarks: The genus *Volutopsius* contains a few arctic species. Tiba & Kosuge (1979) listed the N Pacific species. In the N Atlantic there are two species, *V. norwegicus* and *V. (Pyrulofusus) deformis* (Reeve, 1847). *V. deformis* is sinistral and has lateral teeth of normal *Buccinum* type. *V. harpa* (Mörch, 1857) has often been considered a subspecies of *deformis,* but has the same kind of lateral teeth as *norwegicus* (Habe & Sato 1973) and should be kept distinct. The variation in the lateral teeth in this otherwise uniform group of species clearly shows that it is of little or not value above the specific level.

Volutopsius norwegicus (Gmelin, 1790) Figs 443-444, 467, 518, 520-524

Strombus norwegicus... Chemnitz, 1788:218 (not binominal).
Strombus norwegicus Gmelin, 1790:3250.
Fusus largillierti Petit de la Saussaye, 1851:255.

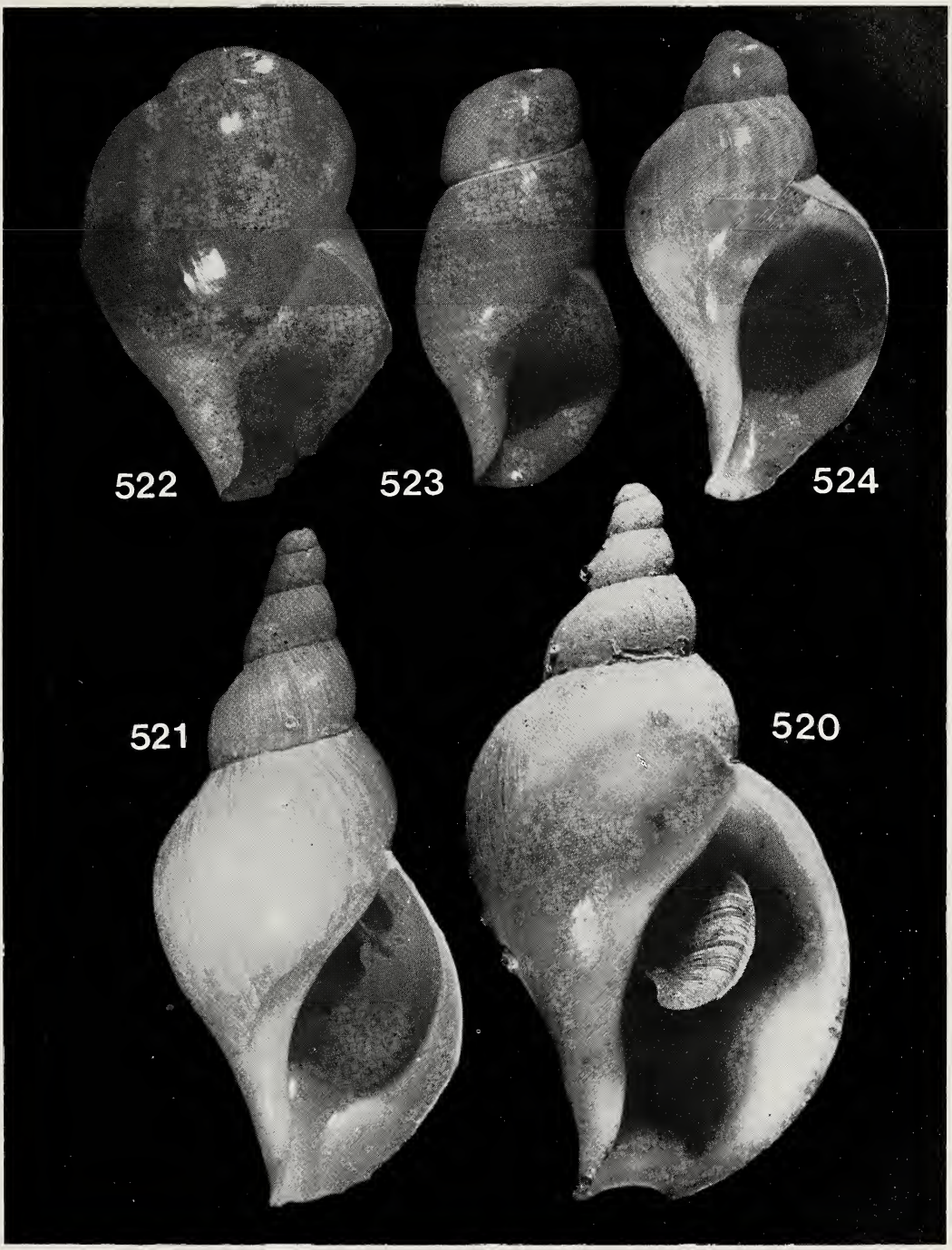
Type material: S. norwegicus, lost? Not found in ZMC; *F. largillierti,* lost? Not in MNHN.

Type locality: S. norwegicus, Norway; *F. largillierti,* Newfoundland.

Material examined: About 150 shells and specimens from all parts of the range.

Distribution: From Spitzbergen, E and W Greenland southwards on the continental shelves, to the North Sea, Shetland, The Faroes, and Iceland (Odhner, 1915; Thorson, 1944; Schlesh, 1926; Sars, 1878; Jeffreys, 1867), and from Arctic Canada, *c.* 95° W, to George's Bank, 42° N (Macpherson, 1971 and unpublished material in USNM). It is restricted to the continental shelf, 25 m (E Greenland, Thorson, 1941) to about 600 m (numerous records) except S of Iceland where it occurs down to 2000 m (unpublished material in ZMC).

Remarks: There is a distinct cline in the size of the larval shell in *V. norwegicus,* W Atlantic specimens having a larger one, but examination of a large collection in ZMC from Iceland and Greenland proved that it is hardly possible to separate *V. largillierti* more than possibly as a western subspecies, not sharply limited from the nominal species. Examination of further Siberian material may show that *V. middendorffi* (Dall, 1891) belongs to the present species and it thus has a more or less circumpolar distribution.



Figs 520-524. *Volutopsius norwegicus*. 520, *norwegicus* form, Balsfjord, Tromsö area, 100 m, 85 mm. 521, *largillierti* form, NW Atlantic, 500 m, 92.5 mm. 522, embryonic shell from egg capsule, Shetland, 8.8 mm. 523, Shetland, 15.7 mm. 524, INGOLF st 81 (61°44 N, 27°00 W, 913 m), 30.6 mm.

Genus *NEPTUNEA* Röding, 1798

Type species: Fusus antiquus Linné, 1758, subsequent designation Sandberger (1861) and Nelson (1976).

Synonym: Aulacofusus Dall, 1918. Type species *Fusus spitzbergensis* Reeve, 1855.

Remarks: Aulacofusus spitzbergensis is quite similar to *Neptunea antiqua,* in shell, radula and opercular characters and differs mainly by its smaller size. We can therefore see no reason for separating *Aulacofusus,* even as a subgenus.

It is not our intention to discuss the *despecta - antiqua* complex or the numerous arctic forms, but we have limited our discussion to the two species that occur on the upper parts of the continental slope in Europe and *N. brevicauda* which has a similar distribution in the NW Atlantic.

Neptunea brevicauda (Deshayes, 1832) Figs 404,456,528-529

Fusus brevicauda Deshayes, 1832:159.
Fusus spitzbergensis Reeve, 1855:395, pl. 32, figs 6a-b.
Tritonium schantaricum Middendorff, 1849:475.
Neptunea terebralis Gould, 1860:326 (not Lamarck, 1803).
Fusus lividus Mörch, 1862:36.

Type material: F. brevicauda, holotype in MNHN; *F. spitzbergensis,* holotype BMNH 197654.
Type localities: F. brevicauda, not known; *F. spitzbergenis*, said to come from Spitzbergen.
Material examined: 20 samples with about 40 shells and specimens, all from the NW Atlantic.

Distribution: From Maine and northwards along the N American Arctic coast, to the state of Washington in 2—548 m (Macpherson, 1971), Bering Sea and the Sea of Okhotsk (Middendorff, 1849). Not known from the Siberian coast, the NE Atlantic or Greenland.

Remarks: Fusus spitzbergensis was said to originate from Spitzbergen in the original description, but no later writers on molluscs from Spitzbergen have reported it, nor is it present in any collections we have examined from the NE Atlantic. Pain (1978) figured a specimen from "west of Spitzbergen, 400 m", but his figure shows a specimen of *Colus sabini.* Therefore we suppose the species to be absent from the N Atlantic, except the American coast. We have therefore preferred to use the older name of Deshayes, which does not imply an erroneous distribution.

No locality was given for *Fusus brevicauda,* but on the label one can read "Kamchatka" (NW Pacific), which probably has been added later.

Probably some specific names described in various papers by Dall have to be added to the synonymy.

N. brevicauda looks like a slender, miniature *N. antiqua,* but has more regular sculpture.

Neptunea antiqua (Linné, 1758) Figs 405, 476, 525-526

Murex antiquus Linné, 1758:754

Type locality: "In oras Europaeo".
Type material: Two syntypes in the Linnean Society, London.

Material examined: THALASSA st W406, 43°55 N, 05°44 W, 700-400 m, 1 sh; st Y418, 41°19 N, 09°15 W, 585 m, 1 sh; st Z435, 48°39 N, 09°54 W, 720 m, 1 sh; BIOGAS CV22, 47°42 N, 08°19 W, 1331 m, 1 sh; several hundred specimens from the Scandinavian and British coasts, 15—600 m (coll. AW, USNM, ZMC, SMNH).

Distribution: Uncertain to the north and west. It is common in S Scandinavia and around the British Isles, 15–1000 m (Seaward, 1982; Pearce & Thorson, 1967).

Remarks: In our material from deep water, there are a few empty shells from the Bay of Biscay and a single one from off N Portugal, which agree well with the form common off the British Isles and Scandinavia in deep water. They are all old and rather worn and probably fossil. This form can neither be attributed to typical *N. antiqua* which is the form common in shallow water in the Skagerrak, the Kattegat and the southern Baltic, nor can it be identified with typical *N. despecta,* which is a more heavily sculptured northern form. Intermediates between all these forms occur, but each of these populations can be recognized from the shell with certainty. The relations between these populations are not known.

Locard (1886) published several records from the Channel and the Bay of Biscay, in shallow water. We have not seen any specimens in his collection, which now is in MNHN, and doubt the validity.

The biology of *N. antiqua* is fairly well known. Pearce & Thorson (1967) summarized what is known, and Fänge (1960) reported on its poisonous salivary secretion.

Neptunea contraria (Linné, 1771) Fig. 527

Murex contrarius Linné, 1771:551.
Fusus sinistrorsus Deshayes, 1832:160.
Fusus perversus Kiener, 1840: pl. 20, fig. 1 (name used only on the plate).

Type material: Holotype in the Linnean Society, London.

Type locality: Vigo Bay, N Spain (here designated). See also Rolan (1983:240).

Material examined: TALISMAN 1883 dr 11, 35°21 N, 07°05 W, 1084 m, 1 spm; dr 18, 33°33 N, 08°59 W, 550 m, 2 shs; THALASSA W400, 43°48 N, 05°10 W, 350–200 m, 3 spms; W405, 43°56 N, 05°44 W, 690-400 m, 1 sh; W426, 44°08 N, 08°24 W, 337-215 m, 1 spm; Y377, 41°32 N, 09°14 W, 320 m, 1 sh; Fosse de Cap Breton, Bay of Biscay, 1 sh; a few dozen shells and specimens with less precise localities: Vigo Bay, Bay of Biscay, Spain etc. (MNHN, USNM, ZMC).

Distribution: Along the shelf and upper continental slope from the southern parts of the Bay of Biscay to Morocco (Locard, 1897) in 100—1000 m. Mediterranean records seem to be based on fossil specimens (Barsotti & Frilli, 1970).

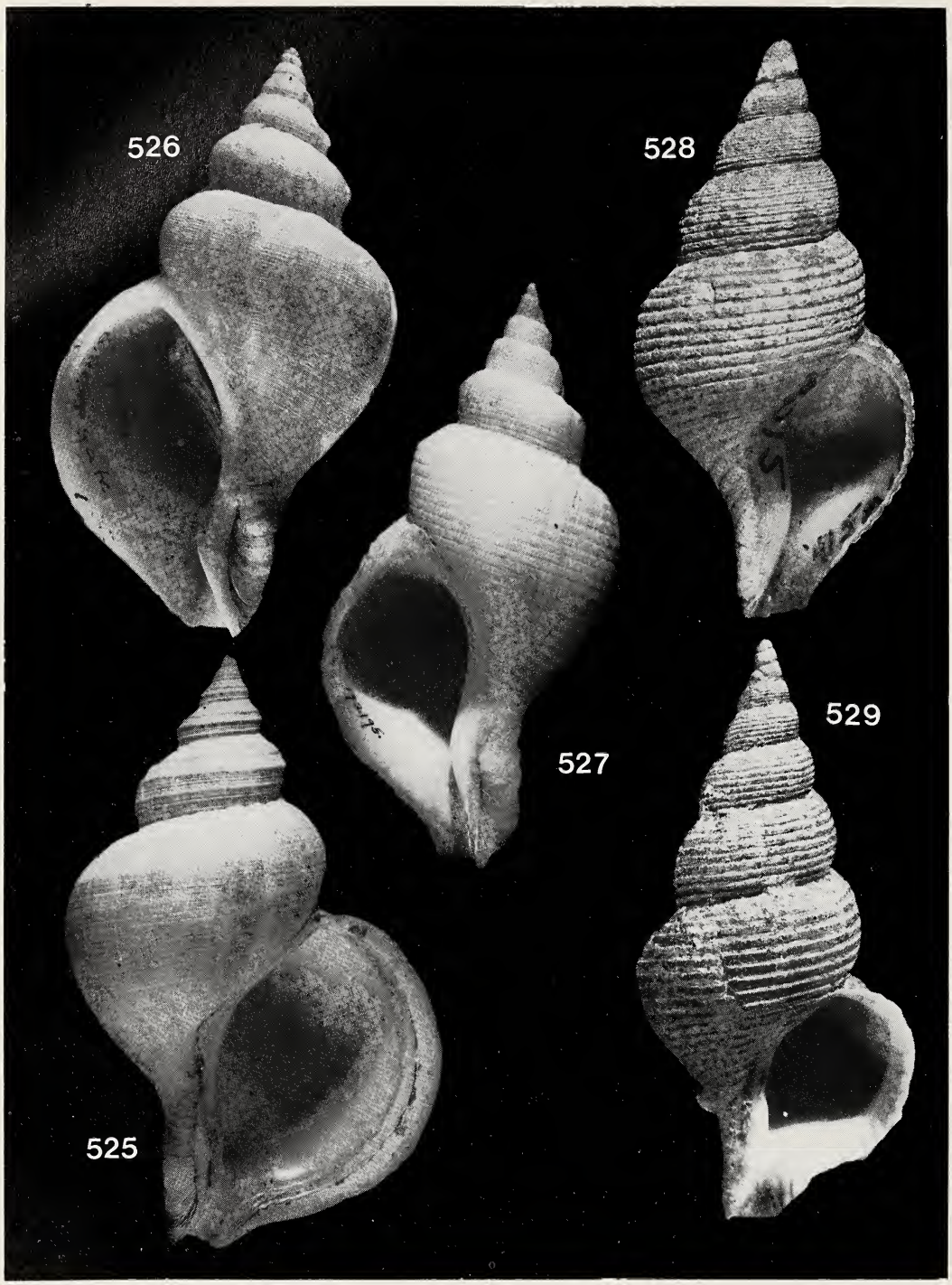
Remarks: There have been numerous discussions in the literature whether *M. contrarius* was based on the normally sinistral S European species or on a sinistral specimen of *N. antiqua.* Examination of the holotype proved that the name was based on the S European species, as Hanley (1855) concluded.

Dautzenberg (1910) recorded *N. contraria* from Cap Blanc, Mauretania, without any comments about the depth. We have examined this specimen in IRSN, and although the shell looks very fresh, the label says that it was collected at 32 m above sea level in a quaternary deposit.

Neptunea contraria resembles sinistral specimens of *N. antiqua,* which occasionally occur, but can be separated by having a sculpture of coarser but more equal sized spiral ribs, that are rounded, never sharp.

Some details on the anatomy of *N. contraria* were given by Fischer & Bouvier (1890).

Golikov (1963) regarded *N. contraria* as a subspecies of *N. antiqua* but we cannot agree. The fossil history of *N. contraria* goes back to the Pliocene, as does that of *N. antiqua,* and there has never been any mixing of them (*cf.* Harmer, 1914 and Strauch, 1972).



Figs 525-529. Genus *Neptunea*. 525, *N. antiqua,* Skagerrack, 155 mm. 526, Great Britain (Jeffreys coll.), sinistral specimen, 88.3 mm. 527, *N. contraria,* off Vigo, NW Spain, 92.5 mm. 528, *N. brevicauda,* Egg Harbor, Labrador, 13 m, 27.7 mm. 529, Newfoundland Banks (45°38 N, 55°00 W), 52.0 mm.

Genus *MOHNIA* Friele in Kobelt, 1878

Type species: Fusus mohni Friele, 1877, by monotypy.

Remarks: In *Mohnia* we have included a number of bathyal and abyssal buccinids that have a more or less distinctly spirally-coiled operculum and a small initial whorl in the larval shell that increases its diameter regularly (Figs 534, 537, 540, 543). The radula has a more or less square central tooth with one or three cusps and lateral teeth with two major and 0–2 minor cusps between these.

All species we know of *Mohnia* are true deep-water species. They are known from the N Atlantic, the N Pacific, and the Arctic basins.

In some species the spiral coiling of the operculum can be observed only in young specimens because its older parts get worn rather early in life.

We have divided *Mohnia* in two subgenera, *Mohnia* s.str. and *Tacita.* The species of *Tacita* have a more or less distinct axial sculpture in addition to spiral lines and lose the spirally-coiled part of the operculum early in life. The species of *Mohnia* lack axial sculpture and usually the operculum keeps the apical part throughout life.

In *Mohnia* we have also included some species for which we could not find a better genus, although we are not satisfied with their position here, viz. *M. carolinensis, M. caelatus* and *M. glyptus.*

The species referred to *Mohnia* can be determined by the following key:

A.	Only spiral sculpture present, suture not very deep	B *(Mohnia* s.str.*)*
A.	Axial sculpture usually present	D
B.	Three or four major spiral ribs on the upper whorls	*M. mohni*
B.	Several to many spiral ribs or lines present	C
C.	Spiral ribs of unequal size, separated by broader interstices	*M. parvus*
C.	Numerous fine spiral ribs of equal size, separated by narrow interstices	*M. simplex*
D.	Whorls with a distinct shoulder	*M. (T.) blakei*
D.	Whorls evenly rounded	E
E.	Broad, rounded axial ribs present on all whorls	F
E.	Axial sculpture usually present only on the upper whorls	H
F.	Spiral sculpture forms knobs at the intersections with the axial ribs	*M. carolinensis*
F.	Spiral sculpture disappears on the axial ribs	G
G.	Columella distinctly curved	*M. caelatus*
G.	Columella almost straight	*M. glyptus*
H.	Axial sculpture of strong short ribs on the upper whorls	*M. (T.) abyssorum*
H.	Axial sculpture of rather indistinct, broad growth lines	I
I.	Spiral lines sharp	*M (T.) krampi*
I.	Spiral lines low and rounded	*M (T.) danielsseni*

Mohnia (Mohnia) mohni (Friele, 1877) Figs 435, 482, 530-531

Fusus mohni Friele, 1877:6.
Fusus concinnus Jeffreys, 1883:396, pl. 44, fig. 8.

Type material: F. mohni in ZMB, not seen; *F. concinnus,* holotype BMNH 85.11.5.4576.

Type localities: F. mohni N. of the Faroes, 1000–2000 m; *F. concinnus,* 60°05 N, 06°21 W, S of the Faroes, 1100 m.

Material examined: 3000 shs and spms, listed by Bouchet & Warén (1979) and from INGOLF st 104, 105, 107, 110, 111, 112, 113, 116, 117, 118, 119, 120, 124, 125 and 139, W and NW of Iceland, 650-2300 m; 81°14 N, 22°50 E, 150 m, 1 sh, SMNH.

Distribution: The Norwegian and Arctic abyssal basins (Bouchet & Warén, 1979; Lus, 1981), in 650-3800 m.

Remarks: M. mohni is only likely to get confused with *M. danielsseni*, with which it occurs together, but it can easily be separated by having the apical whorls of half the diameter of *M. danielsseni* (Figs 531, 540).

Some details on the reproduction were given by Bouchet & Warén (1979). It can be added that the capsules are not attached to some firm substratum as are those of *M. danielsseni.*

The specific names *Mohnia alba* and *Fusus tener* which have been mentioned in the literature, are manuscript names of Friele and Jeffreys. Kobelt (1878) used the name *Mohnia alba* on plate 9 (fig. 5), but in the text he said that this name should not be used.

Mohnia (Mohnia) parva (Verrill & Smith, 1882) Figs 436, 451, 532-534

Sipho parvus Verrill & Smith in Verrill, 1882:504, pl. 57, fig. 20.

Type material: Holotype USNM 38013.

Type locality: USFC st 997, off Delaware, 600 m.

Material examined: Numerous shells and specimens, USFC stns 925, 937, 947, 1030, 1093, 1154, 2048, 2076, 2183, 2203, 2486, 2547, 2586, 2687 and George's Bank, 200 m (USNM); THOR 1902, st 164, SW of Iceland ca. 1900 m, 2 shs; INGOLF st 10, 64°24 N, 28°50 W, 1484 m, 1 sh; 74°17 N, 15°20 W, 200 m, 4 shs.

Distribution: NE America from 39° N, to SW Iceland and NE Greenland, 200—2000 m.

Remarks: This species is characterized by its uneven sculpture, which in worn specimens has an additional incised line on each spiral rib.

The specimens from NE Greenland were determined *dalli* by Posselt (1895) and formed the base for the only record from Greenland. Thus *dalli* can be cancelled from the list of gastropods from Greenland.

Mohnia (Mohnia) simplex (Verrill, 1884) Figs 437-438, 452, 535-537

Sipho (Mohnia) simplex Verrill, 1884:174.

Type material: Holotype USNM 35573.

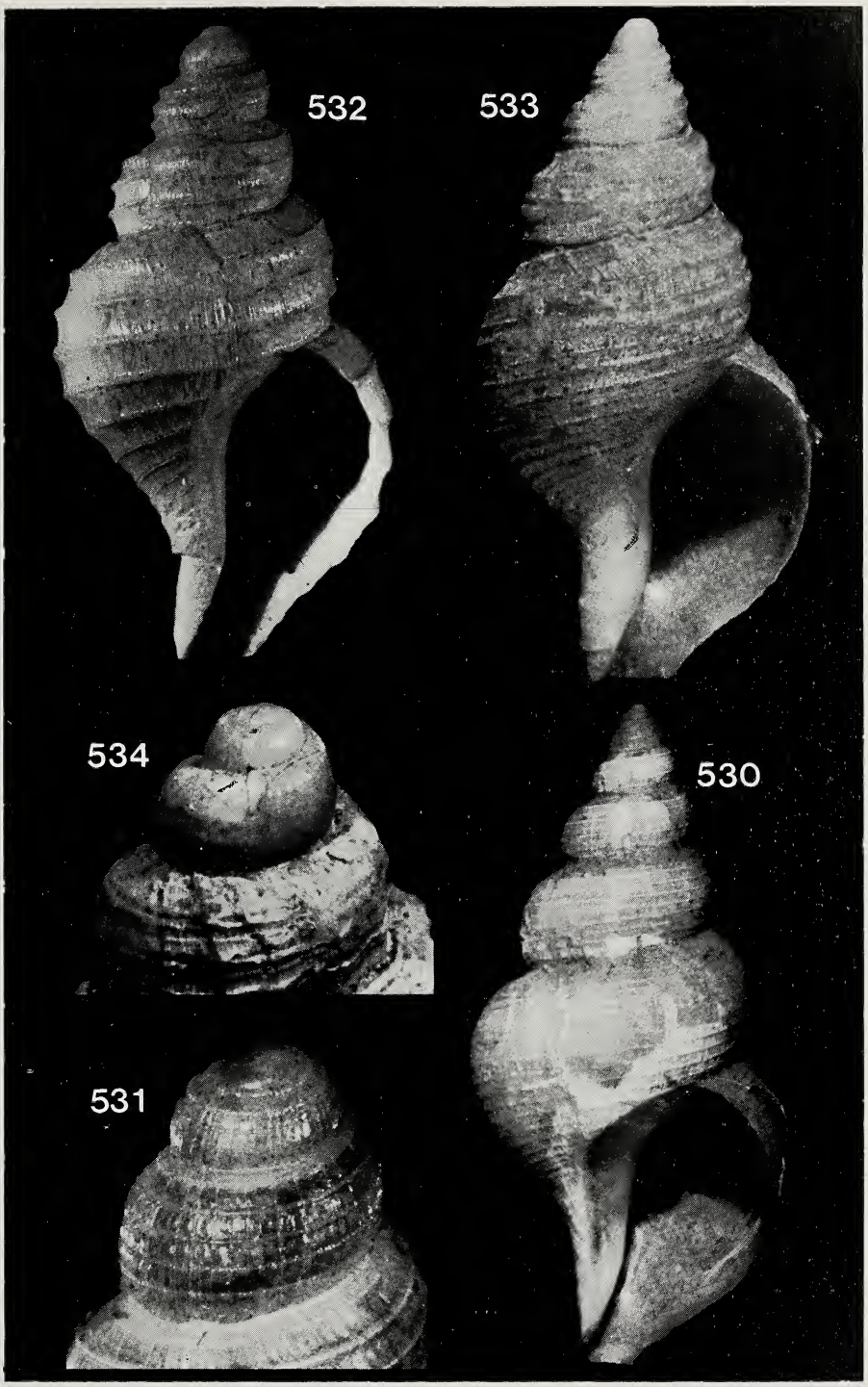
Type locality: USFC st 2115, off N Carolina, 1500 m.

Material examined: The holotype and USFC st 2470, 44°47 N, 56°34 W, 440 m, 1 spm; USFC st 54B, 42°49 N, 68°48 W, 200 m, 2 shs; Lindenows Fjord, SE Greenland, 400—600 m, 1 sh, ZMC; INGOLF st 35, 65°16 N, 55°05 W, 682 m, 5 spms.

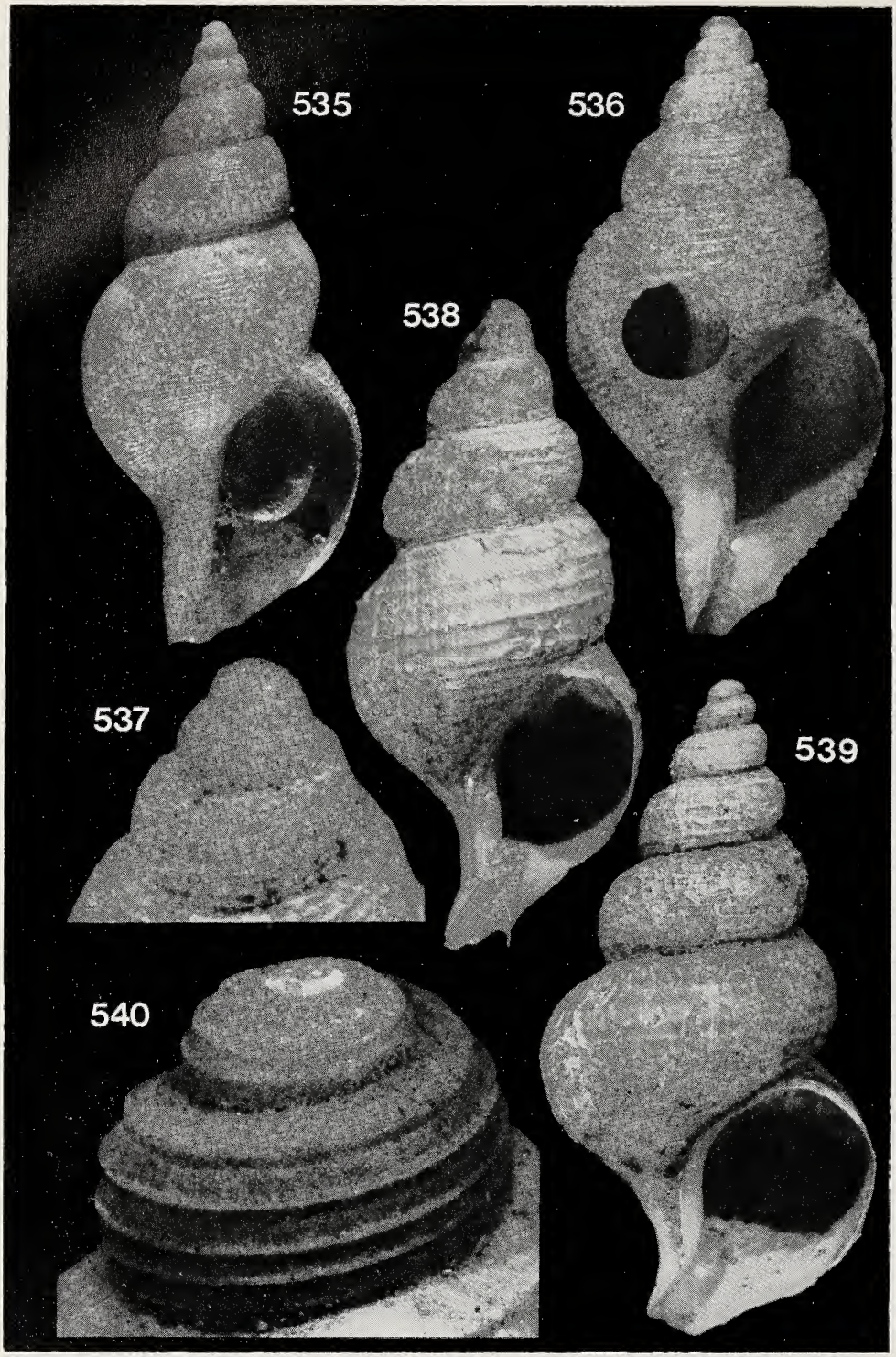
Distribution: On the upper continental slope, from N Carolina to S Greenland, only known from the material examined.

Remarks: The opercula from the specimens from USFC st 2470 and INGOLF st 35 show only traces of being paucispiral. Verrill described it as "distinctly but less than *M. mohni* paucispiral". No original material with soft parts was available to check this, but a specimen in the Locard collection, without precise locality data, had a more distinctly coiled operculum, corresponding to the description. This may indicate that more than one species is involved, but we find it more likely that it depends on intraspecific variation.

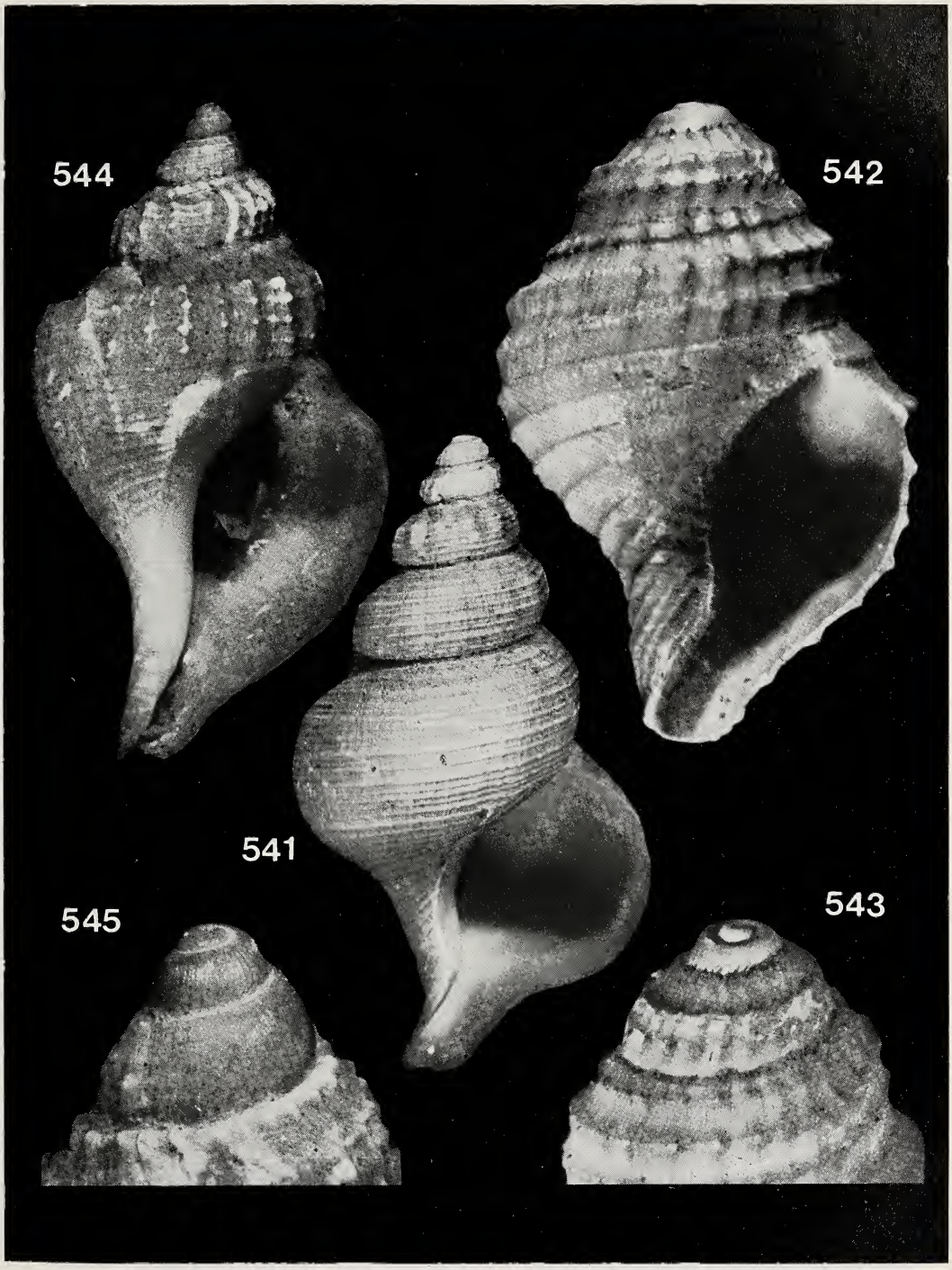
One of the specimens from the INGOLF expedition had a large parasitic copepod in the oviduct.



Figs 530-534. Genus *Mohnia*. 530 and 531, *M. mohni*, NORBI st DS18 (73°36 N, 13°35 W, 2470 m), 23.6 mm and apex 1.7 mm. 532, *M. parva*, 74°17 N, 15°20 W, 234 m, 14.2 mm. 533, *M. parva* off Martha's Vineyard, 12.8 mm. 534, *M. parva*, S of Iceland, apex 1.5 mm.



Figs 535-540. Genus *Mohnia*. 535, *M. simplex,* INGOLF st 35, 20.1 mm. 536, NE America, 202 m, 9.9 mm. 537, off Nova Scotia, 412 m, apex 1.4 mm. 538, *M. krampi,* syntype, 34.5 mm. 539 and 540, *M. danielsseni,* NORBI st CP17 (73°31 N, 13°40 W, 2500 m), 42.7 mm and apex 2.1 mm.



Figs 541-545. Genus *Mohnia.* 541, *M. abyssorum,* NORATLANTE st B17 (45°13 N, 05°31 W, 4700 m), 43.5 mm. 542 and 543, INGOLF st 36 (61°50 N, 56°21 W, 2702 m), 5.4 mm. 544 and 545, *M. blakei,* off Maryland, 3360 m, 14.9 mm and apex 2.3 mm.

Subgenus *TACITA* Lus, 1971

Type species: T. holoserica Lus, 1971, by original designation.

Remarks: The type species was described from the Kuril Trench, in 6100 m. Its anatomy was described in the original description. The shell, operculum and radula resemble rather closely those of *M. abyssorum* and *M. danielsseni.* Lus introduced the genus after comparison with *Neptunea* and *Sipho* and did not give any distinctive characters in relation to *Mohnia.* From shell morphology, radular characters and operculum we find this genus very close to *Mohnia,* but keep it as a subgenus for a number of species that have a less distinctly spirally-coiled operculum, usually are of a larger size and often have some axial sculpture.

Mohnia (Tacita) danielsseni (Friele, 1879) Figs 431-432, 480, 539-540

Type material: M. danielsseni, holotype in ZMB.
Type locality: M. danielsseni, The abyssal area between Norway, Spitzbergen and Greenland; *C. hunkinsi,* the abyssal of the North Canadian Basin.

Neptunea (Sipho) danielsseni Friele, 1879:282.
Colus hunkinsi Clarke, 1960:3, pl. 1, fig. 9.

Material examined: The material enumerated by Bouchet & Warén (1979) and numerous shells and specimens, INGOLF st 112, 113, NW of Iceland, 2400 m; 77°52 N, 03°05 W, 2750 m, 15 shs, SMNH; Recherche Bay, Spitzbergen, 90 m(?), 3 shs, SMNH.

Distribution: The abyssal parts of the Norwegian and Arctic Basins 1400-3700 m.

Remarks: Some information about the biology was given by Bouchet & Warén (1979). For differences from *M. mohni,* see that species. *M. krampi* resembles *M. danielsseni,* but has sharper spiral ridges, flatter whorls and a more narrow aperture.

Lus (1981) placed *M. danielsseni* in *Colicryptus,* which she regarded as a subgenus of *Colus. Colicryptus* is here considered a synonym of *Turrisipho* and is characterized by an apical, pointed nucleus of the operculum (Fig. 407). Therefore we prefer to keep *danielsseni* in *Mohnia.*

Mohnia (Tacita) blakei (Verrill, 1885) Figs 439, 450, 544-545.

Bela blakei Verrill, 1885:417, pl. 44, fig. 8.

Type material: Holotype USNM 44655.
Type locality: USFC st 2226, 37°00 N, 71°54 W, 3850 m.
Material examined: The type material and USFC stn 2714, off Maryland, 4 spms, 3330 m.

Distribution: Only known from the material examined.

Remarks: This species has always been regarded as a turrid but the radula (Fig. 450) clearly shows that it is a buccinid. For differences from *M. abyssorum,* see under that species.

Mohnia (Tacita) abyssorum (Fischer, 1883) Fig 426-427, 481, 541-543, 546-547.

Fusus abyssorum Fischer, 1883:391.
Sipho hispidulus Verrill, 1884:239.
Sipho profundicola Verrill & Smith, 1884: 170, pl. 31, fig. 13.
Sipho profundicola var. *dispar* Verrill, 1884: 171.

Type material: Lectotype of *F. abyssorum* (here selected) in MNHN; *S. profundicola* holotype USNM 37999; *S. profundicola* var. *dispar* holotype USNM 37955; *S. hispidulus* holotype USNM 34840.

Type localities: F. abyssorum, TALISMAN st 131, 38°38 N, 25°06 W, 2995 m; *S. profundicola,* USFC st 2037, 38°53 N, 69°23 W, 3300 m; *S. profundicola* var. *dispar,* USFC st 2042, 39°33 N, 68°26 W, 2800 m; *S. hispidulus,* USFC st 2038, 38°30 N, 69°08 W, 3650 m.

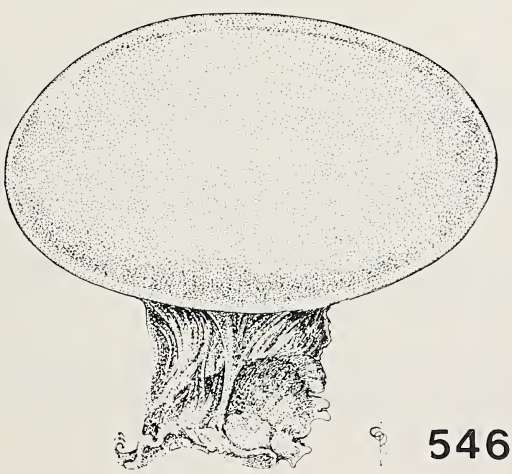
Material examined: 25 samples, mainly USFC material, with about 50 specimens from off Virginia, to George's Bank, S of Newfoundland, material in USNM; INGOLF st 20, 58°20 N, 40°48 W, 3100 m, 1 sh; st 37, 60°17 N, 54°05 W, 3100 m, 1 spm; 95 samples with about 640 shells and specimens from TALISMAN 1883, NORATLANTE, BIACORES, THALASSA, BIOGAS, INCAL, and MONACO Expeditions, mainly in MNHN, a few in MOM and IRSN. The extreme S distribution is TALISMAN st 106 (not 100 as cited by Locard), 15°48 N, 20°23 W, 3655 m; the SW extreme is TALISMAN st 117, 32°19 N, 35°44 W, 3432 m and 118, 34°46 N, 33°51 W, 3175 m. The deepest material is from MONACO expeditions st 2994, 44°08 N, 10°44 W, 5000 m. Four samples come from depths between 1900 and 2100 m; the remaining samples are deeper.

Distribution: The lowermost part of the continental slope and the upper part of the abyssal area of the Atlantic, S to about 15° N.

Remarks: This is one of the most characteristic species of the upper abyssal area of the N Atlantic. It is represented by numerous samples from 2500 m—4800 m but only four more shallow and a single below 4850 m. The S distribution is uncertain because of lack of sampling stations, but it is not present in material from the Vema fracture zone, about 11° N, 5100-5900 m.

Young specimens of *M. abyssorum* resemble *M. blakei* slightly but *M. blakei* has more narrow axial ribs and a larger larval shell. Young specimens also resemble *Kryptos koehleri* of the same size but are broader and increase their diameter more rapidly (Figs 513, 542).

Several egg capsules were present in our material. The capsule is ovate, 5 mm long and about 3 mm in diameter. It is attached to the substratum by a stalk, Y-shaped in cross section and 1.5 mm high, originating centrally from the longer side of the capsule. The capsule is filled by a homogeneous yolk. In two capsules there was a very young embryo in the veliger stage, in a third capsule (Fig. 546) solid yolk; in two capsules there were young almost ready to hatch.



Figs 546-547. *Mohnia abyssorum.* 546, BIOGAS st DS87 (44°05 N, 04°19 W, 1950 m), egg capsule, 5.1 mm. 547, INCAL st DS 10 (50°13 N, 13°17 W, 2719 m), embryo, 5.1 mm.

Mohnia (Tacita) krampi (Thorson, 1951) Figs 425, 449, 538

Sipho krampi Thorson, 1951: 54, fig. 16.

Type material: Holotype and 7 paratypes in ZMC.

Type locality: 69°50 N, 61°36 W, 1880 m, Baffin Bay.

Material examined: The type material.

Distribution: Clarke (1974) recorded *M. krampi* from 570-2300 m, (4 stations) in Baffin Bay. It has not been taken outside the deep parts of Baffin Bay.

Remarks: This species resembles *M. danielsseni* rather closely but is more slender and its whorls are higher.

All material we have examined is badly corroded and the larval shell is not known.

Mohnia carolinensis (Verrill, 1884) Figs 434, 457, 555-556

Urosalpinx carolinensis Verrill, 1884:237.

Mohnia carolinensis, Radwin 1972:339.

Type material: Numerous syntypes USNM 35735.

Type locality: USFC st 2109, off Cape Hatteras, North Carolina, 250 m.

Material examined: The material examined by Verrill (1884).

Distribution: Only known from off North Carolina, 250-1700 m.

Remarks: M. carolinensis was described as as muricid, but was referred to *Mohnia* by Radwin (1972), who examined the radula. We have examined the operculum of a young specimen, 4 mm high, and it is slightly paucispiral. The shell, however, differs widely from *Mohnia,* in being solid with strong axial sculpture and it will probably prove to be more closely related to certain tropical buccinids from deep water that now are considered to be fusinids.

The only species that *M. carolinensis* can be confused with is *M. caelatus,* which differs from *M. carolinensis* in having a weaker spiral sculpture, where the spiral lines disappear on the axial ribs.

Mohnia caelata (Verrill & Smith, 1880) Figs 433, 454, 548-551

Neptunea caelata Verrill & Smith in Verrill, 1880:369.

Sipho caelatus, Verrill 1882:506, pl. 57, fig. 19.

Sipho obesus Verrill, 1884:168.

Sipho caelatus var. *hebes* Verrill, 1884:172.

Sipho caelatulus Verrill, 1884:172.

Type material: N. caelata, syntypes USNM 38026; *S. obesus,* holotype and several syntypes USNM 35600; var. *hebes,* lectotype (here selected) USNM 35424; *S. coelatulus,* lectotype (here selected) USNM 35226.

Type localities: N. caelata USFC st 894, off Pennsylvania, 700 m; *S. obesus* USFC st 2115, off North Carolina, 1500 m; var. *hebes* USFC st 2103 off Delaware 1800 m; *S. coelatulus* USFC st 2076, off New York, 1700 m.

Material examined: The types and numerous specimens from 79 USFC stations and INGOLF st 25, 60°30 N, 54°25 W, 1065 m, 6 spms; 62°57 N, 19°58 W, 957 m, 12 shs, ZMC.

Distribution: along the upper part of the continental slope, from North Carolina to S of Iceland, 1000–2500 m.

Remarks: Comparison of the rich material of the species proved that all intermediate forms exist, although there is a tendency to form uniform populations. The name *obesus* was based on a juvenile specimen, var. *hebes* on an unusually broad specimen.

For differences from *M. carolinensis*, see under that species.

The operculum is slightly paucispiral.

M. caelata is quite similar to *M. frielei* (Dall, 1891) and *M. robusta* (Dall, 1913) from deep water in the N Pacific.

Mohnia glyptus (Verrill, 1882) Figs 430, 453, 552-554

Sipho glyptus Verrill, 1882:505, pl. 52, fig. 22, pl. 53, fig. 1.
Sipho (Siphonorbis) lindahli Posselt, 1898:180, pl. 1, fig. 5.

Type material: S. glyptus holotype USNM 38005; *S. lindahli* holotype SMNH 1566.
Type localities: S. glyptus USFC st 895, off New Jersey, 450 m; *S. lindahli* Umanak, W. Greenland, 270m.

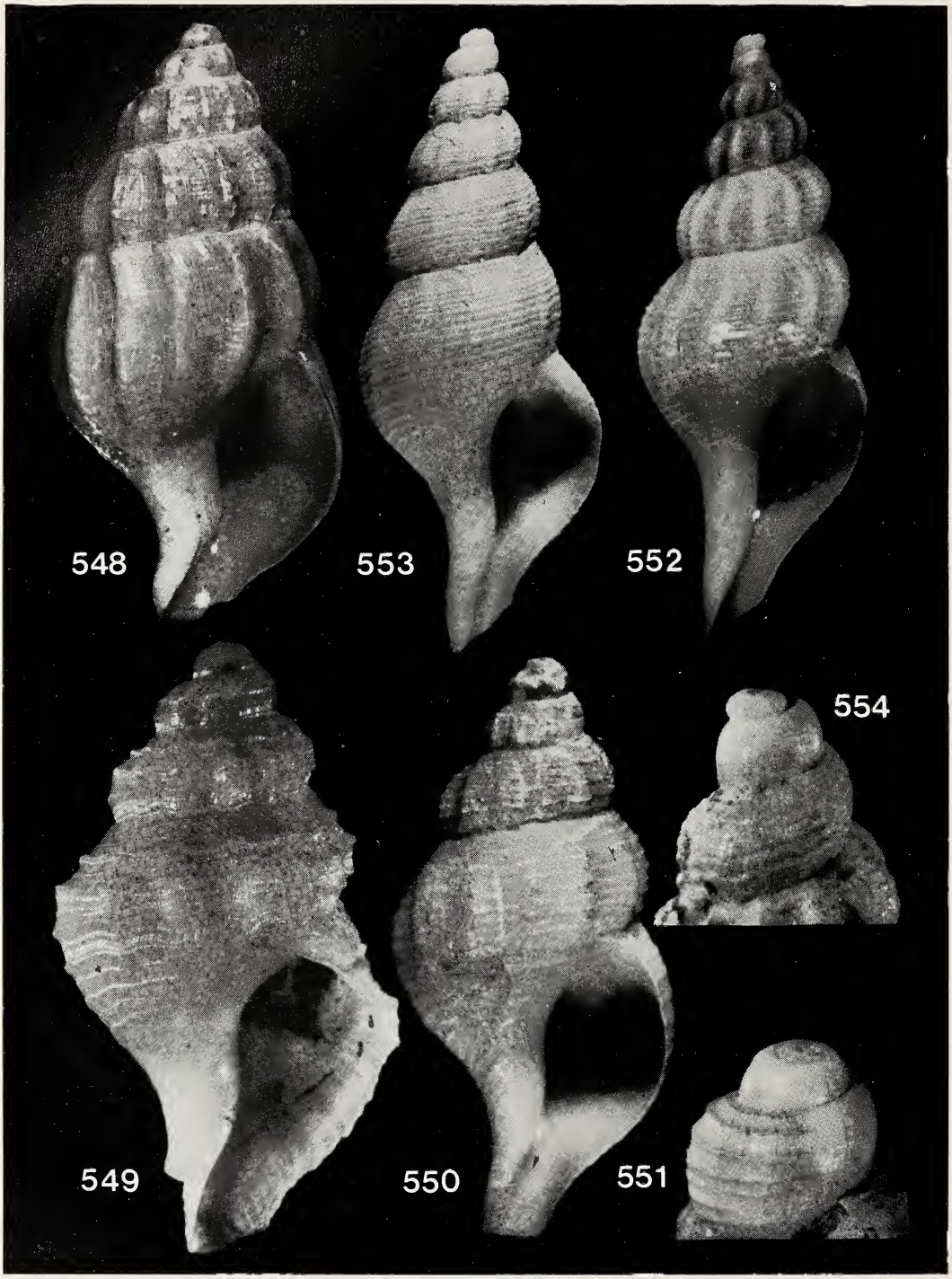
Material examined: The type material and USFC st 1154, off Martha's Vineyard, 350 m, 4 shs; 62°57 N, 19°58 W, 957 m, 4 shs, ZMC; 63°05 N, 20°07 W, 957 m, 1 sh, ZMC; INGOLF st 25, 60°30 N, 54°25 W, 1096 m, 1 sh; st 27, 64°54 N, 55°10 W, 740 m, 1 sh; st 28, 65°14 N, 55°42 W, 791 m, 5 spms; st 32, 65°35 N, 56°38 W, 599 m, 14 spms; Umanak, W Greenland, 740 m, 1 spm, SMNH.

Distribution: From off New Jersey, along the upper continental slope, northwards to S of Iceland, *c.* 300–1000 m. Only known from the material examined.

Remarks: The shell of *M. glyptus* does not resemble *Mohnia,* especially in the characters of the larval shell, but we have not found any genus that resembles this species and we have not wanted to describe a new genus for it.

The shell of *M. glyptus* resembles that of *Metzgeria,* but species of *Metzgeria* have distinct columellar folds.

The larval shell of *M. glyptus* is remarkable (Fig. 554) because of its irregular shape and it does not resemble that of any buccinid known to us. It is, however, a good character for recognizing this species.



Figs 548-554. Genus *Mohnia*. 548, *M. caelata*, SE Delaware bay, 1492 m, 17.6 mm. 549, THOR st 166 (62°57 N, 19°58 W, 957 m), 9.5 mm. 550, INGOLF st 25, 11.4 mm. 551, INGOLF st 10 (64°24 N, 28°50 W, 1484 m), apex 1.2 mm. 552, *M. glyptus*, off Martha's Vineyard, 355 m, 15.8 mm. 553 and 554, INGOLF, st 32, 17.4 mm and apex 1.4 mm.

Genus TURRISIPHO Dautzenberg & Fischer, 1912

Type species: Fusus lachesis Mörch, 1869, by original designation.
Synonyms: Colicryptus Iredale, 1918. Type species *Fusus fenestratus* Turton, 1834, by original designation.
Undacolus Nordsieck, 1968. Type species *Neptunea undulata* Friele, 1882, by original designation.
Remarks: The species of *Turrisipho* are characterized by having the nucleus of the operculum drawn out into a small apical point, a squarish central tooth of the radula with 1-3 cusps, a distinct, hairy periostracum and a high slender shell with numerous whorls.

The species here included in *Turrisipho* have previously been placed in a number of different genera, and Lus (1981) referred *Mohnia danielsseni* to *Colicryptus.* We find, however, the group here put together to be a very uniform group, especially when young specimens are compared. The pointed apical part of the operculum is especially characteristic and we have not seen anything similar in other buccinids.

The species of *Turrisipho* can be separated by the following key:

A. Aperture constitutes 0.4 of the total height of the shell or less	B
A. Aperture constitutes more than 0.4 of the total height	C
B. Diameter of third whorl *c.* 4 mm	*T. voeringi*
B. Diameter of third whorl *c.* 2.5 mm	*T. lachesis*
C. Siphonal canal well developed, occupying 1/3 of the height of the aperture	*T. dalli*
C. Siphonal canal short and broad	D
D. Distinct, broad axial ribs present	*T. fenestratus*
D. No axial ribs	*T. moebii*

Turrisipho dalli (Friele, 1881) Figs. 557-558

Sipho dalli Friele in Tryon, 1881:133 (Not *Fusus (Neptunea) dalli* Watson, 1882:379, renamed *Fusus (Sipho) liberatus* Watson, 1886:206).
Type material: Holotype, ZMB 20644.
Type locality: Between Bear Island and Norway, 350 m.
Material examined: PORCUPINE 1869, 61°21 N, 03°44 W, 1160 m, 1 sh; MONACO st 922, 58°16 N, 05°48 W, 343 m, 1 spm; Varangerfjord, N Norway (G.O. Sars leg., ZMO), 1 sh; off Korsfjorden, W Norway, 250-325 m, 1 spm, 10 shs, coll. A.W.; the material listed by Friele (1882).

Distribution: From Barents Sea, along the Scandinavian shelves, S to the Shetland — Faroe Channel and E of Iceland (Oskarsson, 1977).

Remarks: Live specimens of *T. dalli* are easily recognized by the greyish shell with rows of periostracal bristles along the spiral keels. When dead, it is well characterized by the rounded, slightly-shouldered whorls, polygyrate larval shell, its slender siphonal canal and the rather sharp axial sculpture of incremental lines and alternating spiral keels and smaller ribs. On the shoulder, the spiral ribs are of equal strength.

T. dalli was recorded from NE Greenland by Posselt (1895), but examination of the material proved that the record was based on *Mohnia parva,* and the species thus is unknown from Greenland.

We have not seen opercula of very young specimens, but shells of young specimens are very similar to those of other species of *Turrisipho.*

Turrisipho lachesis (Mörch, 1869) Figs 409, 458, 560-566

Fusus (Siphonorbis) lachesis Mörch, 1869:397.
Sipho undulatus Friele in Tryon, 1881:133.
Sipho (Tritonofusus) costiferus Posselt, 1898:183, pl. 1, fig. 6.
Type material: F. lachesis, holotype in ZMC; *S. undulatus* holotype ZMB 20656; *S. costiferus,* holotype SMNH 1567.
Type locality: F. lachesis, Ikersak, W Greenland, 144 m; *S. undulatus,* NW of N Cape, N Norway, 390 m; *S. costiferus,* off Julianehaab, W Greenland, 310 m.

Material examined: The types and MONACO st 161, 46°05 N, 46°42 W, 1267 m, 7 spms; 73°03 N, 18°30 E, 410 m, 1 sh, SMNH: Lindenowsfjord, SW Greenland, 125-150 m, 1 spm, ZMC; Lindenowsfjord, SW Greenland, 400-600 m, 1 sh, ZMC; 66°18 N, 18°36 W, 360 m, 1 spm, ZMC; TJALFE st 366, 66°22 N, 57°16 W, 686 m, 1 spm; INGOLF st 10, 64°24 N, 28°50 W, 1484 m, 1 spm; st 25, 63° 30 N, 54°25 W, 1096 m, 2 spms; st 28, 65°14 N, 55°42 W, 791 m, 25 spms; st 32, 66°35 N, 56°38 W, 599 m, 1 spm; st 35, 65°16 N, 55°05 W, 682 m, 1sh; st 138, 66°26 N, 07°56 W, 887 m, 1 spm; the material listed by Friele (1882).

Distribution: N and W of Norway, 200-1100 m (Friele, 1882, as *lachesis,* typical form and *undulata*), E and NW of the Faroes (Sykes, 1911 and ZMC) 500-900 m, N and NW of Iceland 200-1500 m (Thorson, 1941 and ZMC), SE Greenland, 400-600 m(Thorson, 1944 as *lachesis* smooth variety), SW Greenland and Davis Strait, 600-1100 m (Thorson, 1940 as *undulatus,* INGOLF & TJALFE, ZMC) and off Newfoundland, 1267 m (Dautzenberg & Fischer, 1912 as *undulatus*).

Remarks: Mörch's original description of *lachesis* was based on a very poor specimen (Fig. 565) and this led to much confusion. Friele (1882) and G.O. Sars (1878) interpreted it correctly, but after Friele's description and illustration of var. *bicarinata* (see *voeringi*) later authors used the name *lachesis* for the "variety".

Thorson (1940) described the egg capsules and larval development of what he considered to be *Sipho undulatus* but we doubt his identification. To give an impression of a higher certainty in his identification of the capsules on which his description was based, he mentioned that *S. undulatus* was taken at two adjacent INGOLF stations, nos 25 and 28, but he did not mention that they originated from depths of 1096 and 791 m, while the egg capsules came from 2260 m, 700 m deeper than any of the about 20 records we know of. There is also a difference in the sculpture of his drawing of the larva and actual specimens of *T. lachesis.* His drawing does not show the faint, but distinct shoulder of the body whorl of the larva which is well shown in his drawing of the apical whorls of an adult specimen. We have not been able to find his specimens in ZMC and are not able to say on which species his description was based.

Some specimens of *T. voeringi* resemble *lachesis* considerably, but can always be separated by their proportionally shorter siphonal canal, more convex whorls of more slowly increasing diameter, and the diameter of the third whorl is about 4 mm in *T. voeringi,* while it is 2.5 mm in *lachesis. T. fenestratus* can be separated by its broader and more solid shell of a larger apical angle and shorter siphonal canal. *T. dalli* has a much stronger spiral sculpture and *T. moebii* has more rapidly growing diameter of the apical whorls and a much broader shape.

Turrisipho voeringi **nom.nov.** Figs 410-411, 567-570

Neptunea (Siphonorbis) lachesis var. *bicarinata* Friele, 1879:282.
(Not *Neptunea despecta* var. *bicarinata* Kobelt, 1878.)

Type material: Holotype, ZMB 26054.

Type locality: Norwegian N Atlantic Expedition st 312, S of Spitzbergen, 1170 m.

Material examined: The types and INGOLF st 101, 66°23 N, 12°05 W, 1011 m, 1 spm; st 105, 65°34 N, 07°31 W, 1435 m, 4 spms; st 116, 70°05 N, 08°26 W, 699 m, 6 spms; st 126, 67°19 N, 15°52 W, 552 m, 2 spms; Dusenfjord, E Greenland, 240 m, 8 spms, ZMC; Franz Joseph Fjord, E Greenland, 320 m, 1 sh, ZMC; Hurry Inlet, E Greenland, 90 m, 3 spms, ZMC; Forsblads Fjord, E Greenland, 90-160 m, 1 spm, ZMC; Lindenows Fjord, E Greenland, 200-350 m, 2 spms, ZMC; Ella Island, E Greenland, 48-51 m, 2 spms, ZMC; Kap Hooker, Jameson Land, E Greenland, 150 m, 2 egg capsules, ZMC; off Cap Powlet, W Greenland, 1000-600 m, 2 spms, ZMC; 75°54 N, 81°00 W, 600 m, 1 spm, ZMC; 75°26 N, 62°26 W, 820 m, 1 spm, ZMC; 63°36 N, 55°15 W, 1200 m, 1 spm, ZMC; 73°20 N, 21°21 W, 70 m, 1 spm, ZMC; 66°02 N, 11°05 W, 900-1040 m, 1 spm, ZMC; M. SARS 1902, st 35 & 96, Faroes, 540-1000 m, 5 spms, ZMC; 72°10 N, 20°37 E, 550-600 m, 1 sh, SMNH.

Distribution: S of Spitzbergen 1170 m (Friele, 1882), the Kara Sea (Thorson, 1941), the Shetland-Faroe Channel 700-1000 m (Jeffreys, 1883; Sykes, 1911), N and E of the Faroes 550-1100 m (material in ZMC), Jan Mayen (material in MNHN), E, N and NW of Iceland 500-1500 m (Thorson, 1941 and material in ZMC), E and W Greenland 25-1200 m (Thorson, 1944, 1951, material in ZMC) (all listed as *lachesis*).

Remarks: The present species was well described and figured by Friele (1882) under the name *lachesis* var. *bicarinata,* a name that cannot be kept because of Kobelt's earlier use of it. Later authors have used the name *lachesis* in that sense. We consider *lachesis* and var. *bicarinata* two

distinct species, because we have never seen any transitional specimens and the two forms can always be separated by the characters mentioned under *lachesis;* it therefore has to be given a new name.

Turrisipho fenestratus (Turton, 1834) Figs 406, 483, 571-574, 591

Buccinum fusiforme Broderip, 1830:45 (not Borson, 1822).
Fusus fenestratus Turton, 1834:351.
Neptunia peregra Locard, 1897:371, pl. 18, figs. 8-11.
Neptunia ecaudis Locard, 1897:368, pl. 18, figs. 5-7.
Neptunia fusiformis vars *gracilis & minor* Locard, 1897:370.

Type material: F. fenestratus, holotype USNM 192347; Locard's species, syntypes in MNHN.
Type localities: F. fenestratus, Cork, Ireland; *N. ecaudis & peregra,* TRAVAILLEUR 1882, dr 2, 44°05 N, 05°36 W, 608 m.
Material examined: The types and about 100 specimens from all parts of the distribution area.
Distribution: From Angmagsalik (SE Greenland), SW and S of Iceland (Thorson, 1944, 1941; Clarke, 1974; material in ZMC), to Lofoten (N Norway) and southwards to W Norway (G.O. Sars, 1878), the Faroes (material in ZMC), W of the British Isles (Seaward, 1982; Massy, 1930), Bay of Biscay (Dautzenberg, 1927; THALASSA, NORATLANTE, BIOGAS), W of Spain (Sykes, 1911) and off Morocco (35° N) (Locard, 1897). It does not occur in the Mediterranean. The depth range is from 50 m in the N and 400 m in the S, down to 1200 m.

Remarks: T. fenestratus is well characterized by its solid shell and short siphonal canal. For differences from *T. lachesis,* see that species.

Two specimens from the Faroes (432m, in ZMC) have been found in stomachs of *Anarrhichas latrifrons* (Pisces).

A single egg capsule of *T. fenestratus* was found 26 Jan 1971 in the S part of Hjeltfjord, W Norway in 90-120 m. It has a diameter of 5.5 mm, a tough, rather thick, leathery wall, it is yellowish brown and spherical with a well-defined attachment area covered with sand grains. It contained a single embryo of 3 whorls and several groups of cells, that evidently were used as nourishment.

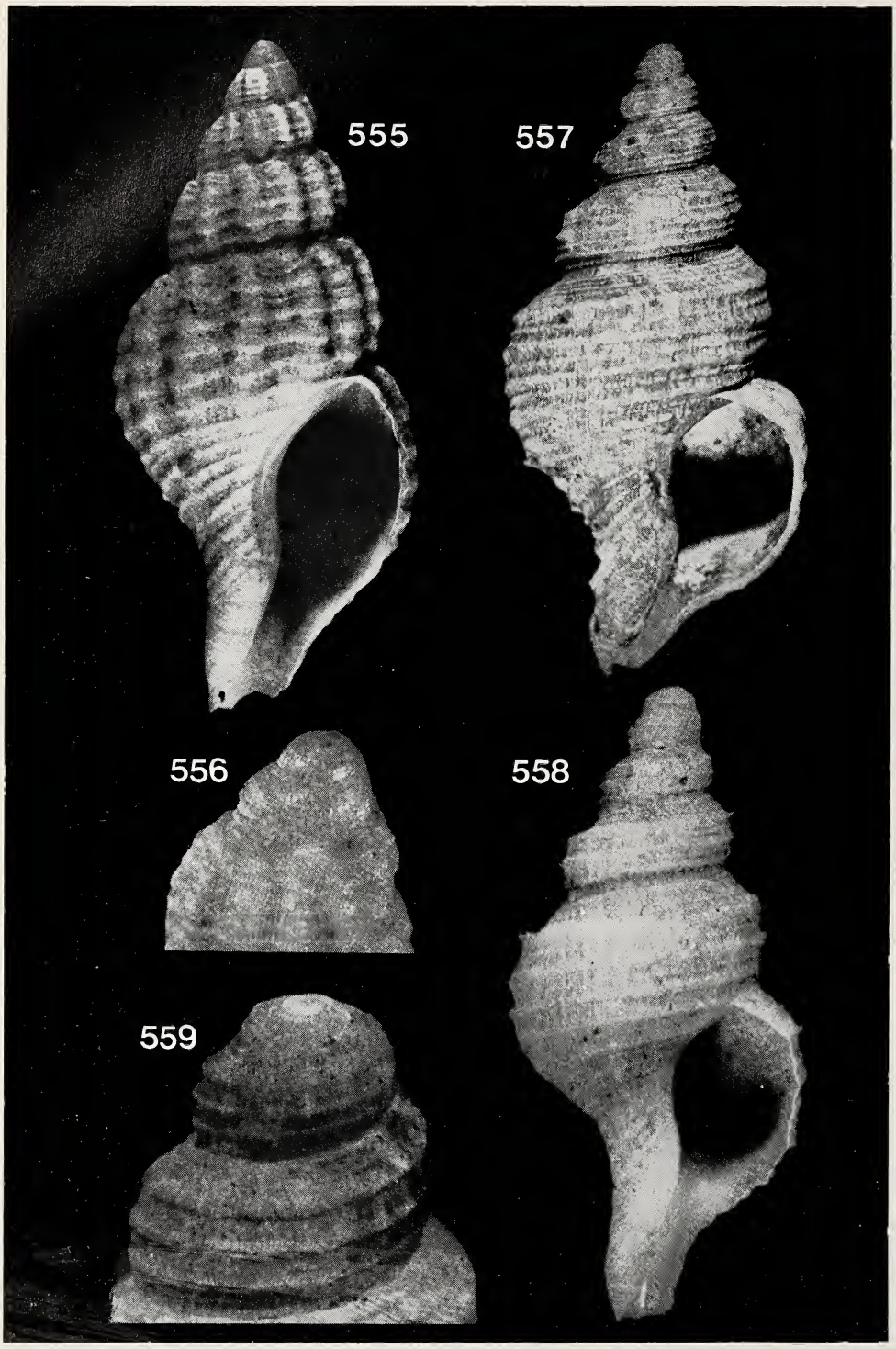
Turrisipho moebii (Dunker & Metzger, 1874) Figs 407-408, 455, 575-578

?*Fusus sarsi* Jeffreys, 1869:168 (nom. nud.) (not *Trophon sarsi* Jeffreys in Wood, 1872:25).
Tritonofusus moebii Dunker & Metzger, 1874:8.
Fusus moebii Dunker & Metzger, 1875:260, pl. 6, fig. 1.
Fusus ebur, Friele 1877:7 and most later authors, not *Fusus ebur* Mörch, 1869.
Sipho sarsi Jeffreys in G.O. Sars, 1878:275, pl. 15, fig. 2.

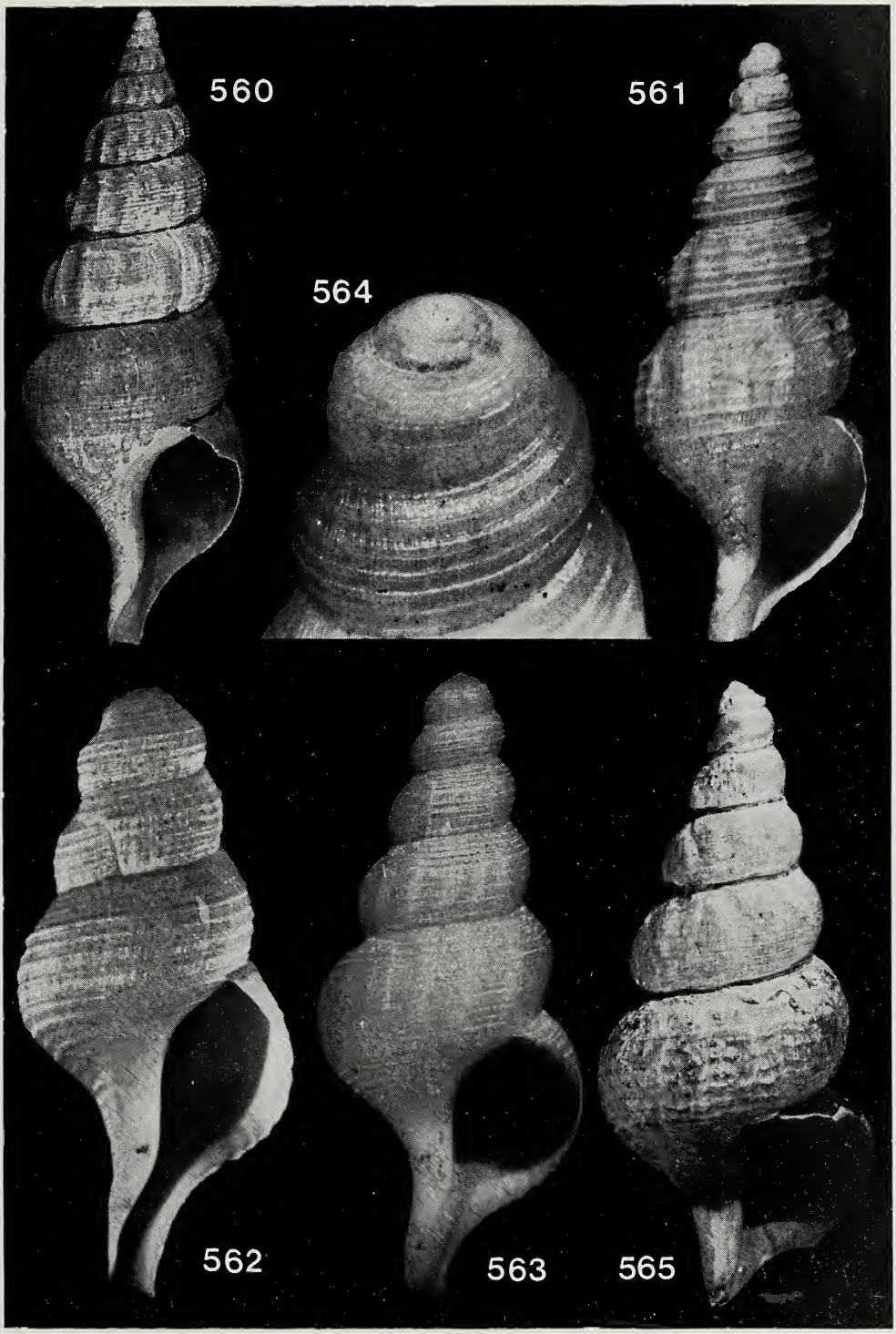
Type material: F. moebii, not found, not in ZMHU.
Type locality: F. moebii, between Lindesnes and Listerfjord, S Norway, 195 m.
Material examined: About 40 shells and specimens from all parts of the distribution area.
Distribution: From between Bear Island and Norway, to NE Norway and along the Norwegian coast into the Skagerrak (Friele, 1882; G.O. Sars, 1878; material in ZMC) and from about 27° W, off Iceland, along S Iceland (Thorson, 1941; material in ZMC), the Faroes (material in ZMC and Sykes, 1911) and off Ireland (Massy, 1930). The depth range is 200—957 m.
Remarks: The nomenclatorial history of the present species is very confused. The main source of this confusion was Mörch's description of *Fusus ebur* from W Greenland (= *sabini* Gray). That species often has quite convex whorls and other malacologists did not recognize it from the description but believed the description to be based on *T. moebii.* This mistake can also be partly blamed on the poor condition of Mörch's specimen. The manuscript name of Jeffreys (*sarsi*) that was validated by G.O. Sars (1878) has been in common use, but is preoccupied by Wood's use of the name for a British Pleistocene fossil (secondary homonym).

One of the specimens from the Faroes (in ZMC), from 400 m, had been taken from the stomach of *Anarrhichas lupus* (Pisces).

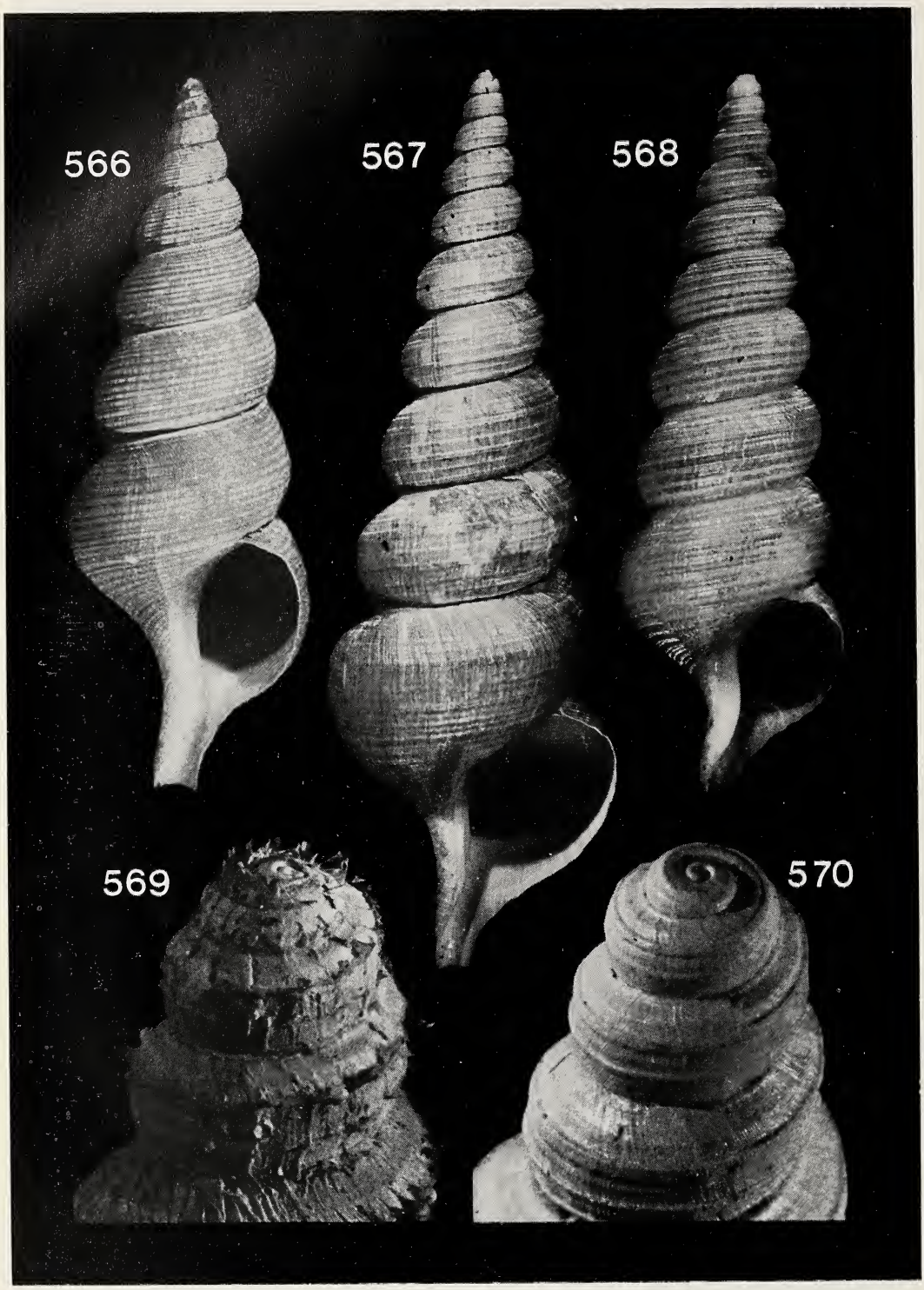
T. moebii can be recognized from its convex whorls, deep suture, hairy periostracum (greenish brown in fresh specimens), regular sculpture and multispiral larval shell.



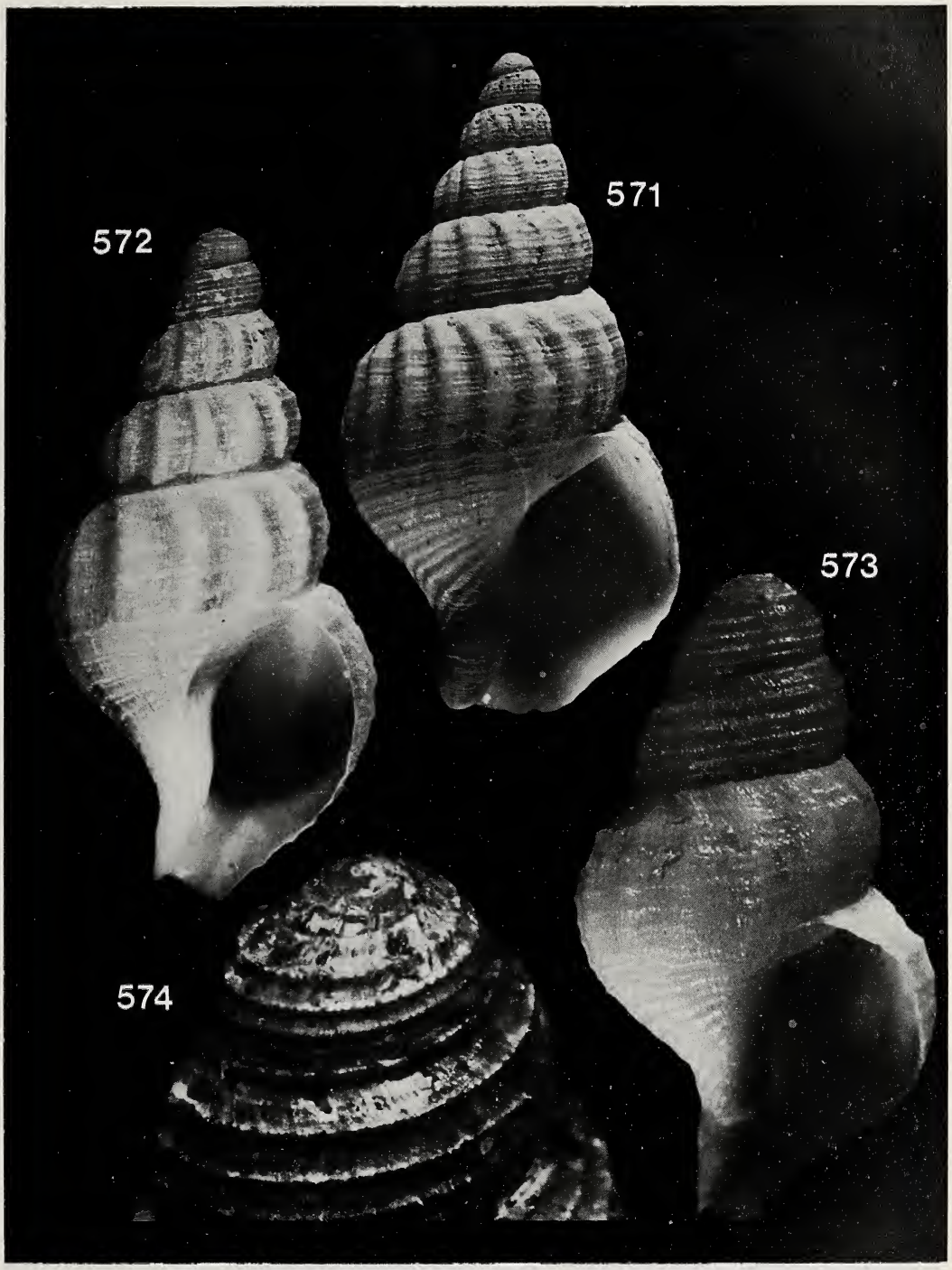
Figs 555-559. Genera *Mohnia* and *Turrisipho*. 555 and 556, *M. carolinensis,* holotype, 11.0 mm and apex 1.2 mm. 557 and 558, *T. dalli,* off Korsfjorden, Bergen area, 300-330 m, 25.0 mm and 20.3 mm. 559, PORCUPINE 1869 st 65 (61°10 N, 02°21 W, 635 m), apex 1.8 mm.



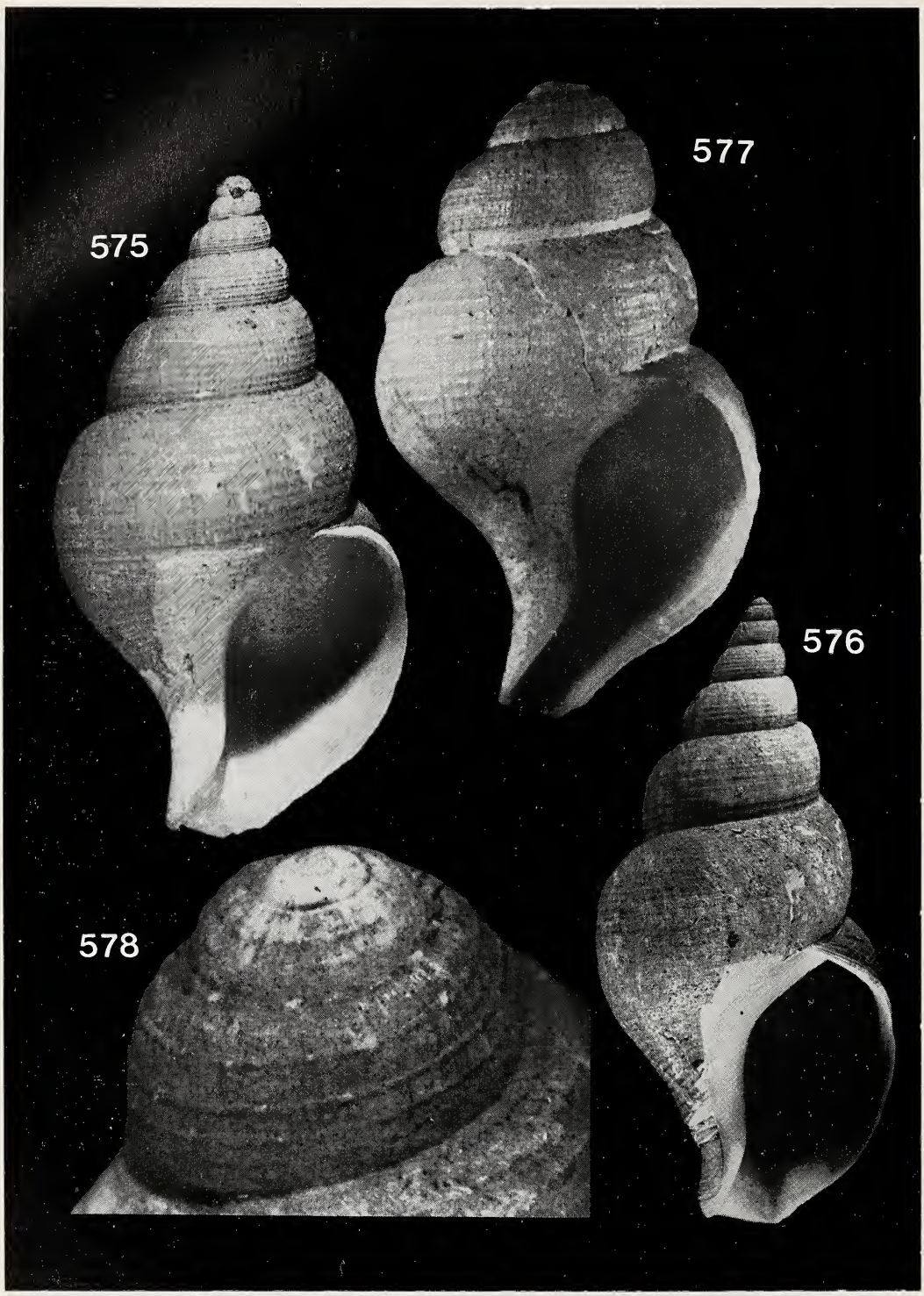
Figs 560-565. *Turrisipho lachesis.* 560, INGOLF st 25, 59.5 mm. 561, no loc. data, 20.4 mm. 562, INGOLF st 28, 9.5 mm. 563 and 564-holotype of *Sipho undulatus,* VÖRINGEN st 290, 18.2 mm and apex 3.0 mm. 565, holotype of *Fusus lachesis,* W Greenland, 144 m, 40.3 mm.



Figs 566-570. Genus *Turrisipho*. 566, *T. lachesis*, INGOLF st 28, 46.8 mm. 567, *T. voeringi*, INGOLF st 105, 77.1 mm. 568, *T. voeringi*, VORINGEN st 312 (74°54 N, 14°53 E, 1203 m), 53.3 mm. 569 and 570, *T. voeringi*, 65°34 N, 07°31 W, 1435 m, apex 6.0 mm.



Figs 571-574. *Turrisipho fenestratus*. 571, Korsfjorden, Bergen area, 130-150 m, 41 mm. 572, same locality, 75-100 m, 23.0 mm. 573, same locality, 55 m, 11.2 mm. 574, same locality 440-500 m, apex 2 mm.



Figs 575-578. *Turrisipho moebii*. 575, Skagerrak, 48.6 mm. 576, SSE of Reykjanes, Iceland, 216-326 m, 80 mm. 577 and 578, outer part of Korsfjorden, Bergen area, 340-420 m, 14.0 mm and apex 2 mm.

Genus *BELOMITRA* Fischer, 1882

Type species: B. paradoxa Fischer, 1882, by monotypy (= *B. quadruplex* (Watson)).

Synonyms: Pleurobela Monterosato in Locard, 1897. Type species *P. spelta* Monterosato in Locard, 1897, by monotypy.
Bathyclionella Kobelt, 1905. Type species *Pleurotoma quadruplex* Watson, 1881, by monotypy.
Cryptomitra Dall, 1924. Type species by original designation *Pleurotomella climacella* Dall, 1895.
Morrisonella Bartsch, 1945. Type species by original designation *Leucosyrinx pacifica* Dall, 1908.
Dellina Beu, 1970. Type species by original designation *Waipaoa munida* Ponder, 1962.

Remarks: Belomitra has always been considered a turrid genus (Powell, 1966), although Vayssière (1930) showed that it has a buccinid radula (Figs 488-489). The radula of *Morrisonella* is known and agrees well with our figures. *Dellina* is known only from empty shells, and was considered to belong to Cancellariidae, but we find the shell so similar to *Belomitra* that we have synonymized it.

Our material of *B. quadruplex* shows great variation and there exist several areas where the species occurs in more shallow water and forms morphologically separable populations. There is, however, a continuous transition to the more uniform deep-water form. Such shallow-water populations exist in the Bay of Biscay and the Azores. These shallow-water animals lack eyes, like the deep-water form; we therefore find it more likely that they are shallow-water outcrops of a deep-water species, than the opposite, because it is most unusual for shallow-water neogastropods to have no eyes, while many deep-water species do lack them.

Belomitra richardi (Dautzenberg & Fischer, 1906) is known only from a few specimens and we have not been able to decide whether it is a valid species or only another shallow-water offshoot of *B. quadruplex.*

The species of *Belomitra* resemble mitrids, but lack columellar folds and are easily distinguished by the radula. The genus is characterized by the distinctly shouldered whorls and the peculiarly shaped lateral teeth.

The central tooth of *Belomitra* resembles that of Fasciolariidae more than that of Buccinidae, but the lateral teeth are more like those of Buccinidae. We have preferred to place *Belomitra* in Buccinidae simply because there is more variation in the buccinid radula than in the fasciolariid one, as far as one can judge from the literature.

Belomitra quadruplex (Watson, 1882) Figs 424, 488-489, 579-586

Pleurotoma (Clionella) quadruplex Watson, 1882:253.
Belomitra paradoxa Fischer, 1882:275.
Pleurotoma climakis Watson, 1886:315, pl. 26, fig. 7.
Clionella quadruplex Watson, 1886:370, pl. 19, fig. 7.
Jumala brychia Verrill & Smith in Verrill, 1885:422, pl. 44, fig. 10.
Bela guernei Dautzenberg, 1891:614.
Belomitra fischeri Locard, 1897:261, pl. 13, figs 7-11.
Clionella delicatulina Locard, 1897:222, pl. 10, figs 9-16.
Clionella delicatulina var. *costulata* Locard, 1897:224.
Clionella conspicienda Locard, 1897: 225, pl. 10, figs 22-27.
Clionella quadruplex var. *minor* Locard, 1897:224.
Belomitra spelta Monterosato in Locard, 1897:263, pl. 13, figs 12-16, pl. 21, figs 15-16.
Belomitra spelta var. *minor* Locard, 1897:264.
Belomitra spelta var. *major* Locard, 1897:264.
Belomitra lyrata Monterosato in Locard, 1897:264, pl. 13, figs 23-28.

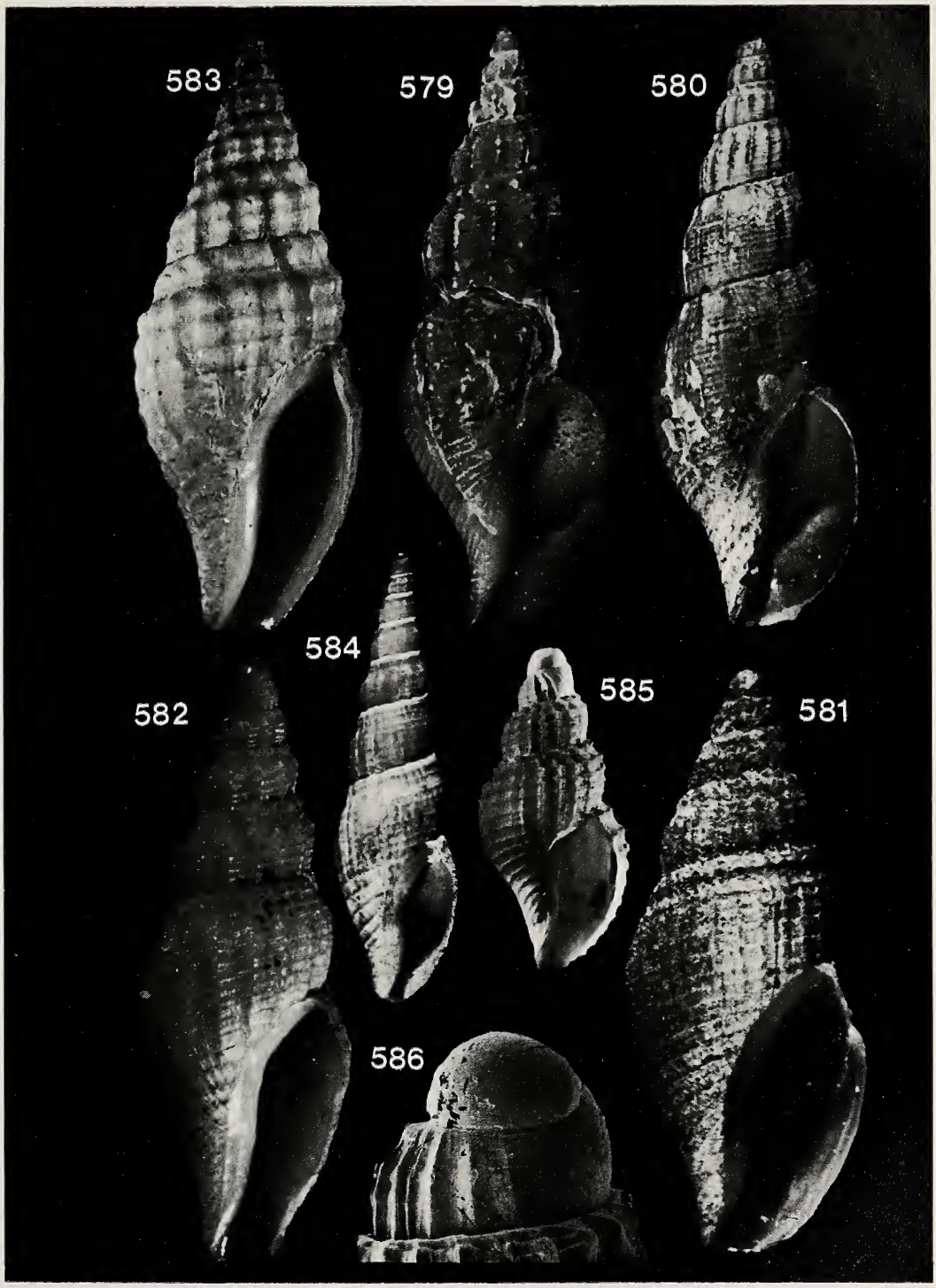
Type material: P. quadruplex holotype BMNH 1887.2.9.1127; *B. paradoxa* neotype = holotype of *B. guernei* in MOM; *P. climakis* holotype BMNH 1887.2.9.1007; *J. brychia* holotype USNM 44647; other types in MNHN.

Type localities: P. quadruplex CHALLENGER st 73, W of the Azores, 1800 m; *J. brychia* USFC st 2224, off North Carolina, 1800 m; *B. paradoxa* TRAVAILLEUR 1882, dr 16, off N Portugal, 627 m.

Material examined: The types and TALISMAN 1883 st 44, 30°03 N, 09°22 W, 2212 m, 1 sh; st 45, 30°01 N, 09°25 W, 2115 m, 3 shs; st 47, 29°52 N, 09°24 W, 2075 m, 3 shs; st 48-49, 29°52 N, 09°24-27 W, 1235-2083 m, 3 shs; st 86, 22°57 N, 15°01 W, 930 m, 2 spms; st 131, 27°35 N, 27°06 W, 1440 m, 7 shs; st 137, 38°37 N, 26°01 W, 1258 m, 10 spms; st 145, 40°35 N, 21°14 W, 4415 m, 2 spms; TRAVAILLEUR 1881 dr 42, 44°01 N, 04°45 W, 900 m, 2 shs; NORATLANTE st BO19, 47°29 N, 08°24 W, 2149 m, 3 spms; BIACORES st 39, 37°44 N, 27°03 W, 420 m, 3 shs; st 66, 38°35 N, 28°20 W, 1245 m, 4 spms; st 120, 39°04 N, 32°44 W, 2100 m, 1 sh; st 150, 37°37 N, 25°35 W, 575 m, 2 spms; st 157, 37°34 N, 25°43 W, 800 m, 1 sh; st 165, 37°33 N, 25°58 W, 2060 m, 1 sh; st 202, 27°36 N, 24°59 W, 2850 m, 3 shs; st 216, 37°05 N, 24°53 W, 1735 m, 2 shs; st 232, 36°55 N, 25°11 W, 390-620 m, 1 spm; st 240, 37°35 N, 25°33 W, 815 m, 1 spm; st 245, 40°57 N, 22°16 W, 4270 m, 3 spms; THALASSA Y 374, 41°31 N, 09°20 W, 1250 m, 1 sh; BIOGAS CV16, 44°07 N, 04°17 W, 1909 m, 1 sh; CV23, 47°33 N, 08°34 W, 2034 m, 1 spm; CP01, 47°35 N, 08°41 W, 2245 m, 1 sh; CP02, 47°33 N, 08°41 W, 2177 m, 2 spms; CP07, 44°10 N, 04°16 W, 2170 m, 1 sh; CP17, 46°31 N, 10°20 W, 4706 m, 1 spm; CP24, 44°08 N, 04°16 W, 1995 m, 1 sh; DS52, 44°06 N, 04°22 W, 2006 m, 1 spm; DS57, 47°31 N, 09°08 W, 2906 m, 2 shs; DS86, 44°05 N, 04°19 W, 1950 m, 1 spm; DS87, 44°05 N, 04°19 W, 1913 m, 1 spm; st 2, 47°30 N, 09°07 W, 3050 m, 1 sh; st 1, 44°33 N, 08°38 W, 2170 m, 4 shs; INCAL CP01, 57°58 N, 10°55 W, 2068 m, 1 spm; CP02, 57°58 N, 10°43 W, 2091 m, 2 spms; CP03, 56°38 N, 11°06 W, 2466 m, 4 shs; CP13, 46°02 N, 10°14 W, 4800 m, ØS05, 47°31 N, 09°34 W, 4296 m, 1 sh; ØS06, 46°27 N, 09°36 W, 4316 m, 1 sh; WS 07, 47°30 N, 09°37 W, 4281 m, 2 spms; WS 08, 47°31 N, 09°34 W, 4300 m, 1 sh; WS 09, 47°29 N, 09°34 W, 4277 m, 3 spms; WS 10, 47°27 N, 09°40 W, 4354 m, 2 spms; INGOLF st 10, 64°24 N, 28°50 W, 1484 m, 1 sh; SEABED II, st CP19, 19°15 N, 29°49 W, 4958 m, 1 spm; CP20, 19°13 N, 29°48 W, 4940 m, 2 spms.

Distribution: The lower parts of the European continental slopes, from S of Iceland, south to 19° N. In the Azores and the Bay of Biscay it also occurs more shallowly, up to about 300 m. It also occurs all over the N Atlantic abyssal area, but does not reach the N American continental slope. The deepest records are from about 5300 m (Fechter, 1979).

Remarks: The animal lacks eyes and has direct development. The variability is discussed under the introduction to the genus. Abyssal specimens tend to be larger and have a thinner shell (*"brychia"* Verrill), bathyal specimens are more solid and smaller (*"paradoxa"* Fischer).



Figs 579-586. *Belomitra quadruplex*. 579, NORATLANTE st B19, 30.4 mm. 580, syntype of *Clionella delicatulina*, 35 mm. 581, BIACORES st 240, 11.4 mm. 582, BIACORES st 232, 15.5 mm. 583, holotype of *Pleurotoma richardi* (see text), 27.6 mm. 584, BIACORES st 39, 14.7 mm. 585, Azores, young specimen. 586, TALISMAN dr 145, apex 1 mm.

Genus *COLUS* Röding, 1798

Type species: Murex islandicus Mohr, 1786, subsequent designation Dall (1906).

Synonyms: Sipho Klein, 1753 and many subsequent authors. Prelinnean.
? *Colus* Humphreys, 1797. Rejected work.
? *Rhombus* Humphreys, 1797. Rejected work.
Atractus Agassiz, 1839. Type species *M. islandicus* Mohr, 1786, subsequent designation Cossmann (1901).
Tritonofusus Mörch, 1857. Type species *M. islandicus* Mohr, 1786 subsequent designation Cossmann (1901).
Brongus De Gregorio, 1885. Type species *M. islandicus* Mohr, 1786, here designated.

Remarks: The history of the name *Sipho,* which has been much used for the species here placed in *Colus,* needs to be discussed because the name *Sipho* has been used until recently and the case has never been thoroughly treated. Klein (1753) used the name for a number of slender neogastropods and this was repeated by Bruguière (1792:532). This use by Bruguière (1792) does not validate the name, because Bruguière only repeated the classification used by Klein, to give the nomenclatorial history of these gastropods, and he did not use the name himself.

Fabricius (1823:83) is cited by Sherborn, and Fabricius (dated 1822) is also cited by Herrmannsen as the first validation of *Sipho.* Fabricius's work is a list of his collection and no descriptions are given. He cited four names under *Sipho* viz. *infundibulum, turritus, polygonus* and *striatus.* These names are nomina nuda and the work has been rejected by ICZN (Opinion 521). Therefore the name cannot be ascribed to Fabricius.

The next time *Sipho* was used was by Brown (1833), who described *Sipho striatus.* This is a junior synonym of *Puncturella noachina* (Linné, 1758). No other species were mentioned in *Sipho* by Brown, and therefore *Sipho* becomes a junior synonym of *Puncturella* Lowe, 1827.

We have therefore followed Dall (1906, 1918), Iredale (1915) and Winckworth (1932) in their use of the name *Colus,* with *Murex islandicus* as type species. They had, however, overlooked the validation of this name by Mohr (1786), and ascribed the name to Gmelin (1790). This does not change anything, because these two authors both refer to Chemnitz's non-binominal use of the name.

We have used *Colus* for a rather heterogeneous assortment of more or less slender buccinids with an operculum with apical nucleus, a radula with a mono- or tricuspidate, square central tooth and laterals with 2 major and 0-3 smaller cusps.

There are several names available for a subgeneric division of *Colus.* The following names are based on N Atlantic species:
Siphonorbis Mörch, 1869. Type species *Fusus (Siphonorbis) ebur* Mörch, 1869, subsequent designation by Cossmann (1901). (Friele's (1882) designation is not valid because the species designated as type was not originally included in *Siphonorbis.*)
Siphonellona Wenz, 1941. New name for *Neptunella* Verrill, 1873 (not Meek, 1864) and *Siphonella* Verrill, 1879 (not Macquart, 1835). Type species *Fusus pygmaeus* Gould, 1841, by original designation.
Plicifusus Dall, 1902. Type species *Fusus kroeyeri* Möller, 1842 by original designation. Synonym: *Parasipho* Dautzenberg & Fischer, 1912, with the same type species.
Anomalosipho Dautzenberg & Fischer, 1912. Type species *Sipho verkruezeni* Kobelt, 1876, by original designation.

None of these names, however, has a type species that is a member of any significantly different group of species, except perhaps *Siphonorbis. Colus sabini* (= *ebur*), the type of *Siphonorbis,* has a perfectly smooth larval shell of about three whorls, almost identical to that of *C. holboelli* and *C. terraenovae.* We are not able to take any decision about this until the N Pacific species of the group are better known and prefer to leave the N Atlantic *Colus* species without a subgeneric classification.

In addition to the species treated here, we have seen two forms from the N American east coast, that we were unable to classify (Figs 644-646). They may prove to be forms of *C. pygmaeus,* but more material from other localities is needed to show this.

Because of the great variation of several of the species, it is close to impossible to give a key to the species, but this attempt may give some help in their determination.

A.	Siphonal canal very short and indistinct, broad	B
A.	Siphonal canal long and slender	C
B.	All the shell covered by spiral sculpture, sometimes also axial ribs	*C. verkruezeni*
B.	Only the apical whorls with spiral sculpture, no axial ribs	*C. turgidulus*
C.	No axial sculpture, shell usually whitish or greyish under the periostracum	E
C.	Axial sculpture present, shell usually brownish or reddish under the periostracum	D
D.	Outer lip flaring in adult specimens, spiral sculpture indistinct	*C. kroeyeri*
D.	Outer lip regularly arched, spiral sculpture distinct	*C. latericeus*
E.	Larval shell consisting of 2-3 distinctly set off, smooth, inflated whorls	F
E.	Larval shell consisting of about one distinctly set off whorl or several, not distinctly set off, whorls	H
F.	Shell very broad and inflated	*C. terraenovae*
F.	Shell slender	G
G.	Outer lip forms a distinct angle with the siphonal canal	*C. holboelli*
G.	Outer lip and siphonal canal form an even arc	*C. sabini*
H.	Larval shell inflated, usually broader than the subsequent whorl (Fig. 616)	*C. islandicus*
H.	Larval shell more slender than subsequent whorls	I
I.	Larval shell with 1-1.5 distinctly set off whorls	*C. gracilis* *C. stimpsoni* *C. pubescens*
I.	Larval shell with a very small initial whorl, not distinctly set off	*C. jeffreysianus* *C. pygmaeus*

Colus gracilis (Da Costa, 1778) Figs 414-416, 473, 587-589, 592-605

Buccinum gracile Da Costa, 1778:124, pl. 6, fig. 5.
Fusus listeri Jonas, 1846:106, pl. 10, fig. 13.
Tritonium (Fusus) islandicum var. *striata* Middendorff, 1849:472.
Fusus gracilis var. *convoluta* Jeffreys, 1867:336.
Sipho glaber Verkrüzen in Kobelt, 1876:174, pl. 3, fig. 3.
Fusus gracilis vars *coulsoni* and *belliana* Jordan, 1890:232.
Neptunia nicolloni Locard, 1891:34.
Neptunia gracilis var. *major* Locard, 1896:150.
Sipho togatus var. *frielei* Harmer, 1914:182, pl. 22, figs 3-4.
Sipho turgidula var. *minor* Thorson, 1944:81, fig. 10.

Type material: B. gracile not known; *F. listeri* not known; *S. glaber* lectotype, here selected, SMF 190099/1.
Type localities: B. gracile, British Isles; *F. listeri,* the Kattegat; *S. glaber,* Porsangerfjorden, N Norway.

Material examined: More than 1000 specimens from all parts of the distributional area, MNHN, USNM, ZMC, SMNH, coll. AW, ZMB.

Distribution: From the Murmansk area (Middendorff, 1849; Herzenstein, 1885) and southwards along the Scandinavian coasts, to S Kattegat (Thorson, 1946), the British Isles (Seaward, 1982), the Bay of Biscay and south to N Portugal (several THALASSA stations). It occurs in the Faroes (Spärck & Thorson, 1933), S, W and N Iceland (Thorson, 1941) and SE Greenland (Thorson, 1944 as *turgidula* var. *minor* and unpublished material in ZMC). *C. gracilis* lives on the continental shelf and the upper slope in 50—1500 m.

Remarks: C. gracilis is a highly variable species that occurs in several morphologically different geographical and bathymetrical forms. These forms may look identical over large areas and easily give an impression that several species are involved.

For Norwegian specimens the name *glaber* has been used. This is a smooth form with flatter whorls and proportionally greater breadth than typical *gracilis.* The *glaber* form reaches the Faroes, Shetland and Iceland. In the Faroes and Shetland there is a transition to typical *gracilis,* while in Iceland there is a tendency to get still smoother, broader and with flatter whorls, which misled Thorson (1944) to refer specimens to *C. turgidulus* (Fig. 598). The transition to typical *gracilis* can also be seen in the North Sea, where the specimens are quite intermediate. To the W and NW of the British Isles and along the Iceland – Faroe Ridge the *glaber* form enters deeper water and at the same time the periostracum becomes less distinct, the shell smoother and the siphonal canal more curved (Fig. 599). To the south, in shallow water, there is little variation in the *gracilis* form, although there exist local populations with a more solid shell and convex whorls, from which Locard described *nicolloni* (Fig. 596). In deeper water there is an increase in size, a reduction of the thickness of the shell and an increase in the convexity of the whorls, from the Faroe-Rockall area southwards. The typical form from the Bay of Biscay in 700—1300 m looks very distinct from the shallow-water form of the same area (Figs 600, 603). These three different forms, *gracilis* (Fig. 597), *glaber* (Fig. 594) and the S deep-water form (Fig. 600) may possibly be worth subspecific distinction.

The egg capsules were described by Jeffreys (1867) but have never been figured so we give figures of specimens from W Norway and deep water in the Bay of Biscay, to show the differences between the populations and to emphasize that differences in the egg capsules should not be used uncritically to prove specific separation.

C. gracilis has been reported from the Mediterranean several times (Crosse, 1875; Spada & Maldonado, 1974, e.g.) but these records have been based on *C. jeffreysianus.*

Colus holboelli (Möller, 1842) Figs 419-421, 471, 606-611

Fusus holbölli Möller, 1842:88.
Fusus tortuosus Reeve, 1855:394, pl. 32, fig. 5.
Sipho tortuosus var. *attenuata* G.O. Sars, 1878:273, pl. 15, fig. 5.
Fusus delicatus Jeffreys, 1883:396, pl. 44, fig. 6.
Sipho (Siphonorbis) turritus var. *distincta* Posselt, 1895:179.
Sipho togatus var. *crassa* Harmer, 1914:182, pl. 22, fig. 6.

Type material: F. holboelli, holotype in ZMC; *F. tortuosus,* neotype, here designated BMNH 1968377.

Type localities: F. holboelli, W Greenland; *F. tortuosus,* N of Beechey Island, NE Canada.

Material examined: About 300 shells and specimens from all parts of the distribution area, ZMC, SMNH, USNM, MNHN, BMNH.

Distribution: Arctic Canada from 90° W (Macpherson, 1971 as *tortuosus*), W Greenland (Thorson, 1951 as *turritus*), E Greenland (Thorson, 1944 as *tortuosus*), W, N and E coasts of Iceland (Thorson, 1941 as *tortuosus*), between Shetland and the Faroes (Jeffreys, 1883, as *delicatus*), deep water off Norway and the Norwegian coast to Spitzbergen (Sars, 1878; Friele, 1882). We have seen no material from Spitzbergen. Normally it occurs in 400-1500 m, although it occurs more shallowly in Greenland and Iceland, 10-500 m.

Remarks: As was pointed out by Friele (1882), Jeffreys and G.O. Sars were using the name *attenuata* in different ways. Jeffreys used it for a deep-water form of *C. jeffreysianus.*

The specific name *holboelli* could possibly be considered a *nomen oblitum,* but we have preferred to use it because of the confusion in the use of *tortuosus.*

We have selected a specimen of *C. holboelli* in the collection of H. Cuming, BMNH, from "Arctic Seas" as neotype of *C. tortuosus,* to stabilize the nomenclature.

Harmer (1914) described *Sipho exiguus* from the British Crag formation and mentioned that he had seen specimens in SMNH from Iceland. We cannot judge the validity of the fossil species, but suppose the Recent record to be based on *C. holboelli* of which certain Icelandic specimens resemble Harmer's figures closely.

C. holboelli is a rather variable species. The type and other specimens from W Greenland are almost as solid as *C. gracilis* while specimens from deep water have a thin, fragile shell. Norwegian specimens are smaller and more slender.

C. holboelli resembles *C. sabini,* but has a smooth periostracum, a more curved siphonal canal and the outer lip is not evenly arched where it goes over into the siphonal canal as in *C. sabini.* Very young specimens may resemble *C. terraenovae* in having a similar shape and larval shell, but that species has a proportionally higher aperture.

When the larval shell is too corroded to be examined *C. holboelli* can be distinguished from other species by its more slender and twisted siphonal canal.

Colus islandicus (Mohr, 1786) Figs 479, 612-616

Fusus islandicus... Chemnitz, 1780:159, figs 1312, 1313 (not binominal).
Murex islandicus Mohr, 1786:136.
Tritonium islandicum var. *sulcata* Middendorff, 1849:471.
Fusus obesus Sowerby, 1880:sp. 129.
Neptunia islandica var. *gallica* Locard, 1896:149.

Type material: F. islandicus, lectotype, here selected, in ZMC (Fig. 612).
Type locality: F. islandicus, Iceland.

Material examined: About 200 specimens from all parts of the distributional area.

Distribution: Along the shelf and upper part of the continental slope from arctic Canada (90° W, Macpherson, 1971), to 150 miles S of Cape Race, Newfoundland (unpublished, USNM), W and E Greenland (Thorson, 1944, 1951), Iceland (Thorson, 1941), the Faroes (Spärck & Thorson, 1933), Spitzbergen (Odhner, 1915), Norway (G.O. Sars, 1878), the outer parts of the Skagerrak and the North Sea (unpublished material in ZMC), Shetland and W of the British Isles (Seaward, 1982; Massy, 1930), the Bay of Biscay, off Spain and Morocco (Locard, 1897; Dautzenberg, 1927). In the arctic area it occurs in 5-500 m, in the southern parts in 400-2000 m.

Remarks: We have not seen E Siberian or N Pacific material of the species and do not exclude that the records from these areas can be ascribed to misidentifications (cf. Odhner, 1915).

We have selected a specimen from the collection of Chemnitz as lectotype. It does not agree very well with the figure in Chemnitz (1780), but Chemnitz had already criticized the figures for not resembling his specimens. Mohr's (1786) validation of the name was based on Chemnitz's figures which therefore have to be considered types.

The size of *C. islandicus* is highly variable. It reaches a maximum size of about 200 mm, but we have seen deep-water specimens of 90 mm that evidently are full-grown. Specimens from the Bay of Biscay and southwards are more slender and solid than arctic specimens.

The development was described by Thorson (1935), who gave figures of egg capsules and young specimens. *C. islandicus* hatches at a size of 5-8 mm.

C. islandicus can be recognized from its large size, unusually inflated larval whorl, the oblique suture and the long, straight, siphonal canal.

Colus jeffreysianus (Fischer, 1868) Figs 428-429, 474-475, 477, 617-630

Fusus propinquus Alder, 1848:157 (not Goldfuss, 1843).
Tritonium turritum M. Sars, 1859:39 (nom. nud.).
Fusus propinquus var. *turrita* Jeffreys, 1867:339 (not *F. turritus* Schafhäutl, 1863).
Fusus jeffreysianus Fischer, 1868:37.
Fusus attenuatus Jeffreys, 1877:326 (not Philippi, 1847).
Fusus (Sipho) pupula Fischer, 1882:274.
Neptunia jeffreysiana vars *major, minor, ventricosa, elongata* & *bicolor* Locard, 1896:151-152.
Neptunia torra Locard, 1897: 361, pl. 17, figs 21-25.
Neptunia pupoidea Locard, 1897:363, pl. 17, figs 26-28.
Fusus consimilis Marshall, 1902:49.
Fusus propinquus var. *howsei* Marshall, 1902:46; 1911:226.
Fusus propinquus var. *laevis* Marshall, 1902:46; 1911:225.
Fusus marshalli Iredale, 1918:33.

Type material: F. jeffreysianus, lectotype , here selected, in MNHN.
Type locality: F. jeffreysianus, Arcachon, Gironde, SW France.

Material examined: About 600 specimens from all parts of the distribution area.

Distribution: From the Kattegat and SW Skagerrak (20-200 m, Petersen, 1888, ZMC), the British Isles, Shetland (Seaward, 1982; Massy, 1930), the Faroes (unpublished material ZMC) and S Iceland in deep water (400-2100 m, unpublished material in ZMC). From the British Isles southwards on the continental shelf and slope S to Casablanca (Morocco) and into the Mediterranean, at least to the Alboran Sea (Locard, 1897; material in MNHN), possibly also S France (Monterosato, 1877).

Remarks: C. jeffreysianus is an extremely variable species which has given rise to a prolific synonymy. In S Scandinavia and N Great Britain including the Shetlands, the predominant form is small, solid, with convex whorls and a rather coarse periostracum. The name *howsei* was based on this form. Off W Great Britain and Ireland this form goes over into typical *jeffreysianus*, which is larger, higher, has flatter whorls and a thinner periostracum. This transition has already been pointed out by Marshall (1911) and Massy (1930), but has never been accepted in the literature. The *jeffreysianus* form occurs mainly in 100-200 m and is distributed southwards to the Spanish N coast, where it goes deeper and becomes smaller. In the area off N Great Britain the *howsei* form becomes more slender, more cylindrical and gets a thinner periostracum when it is found in deeper water, the *attenuata* form (Fig. 622). This is a continuous change and we have observed a similar change in the Bay of Biscay from typical *jeffreysianus*, via the *torra* and *pupoidea* forms to typical *attenuatus* (cf. Figs 624, 626-628). There cannot be put any sharp upper limit for the *attenuata* form, but usually it occurs below 1000 m, while specimens from 200-1000 m are usually transitional between *jeffreysianus* and *attenuatus.*

Thorson (1944) excluded *C. jeffreysianus* from the Greenlandic fauna, which we find correct. There are a few specimens in ZMC labelled "Greenland" by Möller, but they belong to the Kattegat form of *howsei* and there is no doubt that the labels are erroneous. Locard (several papers) reported *C. jeffreysianus* from "Provence", but we have not seen any material in his collection.

Monterosato (1877) discussed the occurrence of *C. jeffreysianus* in the Mediterranean and wrote that Martin's (Jeffreys, 1867) record of *Fusus buccinatus* from the stomach of *Trigla gurnardus* (Pisces), from Golfe du Lion, S France was based on *C. jeffreysianus.* He also mentioned that he had often found broken specimens in that fish, and referred Crosse's record (1875) of two specimens of *Fusus gracilis* from Golfe du Lion to *C. jeffreysianus.* It seems therefore that the species occurs further into the Mediterranean than our material indicates.

Thorson (1946) described the larval development under the name *Sipho propinquus.*

Colus jeffreysianus and *C. gracilis* are often quite difficult to separate. When the larval shell is present they can easily be distinguished (*cf.* figs 604-605, 629-630), but this is often corroded. Then one can use the general shape of the shell, which is more slender, with flatter whorls in *C. gracilis*, but often it is necessary to wait until one gets some young specimens with preserved larval shell from the population in question, especially if the specimens come from deep water.

Colus kroeyeri (Möller, 1842) Figs 631-633

Fusus kröyeri Möller, 1842:88.
Fusus arcticus Philippi, 1850:119, pl. 5, fig. 5.
Fusus (Tritonofusus) kroeyeri vars *major & pumila* Mörch, 1869:19.
Plicifus johanseni Dall, 1919:21A.
Type material: F. kroeyeri, lectotype, here selected, in ZMC.
Type locality: F. kroeyeri, W Greenland.
Material examined: The type and the material listed by Thorson (1944, 1951) and Odhner (1915) and about 25 samples scattered over the N Atlantic part of the range (MNHN, SMNH, USNM, ZMC).

Distribution: Circumpolar in 0-200 m (Macpherson, 1971). Not present in Norway (Sars, 1878) or Iceland (Thorson, 1941).

Remarks: We have included this species to make the ennumeration of N Atlantic species of *Colus* complete. There are no species in the N Atlantic that are easily confused with *C. kroeyeri.* The distinct axial ribs in combination with the brownish shell make it easily recognizable.

Fusus cretaceus Reeve, 1847 has usually been synonymized with *C. kroeyeri* but Cernohorsky (1977: Rec. Auckland Inst.Mus., 14:97) has shown that it is a synonym of the New Zealand muricid *Xymene ambiguus* (Philippi, 1844).

Colus latericeus (Möller, 1842) Figs 423, 478, 634-636

Fusus latericeus Möller, 1842:88.
Fusus pellucidus Hancock, 1846:330, pl. 5, fig. 3.
Fusus pullus Reeve, 1848:sp. 89.
Fusus (Tritonofusus) latericeus var. *laevis* Mörch, 1869:19.
Sipho geminostriatus Pfeffer, 1886:4, fig. 1.
Neptunea (Sipho) pertenuis Sykes, 1911:339, fig. page 340.
Type material: F. latericeus, lectotype, here selected, in ZMC.
Type locality: W Greenland.
Material examined: The material enumerated by Thorson (1941, 1951) and Odhner (1915) and a few additional localities from the known distributional area.

Distribution: Along the W Greenland coast, Jan Mayen (absent from E Greenland) (Thorson 1944, 1951), NW and N Iceland (Thorson, 1941), N Norway (G.O. Sars, 1878), Spitzbergen (Odhner, 1915) and Barents Sea, in 20-200 m.

Remarks: This is a coast and shelf species, but we have included it to make this a complete treatment of the N Atlantic species of *Colus.* It has been recorded from 1187 m (Friele, 1882) but this record is based on an empty shell. *Fusus pertenuis* (holotype BMNH 1885.11.5.2931) was based on an unusually slender and thin specimen, but the sculpture and apex are normal.

C. latericeus may be recognized by the reddish brown shell (occasionally colourless), the sculpture of strong spiral lines and axial ribs and its small size.

Colus pubescens (Verrill, 1882) Figs 465, 639-640

Sipho pubescens Verrill, 1882:501, pl. 43, fig. 6, pl. 57, fig. 25.
Type material: Three syntypes, USNM 37767.
Type locality: USFC st 793, off Newport, Rhode Island, 35 m.
Material examined: Many hundred specimens, from off Daytona, Florida, to Newfoundland, 20-800 m (USNM).
Distribution: As above.

Remarks: C. pubescens has often been confused with *C. stimpsoni,* but differs by having a smaller larval shell and a hairy periostracum; it is more slender and has more convex whorls than *stimpsoni.* It also resembles *C. gracilis* very much, but that species has a smooth periostracum.

Macpherson (1971) recorded *C. pubescens* from arctic Canada, but her figure (pl. 5, fig. 1) clearly shows a specimen of *C. sabini,* so we consider her record uncertain.

Colus pygmaeus (Gould, 1841) Figs 464, 641-643

Fusus islandicus var. *pygmaeus* Gould, 1841:284, fig. 199.
Fusus trumbulli Linsley, 1845:285.
Sipho pygmaeus var. *planulus* Verrill, 1882:505.

Type material: All lost.

Type locality: F. pygmaeus, "In fish, our harbour" (Boston, Massachusetts).
Material examined: A few hundred shells and specimens from all parts of the distribution area.

Distribution: From Gulf of St. Lawrence to North Carolina, NE America, in 1—1100 m (Abbott, 1974).

Remarks: There seem to be no problems with the identity of this species, but the young looks rather different from the adult specimens (Figs 641, 642). We have, however, seen two more forms, one from Florida (Fig. 644) and one from off N. Carolina (Fig. 645), which differ from *pygmaeus* by their larger size and more straight columella. These two forms also resemble *C. jeffreysianus,* but we consider them too imperfectly known to allow any further speculations.

Colus sabini (Gray, 1824) Figs 418, 472, 647-652

Buccinum sabini Gray, 1824:240.
Fusus reeveanus Petit de la Saussaye, 1851:365, pl. 10, fig. 7.
Fusus (Siphonorbis) togatus Mörch, 1869:398.
Fusus (Siphonorbis) ebur Mörch, 1869:398.
Fusus (Siphonorbis) pfaffi Mörch, 1876:369.
Neptunea (Sipho) hanseni Friele, 1879:281.
Fusus hirsutus Jeffreys, 1883:396, pl. 44, fig. 7.
Sipho brevispira Brögger, 1900:49, pl. 3, fig. 4.
Sipho togatus vars *vallensis* & *sinuosa* Brögger, 1900:47, pl. 2, fig. 2 and pl. 3, fig. 5.

Type material: B. sabini, one neotype in BMNH, here selected, no. 1968376; *F. reeveanus,* holotype in MNHN; *F. togatus, ebur, pfaffi,* syntypes in ZMC; *N. hanseni,* holotype ZMB 20621.

Type localities: B. sabini, NW Arctic Atlantic; *F. reeveanus,* presumably the Newfoundland Banks.
Material examined: About 400 specimens from all parts of the N Atlantic range, USNM, ZMC, SMNH, ZMB, MNHN.

Distribution: From arctic Canada (Macpherson, 1971 as *pubescens* and *togatus*) south to 150 miles S of Cape Race, Newfoundland (unpublished in USNM), W Greenland (Thorson, 1951, as *togatus*), E Greenland (Thorson, 1944, as *curtus*), N and E Iceland (Thorson, 1941, as *togatus*), between Shetland and the Faroes (Jeffreys, 1883, as *hirsutus*), Spitzbergen (Odhner, 1915, as *hanseni, togatus* and *hirsutus*), Novaja Zemlya (Leche, 1878, as *sabini*) and the Laptev Sea (Aurivillius, (1885). Absent from Norway (Friele, 1882). It occurs in 5-1200 m, normally 100-600 m, in high arctic areas in more shallow water.

Remarks: Some developmental stages were described by Thorson (1935) under the name *S. curtus.* The young live on nurse eggs and hatch at a size of 5 mm.

C. sabini is quite variable, both in size (max. 83 mm, the type of *reeveanus*) the solidity of the shell, and the sculpture. A good help in recognising it is the sculpture, which consists of alternating strong and weak spiral ribs. Usually the apical whorls are completely corroded. The parietal callus is

often very solid in adult specimens and sometimes there is an umbilical chink.

We are not aware why Macpherson (1971) considered *Buccinum sabini* a *nomen dubium.* We have selected a neotype from an old sample labelled *sabini* and collected by Sabine. The description is not less precise than that of most other species described at the same time.

Colus stimpsoni (Mörch, 1867) Figs 463, 653-657

Fusus striatus Reeve, 1847:sp. 42 (not Sowerby, 1828).
Fusus curtus Jeffreys, 1867:336 (not Fleming, 1828).
Fusus stimpsoni Mörch, 1868:83.
Fusus americanus Bell, 1870:214.
Fusus solidulus Sowerby, 1880:sp. 131.
Neptunea (Sipho) arata Verrill, 1880:370 (*fide* Verrill 1882:500).
Sipho stimpsoni vars *brevis & liratulus* Verrill, 1882:500.
Neptunea tenuistriata Harmer, 1918:369, pl. 37, figs 1-2.

Type material: F. stimpsoni, neotype, here selected, in ZMC.
Type locality: F. stimpsoni, "Shores of New Jersey", NE US.
Material examined: Several hundred specimens from all parts of the distributional area, mainly in USNM.

Distribution: Labrador to off N Carolina, 2—850 m (Abbott, 1974).

Remarks: C. stimpsoni is a highly variable species. The short broad form (Fig. 653) has often been confused with *C. terraenovae* and has a more N and shallow distribution, from the New England area northwards. All intermediates between this form and the more slender, more southern and deeper form (Fig. 655) exist.

C. stimpsoni may be recognized from its smooth, shiny, naked periostracum and usually very solid shell. These features are shared with *C. terraenovae* but that species has a smooth, multigyrate larval shell and is still shorter and broader even than the form from the Banks.

To stabilize the nomenclature, we have selected a neotype from the Mörch collection in Copenhagen.

The development and reproductive anatomy were described by West (1973, 1978).

Colus terraenovae **nom.nov.** Figs 413, 462, 658-660

Fusus ventricosus Gray, 1839:117 (not Anton, 1838).
Type material: Two syntypes in BMNH, no reg. no.
Type locality: Not mentioned, here restricted to Newfoundland Banks.

Material examined: About 40 specimens from the Newfoundland Banks.

Distribution: Uncertain because of confusion with the short forms of *C. stimpsoni.* We have only seen reliable records from the Banks around Newfoundland, in 40—150 m. Verrill (1882) considered the records from New England doubtful.

Remarks: Colus terraenovae has very often been confused with the short, stout forms of *C. stimpsoni.* This is probably the reason why it has been recorded from the NE U.S. (Abbott, 1974) and as a fossil from Great Britain (Pain, 1981). They can, however, easily be distinguished by the outlines of the spire, which are convex in *terraenovae* and concave in *stimpsoni.* Also the larval shells are widely different: that of *terraenovae* consists of 2-3 smooth, distinctly set off whorls while that of *stimpsoni* is not distinctly set off, starts with a large initial whorl and has a rough surface (Figs 657, 660).

The name *ventricosus* under which it has been usually known is preoccupied by Anton's (1838) use of the name and it has to be given a new name. The date of publication of Anton's catalogue was discussed by Cernohorsky (*Veliger,* 1978, page 299), who showed that it had already been published in 1838 instead of 1839 as generally supposed.

Colus turgidulus (Jeffreys, 1877) Figs 417, 422, 470, 637-638

(no generic name) *turgidulus* Jeffreys in Wood, 1872:25, nomen nudum.
Fusus turgidula Jeffreys in Friele, 1877:8.
Not *Sipho turgidula* var. *minor* Thorson, 1944 (see *C. gracilis*).

Type material: Holotype ZMB 20619.
Type locality: Shetland-Faroe Channel.

Material examined: The material listed by Friele (1882) and TRITON st 9, 60°05 N, 06°21 W, 1130 m, 4 spms; PORCUPINE 1869 st 78, 60°15 N, 04°45 W, 550 m, 2 shs; st 65 + 84, Shetland-Faroe Channel, 400-800 m, 2 shs; INGOLF st 59, 65°00 N, 11°16 W, 584 m, 1 sh; st 101, 66°23 N, 12°05 W, 1011 m, 6 shs; st 103, 66°23 N, 08°52 W, 1090 m, 2 shs; st 116, 70°05 N, 08°26 W, 699 m, 6 shs; 64°58 N, 11°12 W, 564 m, 8 shs, ZMC.

Distribution: Along the slopes of the Norwegian Basin, from between Norway and Spitzbergen, to the Shetland-Faroe Channel and E Iceland, in 400—1100 m.

Remarks: Colus turgidulus is a characteristic species but resembles *Buccinum* more than *Colus* at the first glance. The operculum is, however, not of *Buccinum* type but normal for a species of *Colus,* as is also the radula. The fine spiral sculpture is present only on the first postlarval whorls.

Thorson's var. *minor* of *C. turgidulus* was based on specimens of *C. gracilis* and the species is thus not known from Greenland.

Colus verkruezeni (Kobelt, 1876) Figs 661-664

Sipho verkrüzeni Kobelt, 1876:70, pl. 2, fig. 2.
Neptunea (Sipho) virgata Friele, 1879:261.
Buccinum brucei Melvill & Standen, 1900:9, fig. page 9.
Sipho verkrüzeni var. *plicifera* Brögger, 1900:50, pl. 1, fig. 1.
Anomalosipho dautzenbergi Dall, 1916:8.
Helicofusus paraelatior Kantor, 1981:1147.

Type material: S. verkrüzeni, lectotype SMF 253576/1, selected by Tiba & Kosuge, 1981; *N. virgata,* holotype ZMB 20622; *A. dautzenbergi,* holotype in MOM.
Type localities: S. verkrüzeni, Porsangerfjord, N Norway; *S. virgata,* VÖRINGEN st 124, SW of Lofoten, N Norway, 640 m; *A. dautzenbergi,* off North Cape, N Norway 394 m.

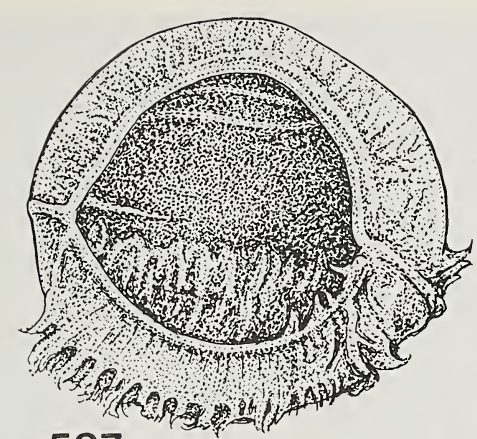
Material examined: The type material listed and the material reported by Friele (1882), Thorson (1941, 1944), Odhner (1915) and Dautzenberg & Fischer (1912). Also a few additional specimens from different parts of the known distributional area (SMNH, ZMC).

Distribution: From E Greenland (Thorson, 1944), N Iceland (Thorson, 1941), W and N Norway (Friele, 1882), Spitzbergen (Odhner, 1915) and the Kara Sea (Thorson, 1941), in 30—640 m.

Remarks: Macpherson (1971: pl. 5, fig. 6) figured a specimen that she had reluctantly determined as *C. verkruezeni,* from NE Canada. We agree that it probably does not represent that species.

Golikov & Scarlato (1977) identified *B. brucei* with *C. latericeus,* but the very short siphonal canal and the size (41 mm) indicate that it must be a synonym of *C. verkruezeni.*

C. altus (S. Wood, 1842) from the British Crag Formation, resembles *C. verkruezeni* closely, but we hesitate to consider them conspecific.



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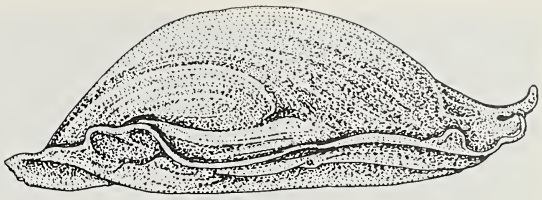

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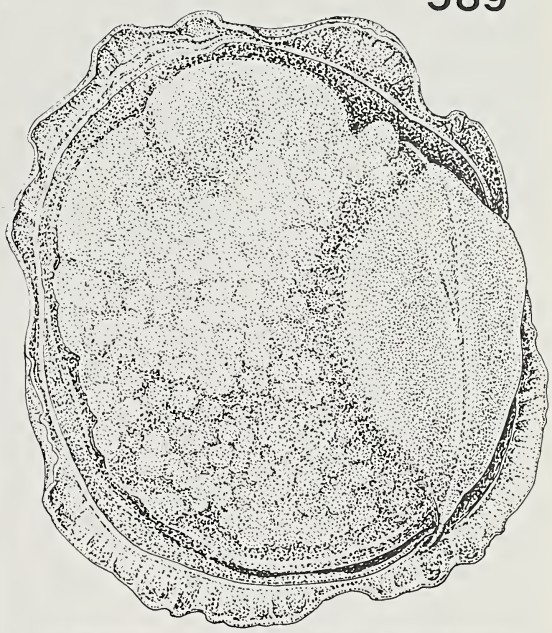

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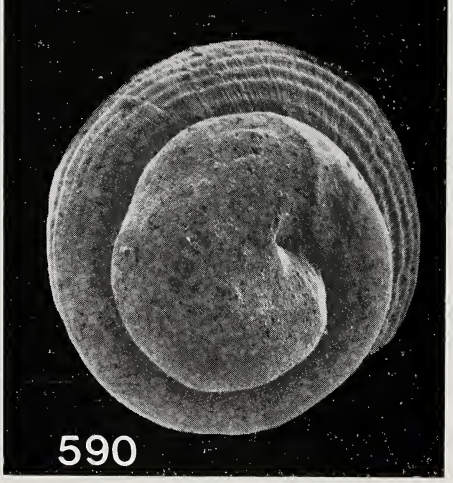

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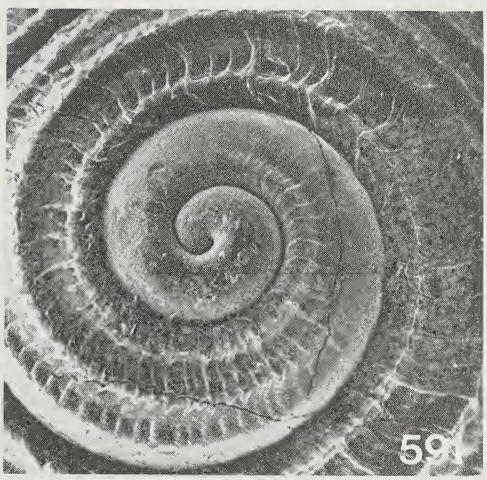

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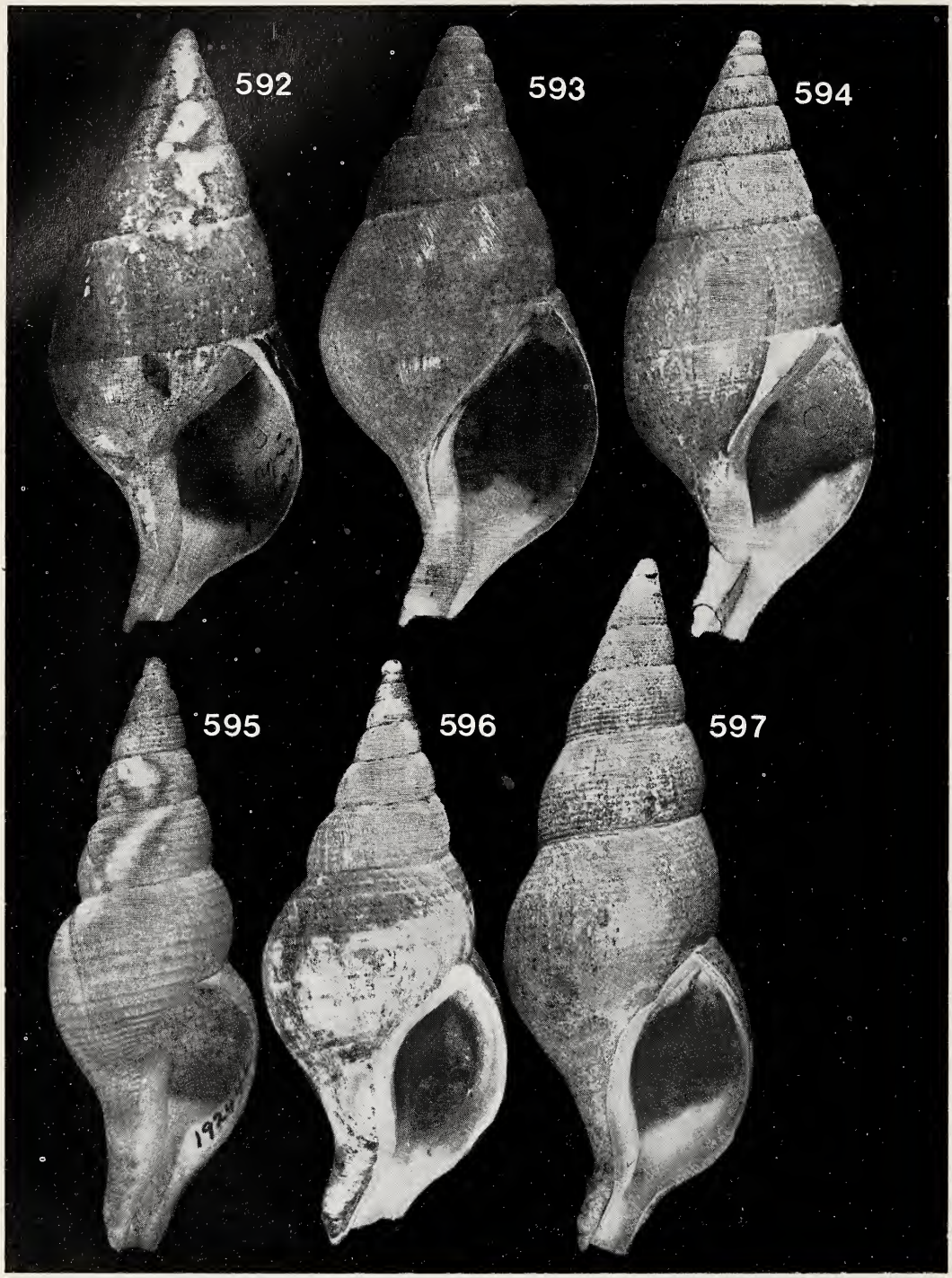
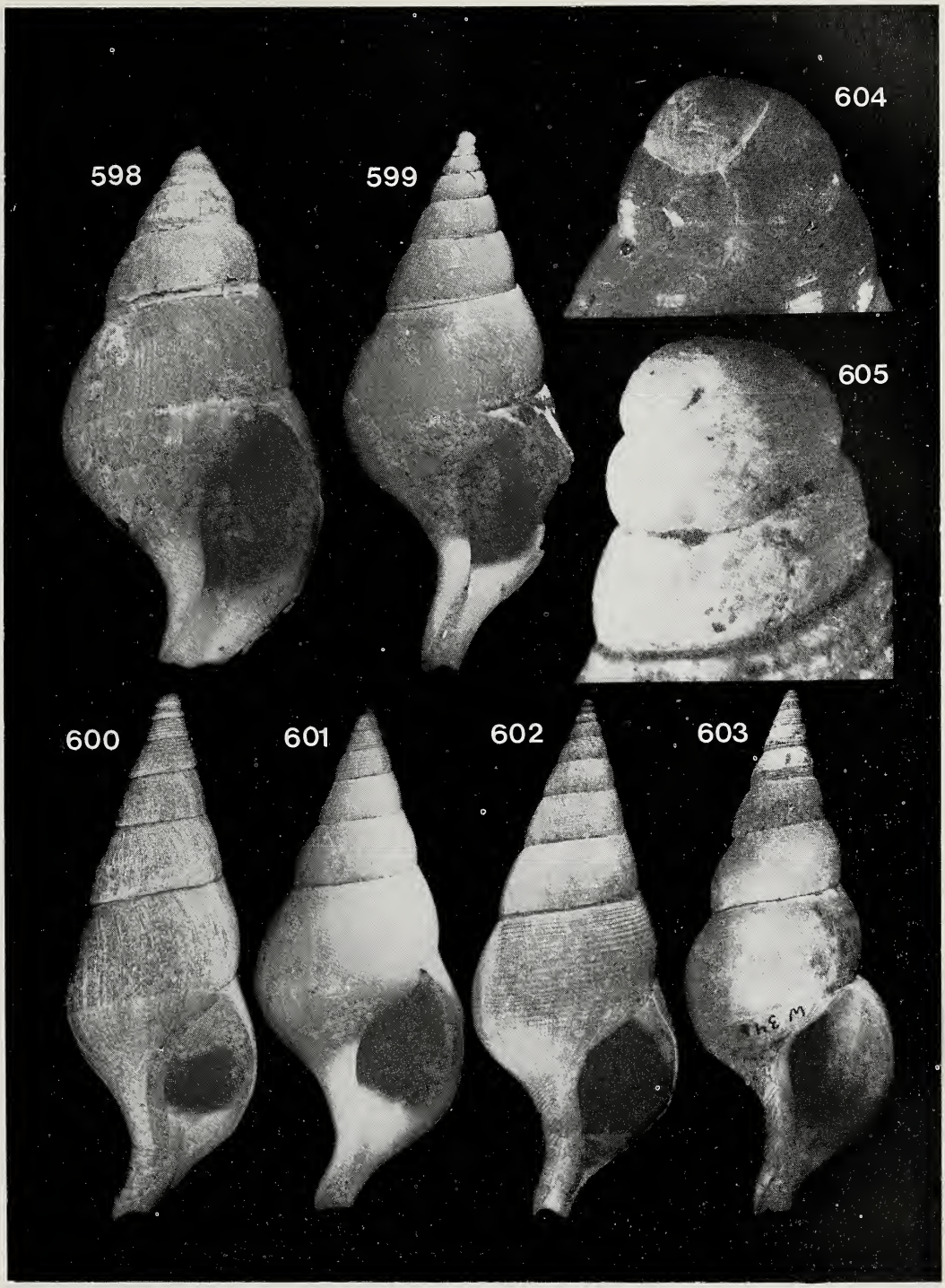
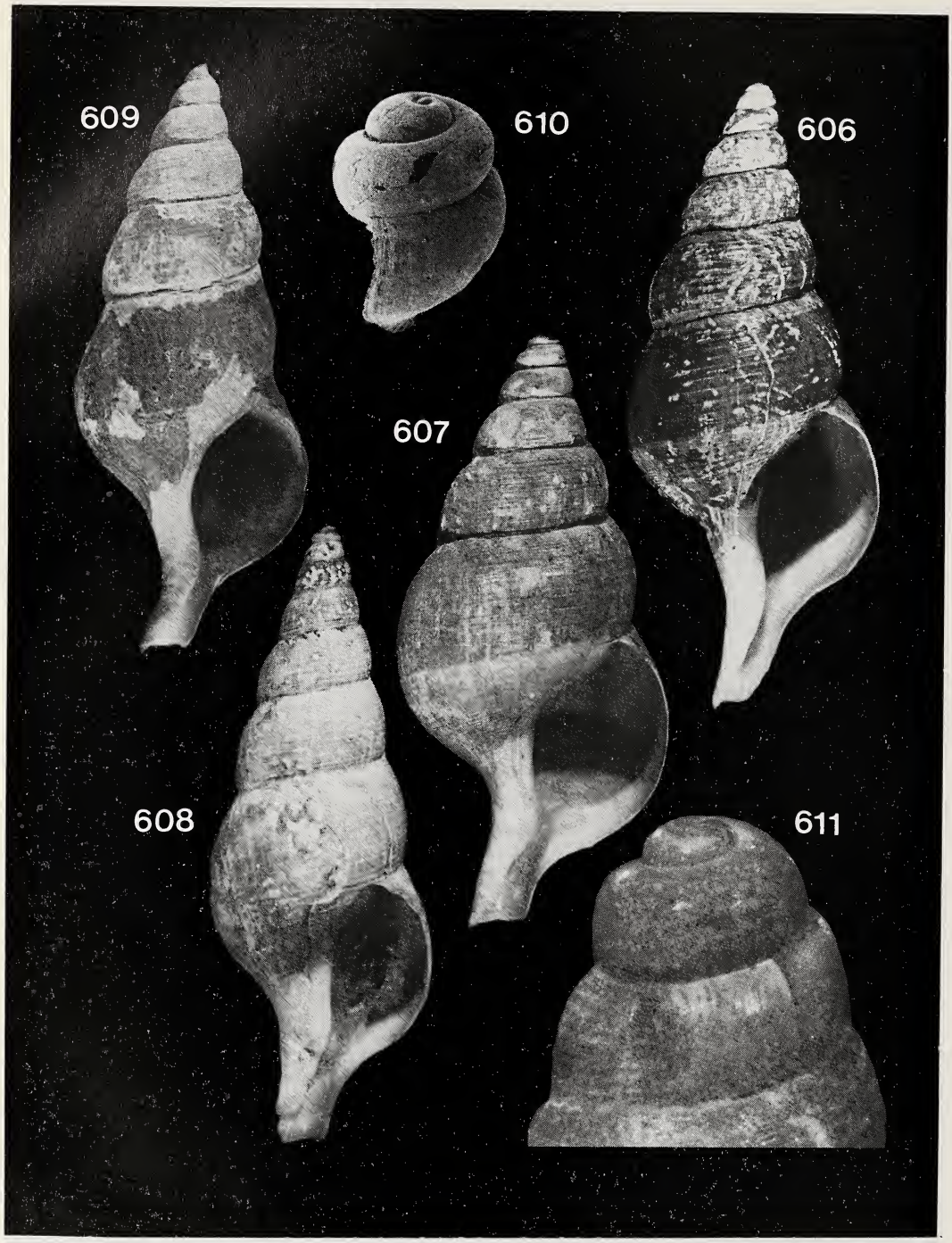
Figs 587-591. Buccinid egg capsules and embryos. 587-*Colus gracilis,* Hjeltefjord, Norway, egg-capsule in side view showing opened hatching hole, diameter 6 mm. 588-Larval shell from the same egg-capsule, diameter 3.0 mm. 589-*Colus gracilis,* THALASSA st Z407 (47°44 N, 08°07 W, 1085-1115 m), egg-capsule, diameter 17 mm. Top and side views showing the pre-formed hatching hole closed by a thin membrane. 590-*Buccinum undatum,* embryo from egg-capsule, diameter 2.5 mm. 591-*Turrisipho fenestratus,* Bergen, apical view, ×13.



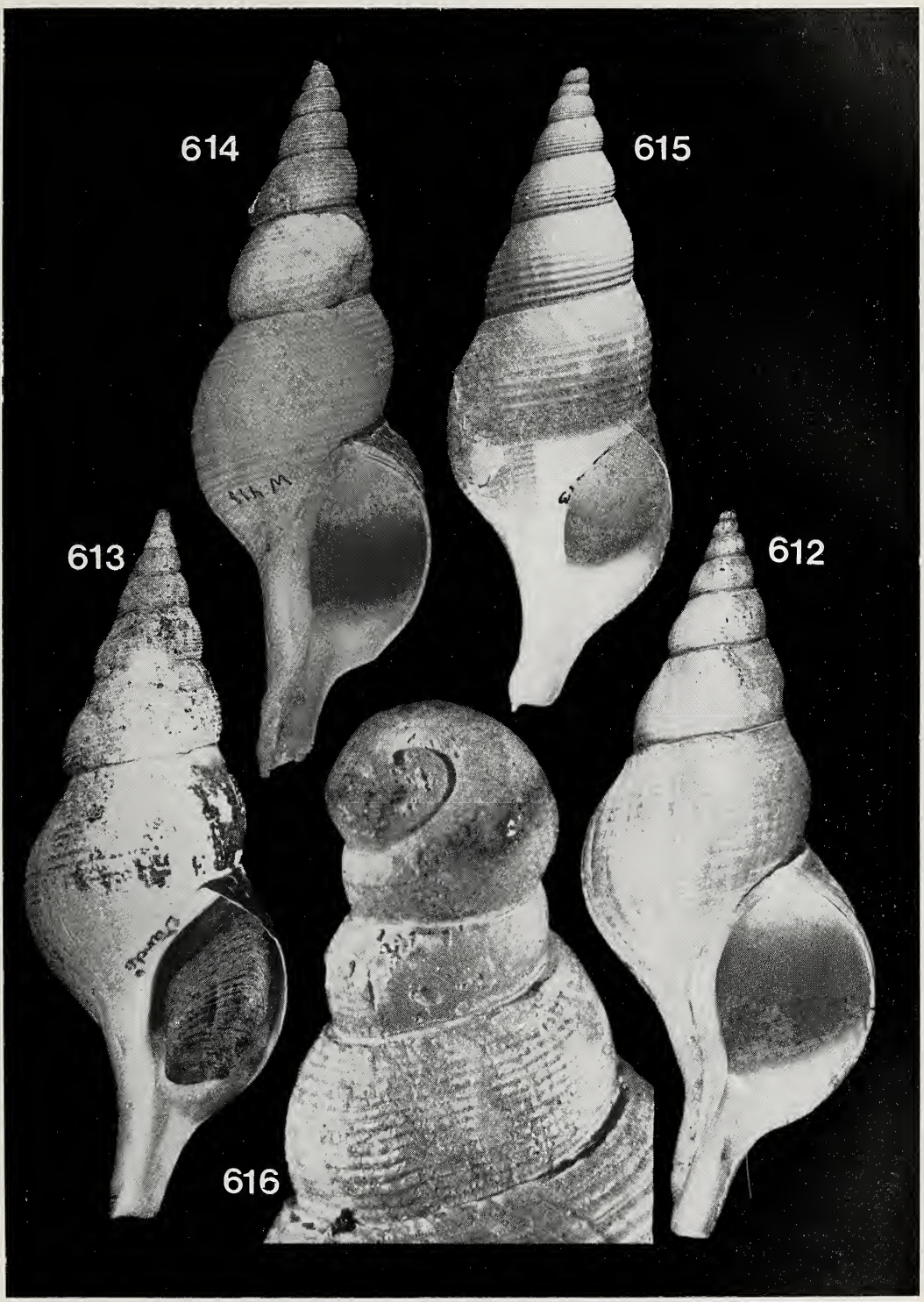
Figs 592-597. *Colus gracilis*. 597-lectotype of *Sipho glaber*, 62 mm. 593-East of Faeroes 385-420 m, 34 mm. 594-Hjeltefjord, Bergen area, 100-180 m, 57.5 mm. 595-Moray Firth, Scotland, 50.9 mm. 596-syntype of *Neptunia nicolloni*, 69 mm. 597-N of Jutland, Skágerrack 185-370 m, 99.5 mm.



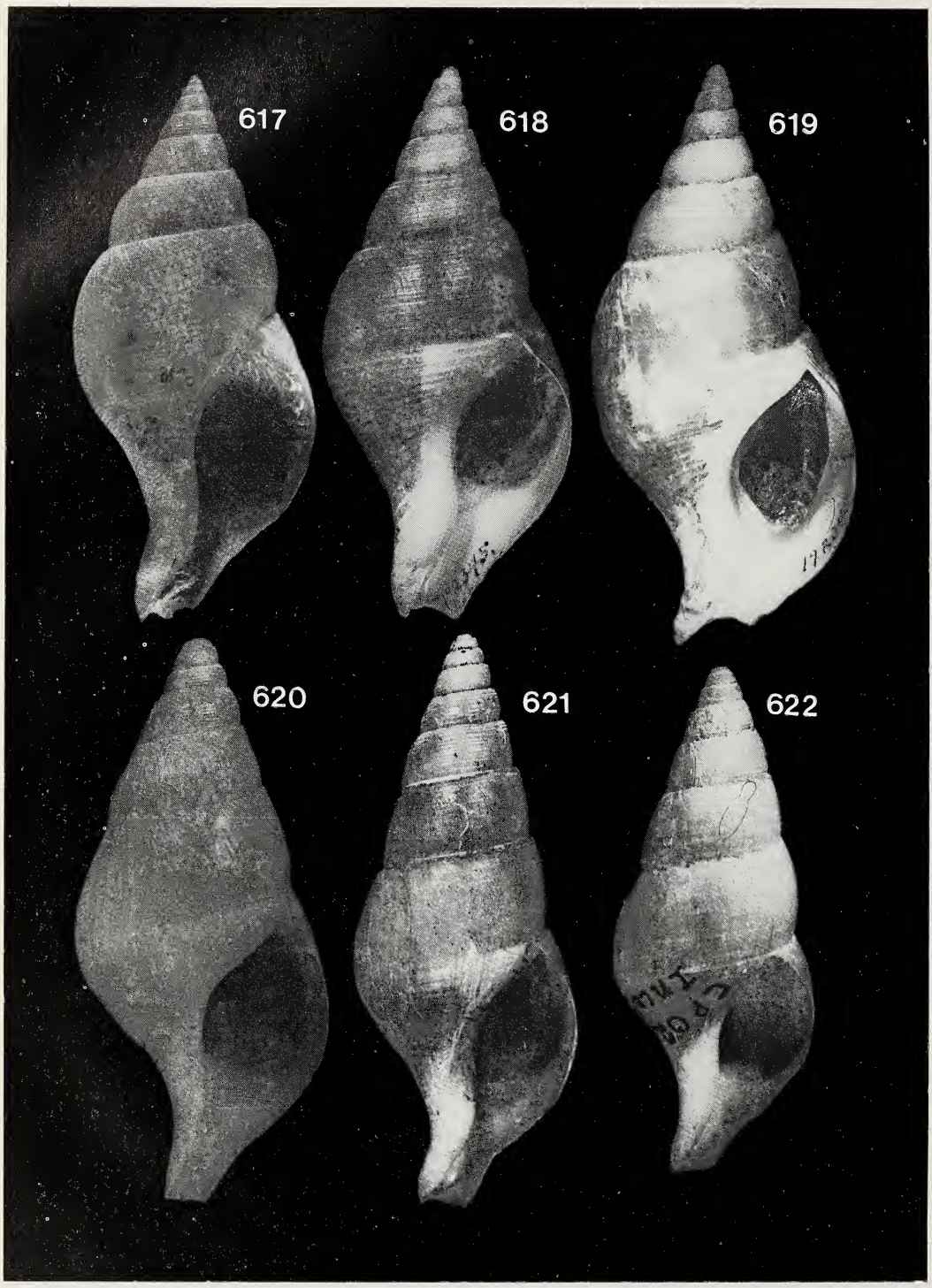
Figs 598-605. *Colus gracilis.* 598-syntype of *Sipho turgidula minor,* 34.7 mm. 599-Hebridean Terrace, 750-1000 m, 62 mm. 600-THALASSA st W423 (44°04 N, 07°07 W, 710-1070 m), 44.3 mm. 601-THALASSA st Z414 (48°05 N, 08°30 W, 650 m), 47.4 mm. 602-BIOGAS st CV2 (47°42 N, 08°03 W, 994 m), 83.8 mm. 603-THALASSA st W346 (43°51 N, 02°11 W, 460-520 m), 93.4 mm. 604-Bergen area, apex 1.6 mm. 605-SE bay of Biscay, apex 2.3 mm.



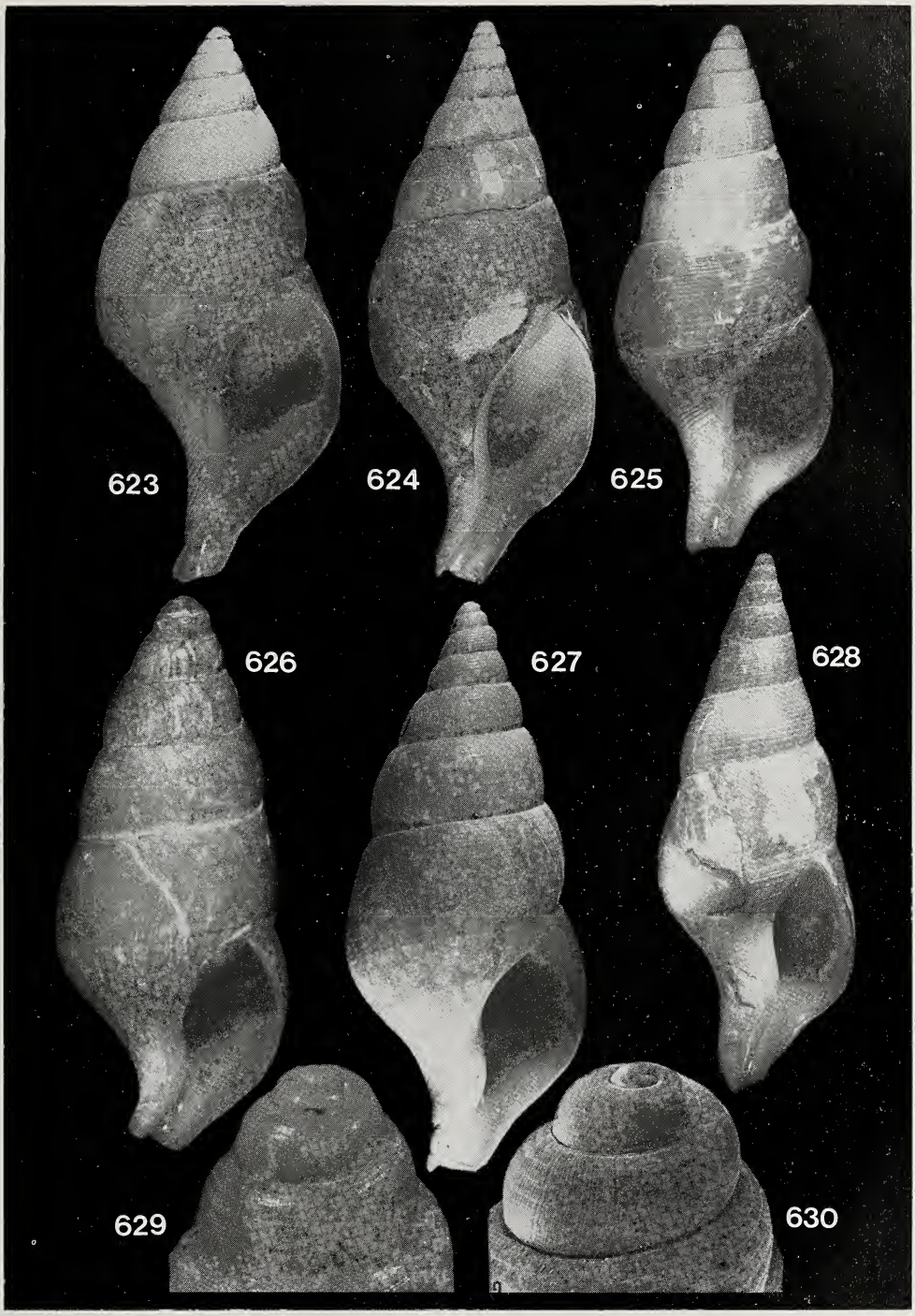
Figs 606-611. *Colus holboelli.* 606-Finmark, Norway, 39.1 mm. 607-paralectotype of *Fusus delicatus,* TRITON st 8 (60°18 N, 06°15 W, 1178 m), 29 mm. 608-lectotype of *Tritonium turritum,* Öksfjord, Tromsö, 44.3 mm. 609 and 610-INGOLF st 33 (67°57 N, 55°30 W, 66 m), 69 mm and apex 1.7 mm. 611-Finmark, Norway, apex 2.1 mm.



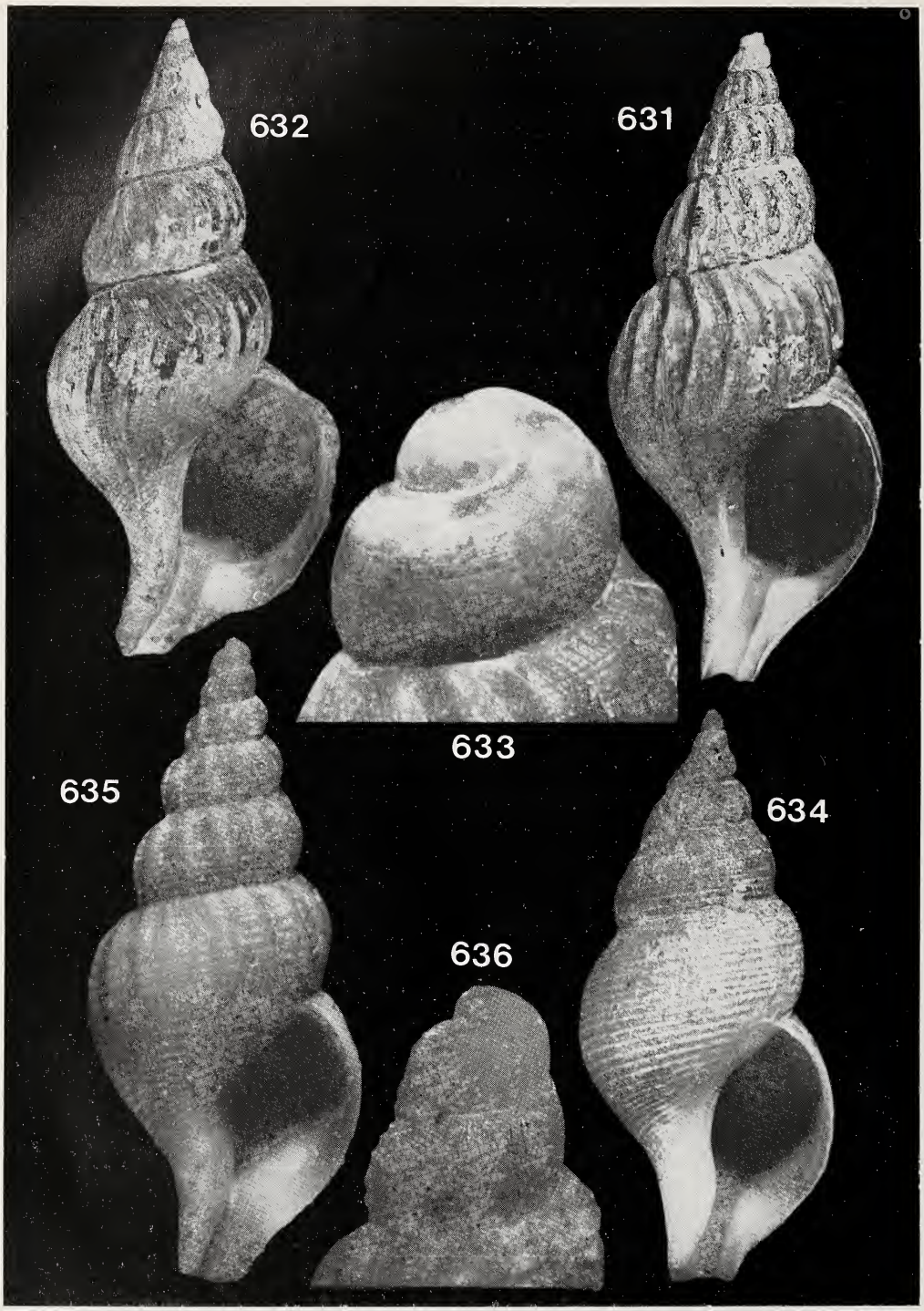
Figs 612-616. *Colus islandicus*. 612-lectotype, 129.5 mm. 613-Tromsö, 110 m. 614 and 615-THALASSA st W413 (43°50 N, 06°09 W, 500-540 m), 131 mm and 73.8 mm. 616-INGOLF st 75 (61°28 N, 26°25 W, 1469 m), apex 8.7 mm.



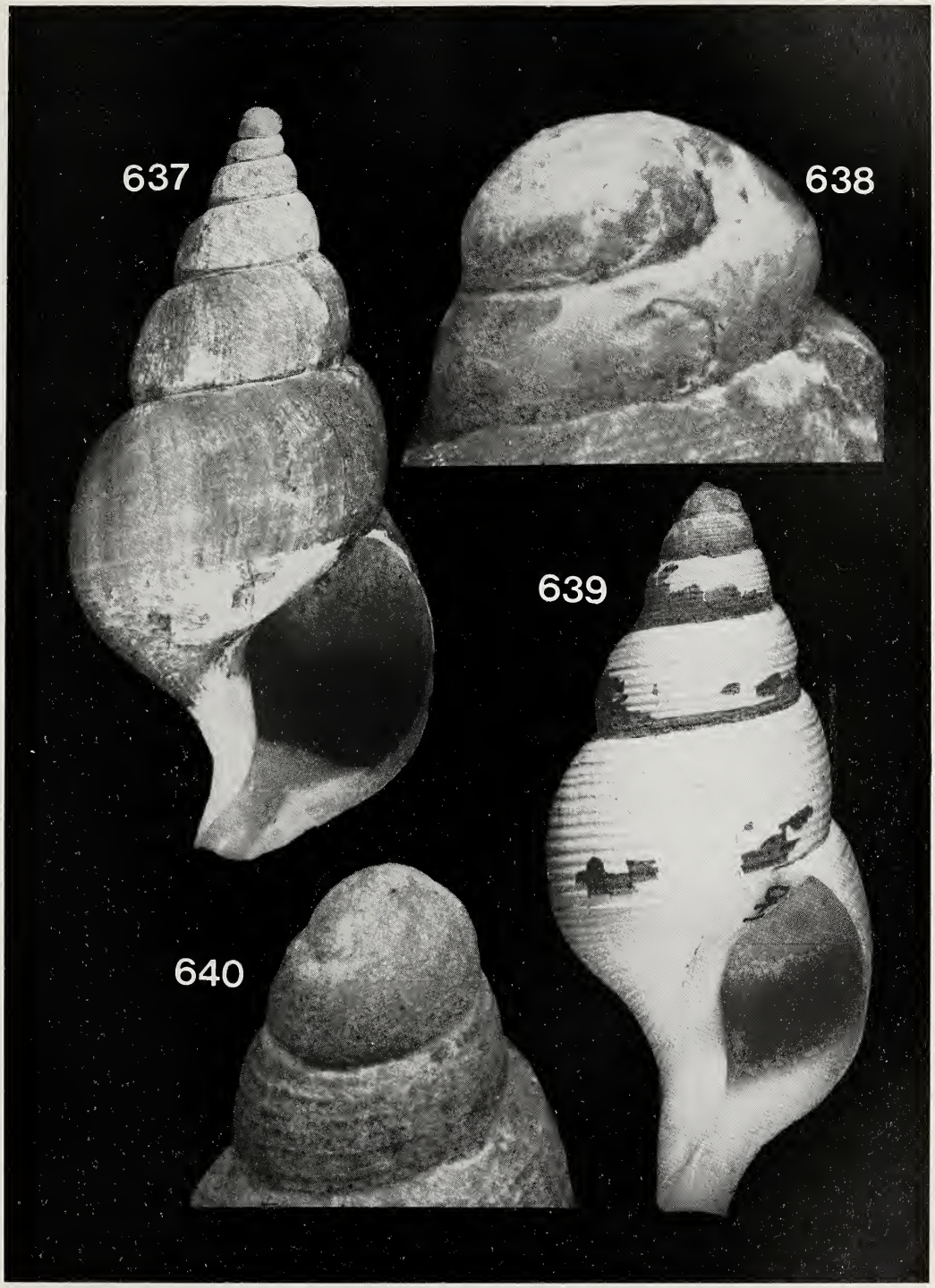
Figs 617-622. *Colus jeffreysianus*. 617-lectotype, 70 mm. 618 and 619-Great Britain, Jeffreys *ex* Jordan, 50 mm and 58.3 mm. 620-INGOLF st 10 (64°24 N, 28°50 W, 1484 m), 39 mm. 621-Shetland, 43 mm. 622-INCAL st CP2 (57°58 N, 10°43 W, 2091 m), 50.4 mm.



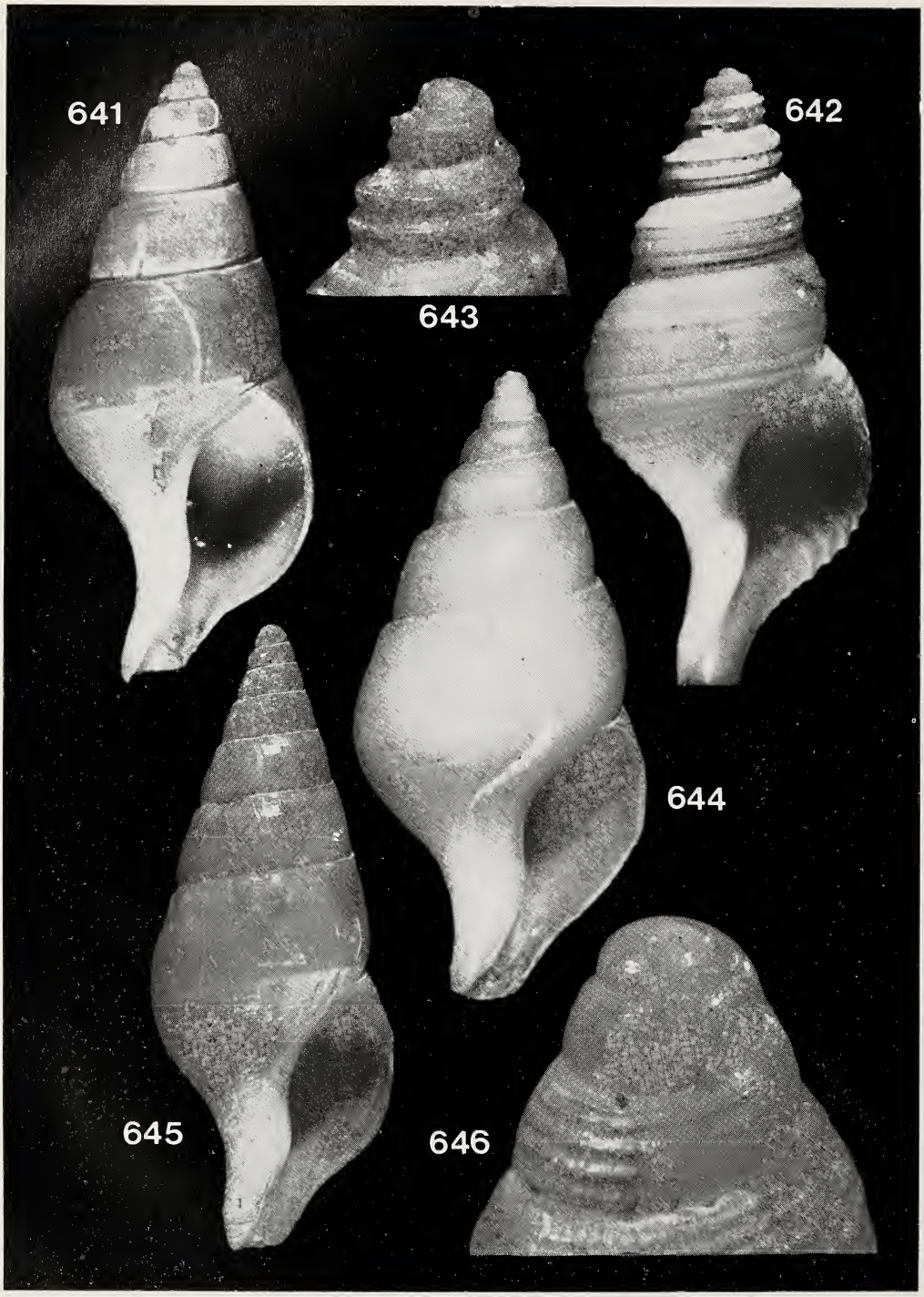
Figs 623-630. *Colus jeffreysianus*. 623-POLYMEDE st CM15 (36°28 N, 04°09 W, 609 m), 49.5 mm. 624-THALASSA st W412 (43°50 N, 06°06 W, 272-310 m), 52.7 mm. 625-syntype of *Neptunia torra*, 38 mm. 626-THALASSA st W338, N Spain, 19.8 mm. 627-THALASSA st W409 (43°55 N, 06°03 W, 176-185 m), 37.6 mm. 628-THALASSA st X375 (44°07 N, 04°43 W, 625-650 m), 43.7 mm. 629-Great Britain, Jeffreys *ex* Jordan, apex 2.7 mm. 630-apex 2.5 mm.



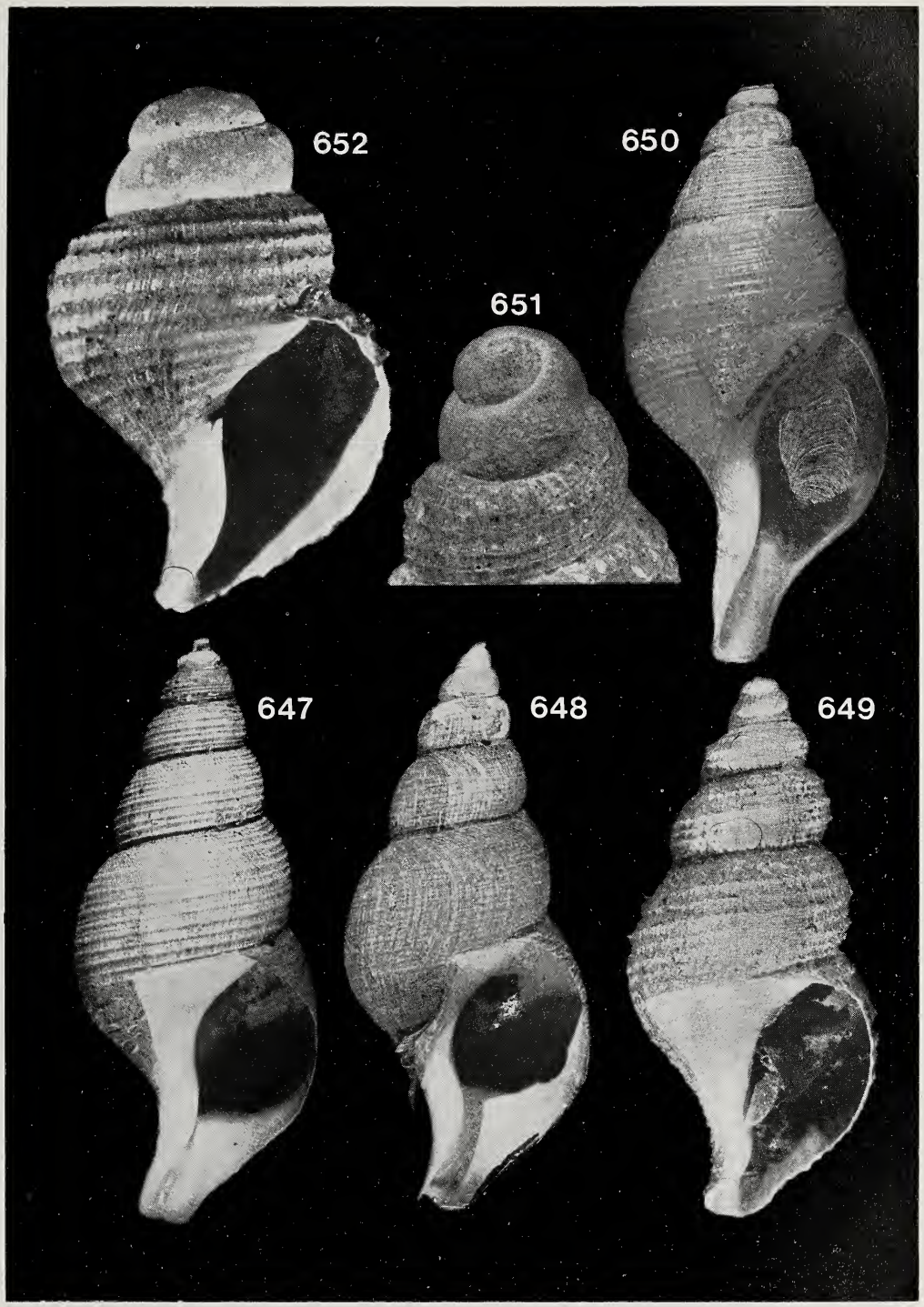
Figs 631-636. Genus *Colus*. 631-*C. kroeyeri*, lectotype, 68.0 mm. 632-Bellsund, Spitzbergen, 89.4 mm. 633-Spitzbergen, apex 2.3 mm. 634-*C. latericeus*, MONACO st 162 (46°50 N, 47°51 W, 155 m), 27.6 mm. 635 and 636-Lofoten, 19.5 mm and apex 1.7 mm.



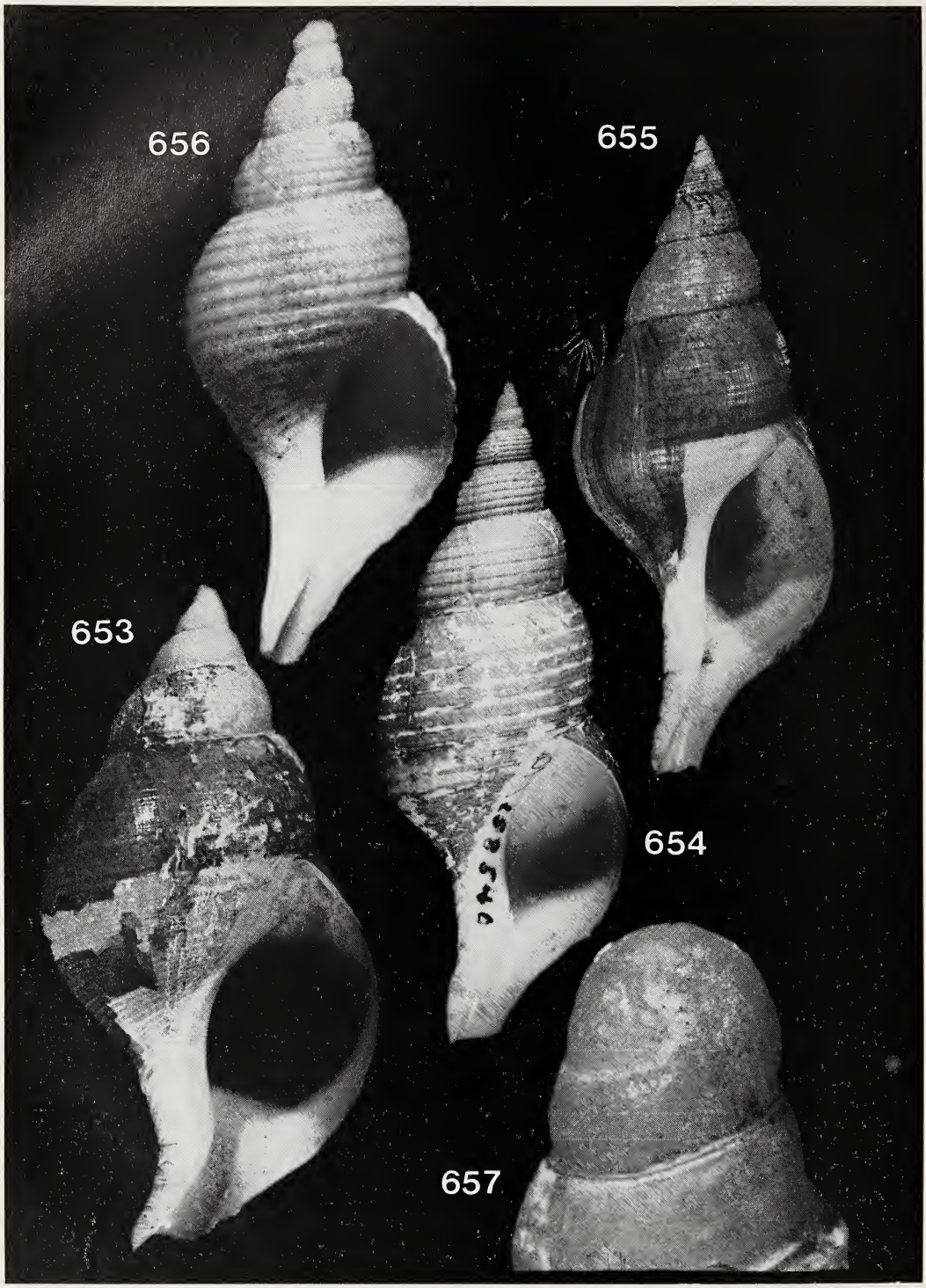
Figs 637-640. Genus *Colus*. 637-*C. turgidulus,* VÖRINGEN st 286 (72°57 N, 14°32 E, 817 m) 52.7 mm. 638-VÖRINGEN st 323 (72°53 N, 21°51 E, 408 m), apex 2.8 mm. 639 and 640-*C. pubescens,* off Martha's Vineyard 616 m, 60.3 mm and apex 1.7 mm.



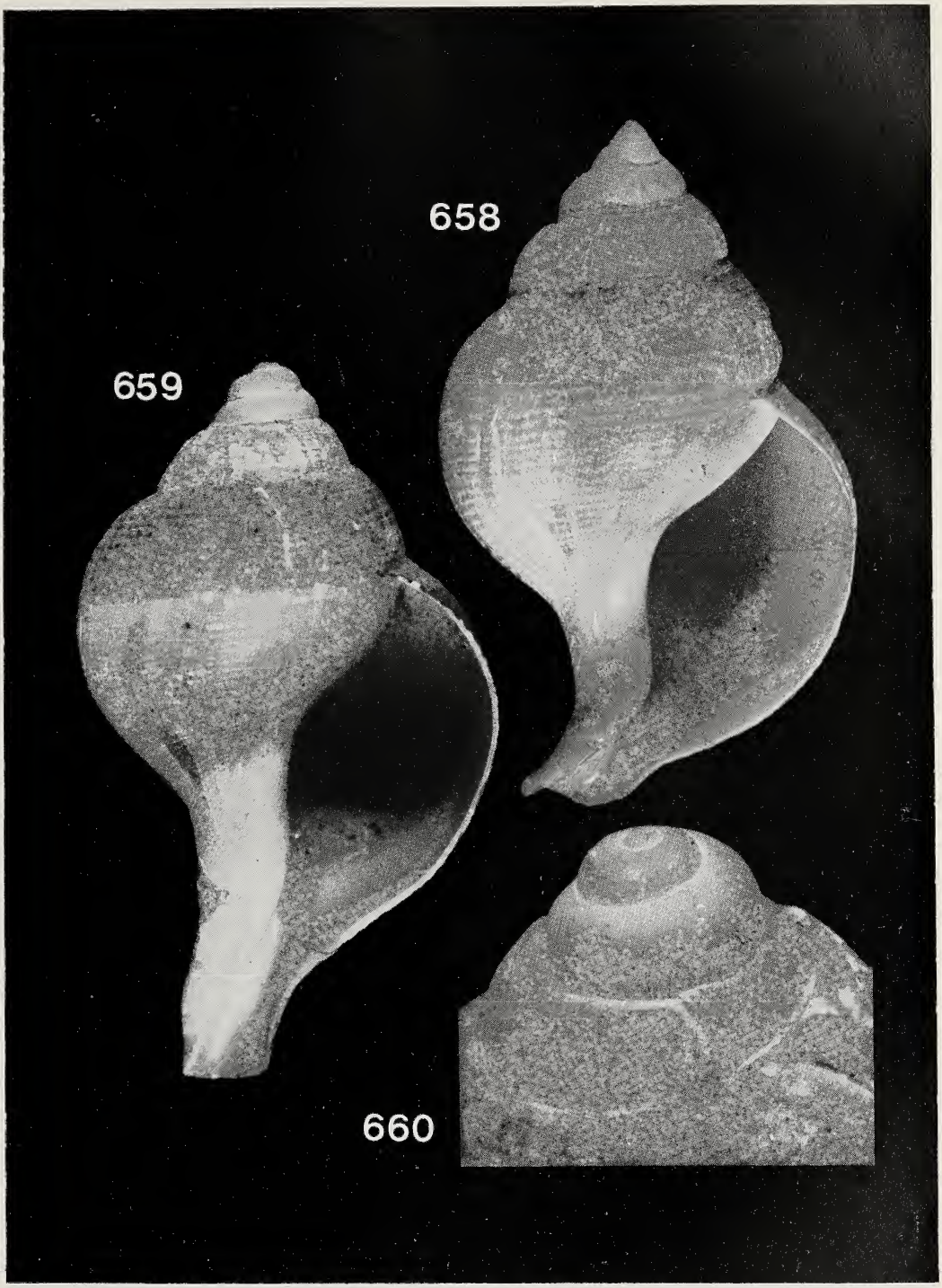
Figs 641-646. Genus *Colus*. 641-*C. pygmaeus*, off Martha's Vineyard 185 m, 21.6 mm. 642 and 643-Georges Bank (41°30 N, 66°55 W), 11.8 mm and apex 1.2 mm. 644-*Colus* sp. aff. *pygmaeus*, off Fowey Light, Florida, 185 m, 13.3 mm. 645 and 646-*Colus* sp. aff. *pygmaeus*, SSE of Cape Fear, North Carolina, 977 m, 39 mm and apex 1.9 mm.



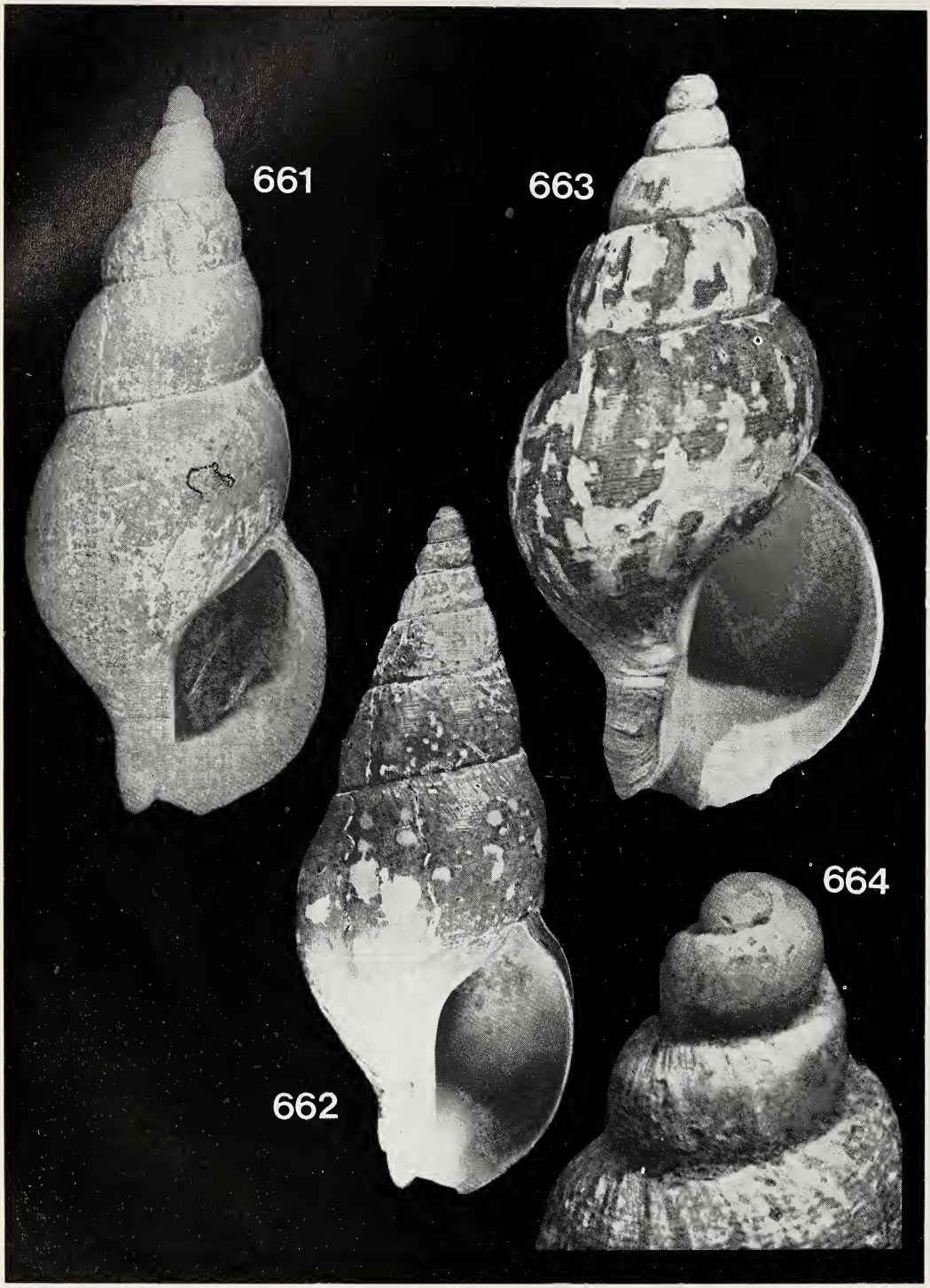
Figs 647-652. *Colus sabini.* 647-Hebron Fjord, 175 m, 59.9 mm. 648 and 649-74°12 N, 77°05 W, 680 m, 69.2 mm and 24.1 mm. 650 and 651-KNIGHT ERRANT st 8 (60°03 N, 05°51 W, 994 m) 42.6 mm and apex 3 mm. 652-INGOLF st 28 (65°14 N, 55°42 W, 791 m), 8.0 mm.



Figs 653-657. *Colus stimpsoni*. 653, Coast of Maine, 45.3 mm. 654, off Martha's Vineyard 381 m, 74.1 mm. 655, "E of Bunker's Ledge", NE America, 77.7 mm. 656, off Martha's Vineyard 185 m, 19.8 mm. 657, Newfoundland Banks, apex 1.9 mm.



Figs 658-660. *Colus terraenovae*. 658, Newfoundland Banks, 57.8 mm. 659 and 660, NE part of Grand Bank 74 m, 26.7 mm and apex 1.7 mm.



Figs 661-664. *Colus verkruezeni*. 661, lectotype, 49.7 mm. 662, N Norway, 45.5 mm. 633, Göteborg, glacial deposit, 38.3 mm. 664, holotype of *Neptunea virgata*, apex 2.9 mm.

Family OLIVIDAE

Genus *BENTHOBIA* Dall, 1889.

Type species: Benthobia tryoni Dall, 1889 (by monotypy).

Synonym: Nux Barnard, 1960. Type species *N. alabaster* Barnard, 1960 by original designation.

Remarks: Dall originally suggested a cancellariid affinity for *Benthobia* and the genus remained placed in this family without any particular reason. We have examined the radula of a specimen of the type species and found it to be a rachiglossan type. The presence of the spiral sulcus on the body whorl recalls that of several Olividae grouped as Pseudolivinae, both Recent, such as *Fulmentum sepimentum* (Rang), and fossil, such as *Pseudoliva elisae* Briart & Cornet figured in Glibert (1973, pl. 9), and several species figured by Cossmann & Pissarro (1907-1913, pl. 36, figs 177-1 - 3). We also figure the radula of the Recent *Fulmentum sepimentum* from West Africa, for comparison with *Benthobia* (Figs 669-670).

In the original description of *Nux,* Barnard noted a resemblance to *Benthobia* but assumed they belonged to different superfamilies because *Benthobia* was then believed to be a cancellariid and *Nux* had a rachiglossate radula. Barnard did not locate *Nux* in a family.

Benthobia tryoni Dall, 1889 — Figs 665-668

Benthobia Tryonii Dall, 1889:132, pl. 35, fig. 6.
Lacuna cossmanni Locard, 1897:493, pl. 22, figs 4-9.
Nux alabaster Barnard, 1960:439, fig. 2.

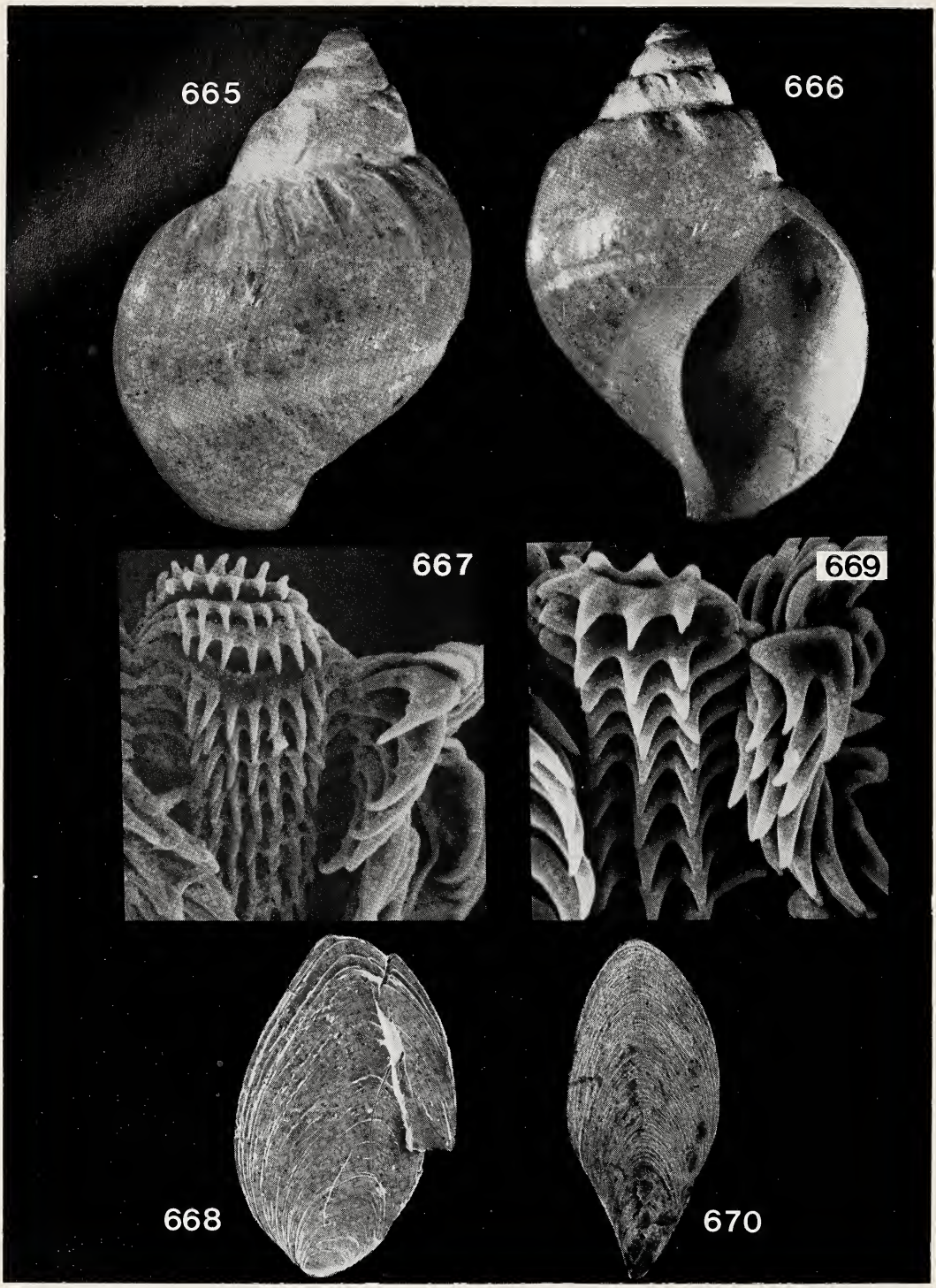
Type material: B. tryoni, holotype in USNM; *L. cossmanni,* 2 syntypes in MNHN; *N. alabaster,* holotype in the South African Museum, Cape Town.

Type locality: B. tryoni, USFC st 2678, off Cape Fear, N. Carolina, 1338 m; *L. cossmanni,* TALISMAN dr 76, 25°01 N, 16°55 W, 2638 m; *N. alabaster,* 33°26 S, 16°33 E, 2392 m.

Material examined: the type material and BIACORES st 165, 37°33 N, 25°58 W, 2050-2085 m, 1 sh; DISCOVERY st 8524-6, 20°46 N, 22°44 W, 4415 m, 1 spm; Gulf of Mexico, 28°13 N, 87°04 W, 800-1200 m, 1 sh; 27°01 N, 94°43 W, 1399 m, 1 sh; 25°39 N, 95°49 W, 960 m, 1 spm, MNHN; 33°52 S, 16°51 E, 2540-2797 m, 2 shs; ABYPLAINE st DS2, 37°20 N, 15°37 W, 4220-4380 m, 2 spms.

Distribution: Only known from the material examined.

Remarks: The animal has no eyes. The foot is large, with a distinct propodium. The operculum has an apical nucleus (Fig. 668). There is a short proboscis with two large salivary glands. The large protoconch, preserved on a single shell, is multispiral, which indicates planktotrophic larval development.



Figs 665-670. Pseudolivinae. 665 and 666, *Benthobia tryoni,* syntypes of *Lacuna cossmanni,* 9.4 mm and 6.5 mm. 667, *B. tryoni,* radula, breadth of central tooth 48 μm. 668, Operculum, 4.1 mm. 669, *Fulmentum sepimentum* (Rang), radula, breadth of central tooth 42 μm. 670, Operculum, 4.5 mm.

Family VOLUTOMITRIDAE

The family was revised by Cernohorsky (1970) and two additional Atlantic species were described by Bayer (1971). We have moved the genus *Latiromitra* to Turbinellidae after examination of the radula, and we describe a new species of *Microvoluta* from the Josephine sea-mount.

Most Volutomitridae are known from very few specimens.

Genus *Volutomitra* H. & A. Adams, 1853

Type species: Mitra groenlandica Beck in Möller, 1842, subsequent designation Fischer, 1884.

Remarks: In our material *Volutomitra* is represented by two species, of which we leave one undescribed. The genus is mainly known from Arctic, Antarctic and Subantarctic areas.

Volutomitra groenlandica (Beck in Möller, 1842) Figs 391, 671-672

Mitra groenlandica Beck in Möller, 1842:88.

Type material: Numerous syntypes in ZMC.

Type locality: W Greenland.

Material examined: PORCUPINE 1869 st 23a, 56°13 N, 14°18 W, 773 m, 3 shs; st 65, 61°10 N, 02°21 W, 635 m, 3 shs; st 74, 60°39 N, 03°09 W, 373 m, 3 shs; st 75, 60°45 N, 03°06 W, 460 m, 3 shs; st 78, 60°14 N, 04°30 W, 534 m, 3 shs; USFC st 2486, between St Peters and Baguerau, Nova Scotia, 350 m, 1 sh; Wellington Channel, 2 spms, USNM; Fiskenaes, Greenland, ex Möller, 7 shs, ZMC; Godthaab, Greenland, 16 shs, ZMC; 76°08 N, 13°26 W, 250-300 m, 1 spm, ZMC; 61°00 N, 08°49 W, 105-100 m, 1 spm, ZMC; Iceland and the Faroes, 4 samples with 5 spms, ZMC (listed by Thorson, 1941 and Spärck & Thorson, 1933); 20 samples with 50 specimens, Greenland, ZMC; 18 samples with 65 specimens, Greenland, Iceland, N Norway, Spitzbergen, SMNH.

Distribution: The N North Atlantic upper bathyal zone, in arctic areas also coastal waters; Canada (Macpherson, 1971), E and W Greenland (Thorson, 1944, 1951), Iceland (Thorson, 1941), off Ireland (Massy, 1916), the Faroes (Spärck & Thorson, 1933), Norway N of Lofoten (G.O. Sars, 1878), Spitzbergen (Odhner, 1915), Novaya Zemlya (Golikov, 1964). Depths 7—773 m, usually 20—100 m.

Remarks: V. groenlandica is quite variable in the shape of the shell and the colour. Arctic specimens tend to be more light brown while southern specimens are more greyish. We have examined the material found off Ireland by Massy (1916) and one specimen looked recently dead; other findings from southern localities may be subfossil.

Volutomitra sp. Fig. 673

We figure a shell from THALASSA st Z424, 48°28 N, 09°44 W, 475 m, that does not agree with any form of *V. groenlandica* we have seen. It is a rather fresh-looking shell and it differs from *V. groenlandica* by having flatter whorls, being more slender and by having a grey shell. It may be an undescribed species, but it may also be a more southern form of *groenlandica.* It is, however, unusual for species that occur in arctic shallow water to go so far to the south.

Genus *MICROVOLUTA* Angas, 1877

Type species: M. australis Angas, 1877, by monotypy.

Remarks: The related genus *Conomitra* Conrad, 1865 is represented by numerous fossil species in the lower Tertiary beds of Europe. The species described below is the first of this group known from the NE Atlantic as Recent.

Microvoluta superstes **sp.n.** Fig. 674

Type material: Holotype and 18 paratypes in MNHN.
Type locality: NORATLANTE st E9, 36°41 N, 14°15 W, 208-230 m.

Material examined: Only known from the type material.

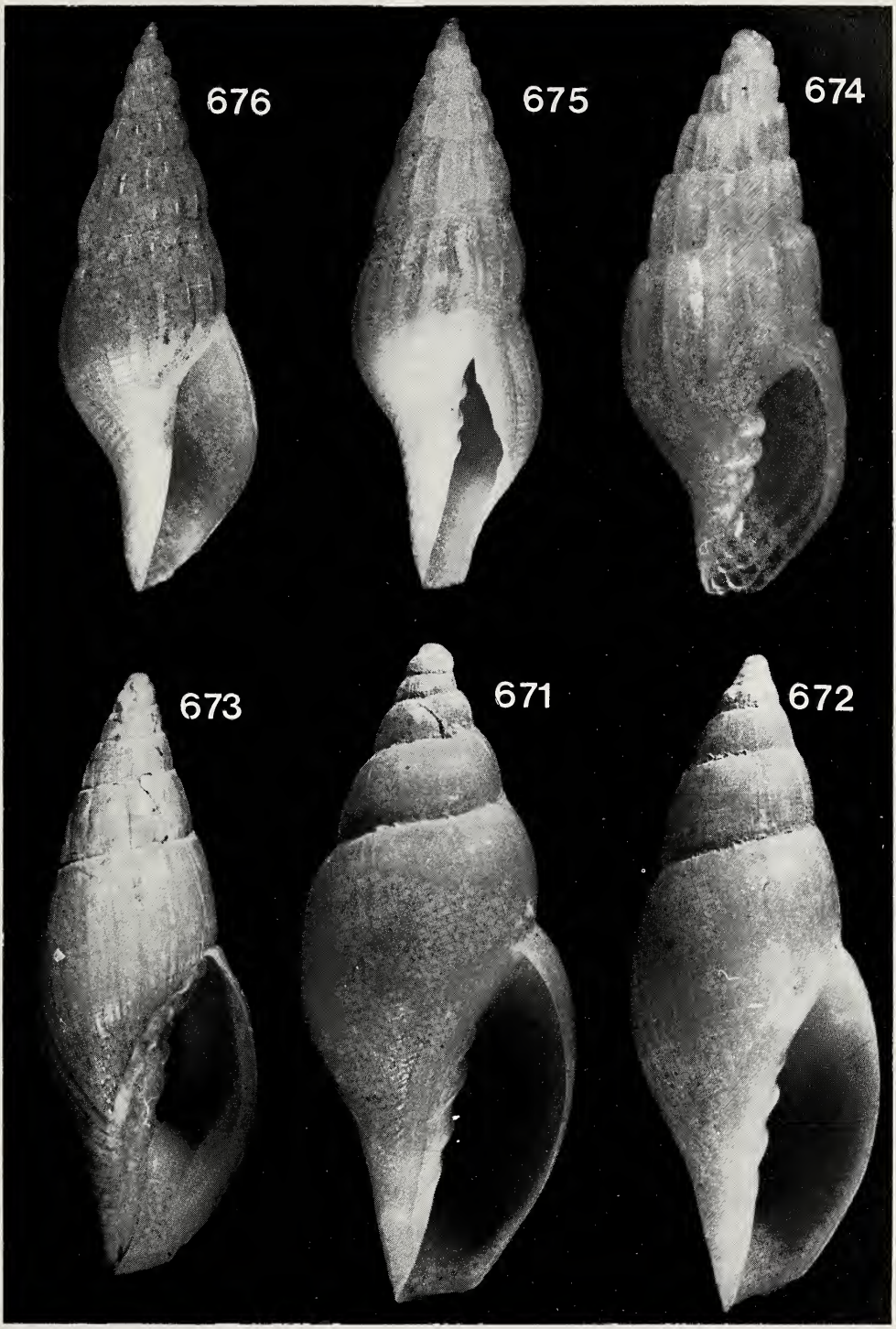
Description: (Holotype) Shell white, glossy, consisting of 5.5 slightly convex whorls, with a well-marked suture; protoconch of one globular smooth whorl; postlarval sculpture of strong axial ribs of which 12 and 11 can be counted on the body- and penultimate whorl respectively; postlarval spiral sculpture of rather deep grooves of which there are two below the suture and nine at the base of the body whorl; at the base of the shell these spiral grooves are more closely-spaced and form granules where they cross the base of the axial ribs; there is a narrow concave columellar zone; three columellar folds of which the lowermost one is very oblique; outer lip thin, siphonal canal short.

Dimensions of the shell height: 5.55 mm, breadth 2.45 mm; height of the aperture 2.5 mm, breadth 1.1 mm.

Some paratypes lack the spiral threads below the suture, while in others the spiral sculpture is present even at the middle of the whorls.

Remarks: All shells are empty, and most of them were bored by naticids.

Because no animal is available, the generic placement is only tentative.



Figs 671-676. Genera *Volutomitra, Microvoluta* and *Latiromitra.* 671 and 672, *V. groenlandica,* INGOLF st 32 (66°35 N, 56°38 W, 599 m), 19.7 mm and 26.8 mm. 673, *Volutomitra* sp., THALASSA st Z424, 19.0 mm. 674, *M. superstes,* paratype, 5.5 mm. 675 and 676, *L. cryptodon,* syntype, 30.3 mm.

Family TURBINELLIDAE

The family Turbinellidae contains two genera present in the deep water of the NE Atlantic. A third genus, *Ptychatractus* Stimpson, 1865 is represented by a single species in the NW Atlantic, in shallow water. Several tropical species are known from the deep shelf or upper continental slope.

Genus *METZGERIA* Norman, 1879.

Meyeria Dunker & Metzger, 1874:150 (non *Meyeria* McCoy, 1849).
Type species: Lathyrus albellus Dunker & Metzger, 1874, by monotypy.
Metzgeria Norman, 1879:56, new name for *Meyeria* Dunker & Metzger, non McCoy.
Remarks: Metzgeria includes three NE Atlantic species, all living in deep water, of which *M. gagei* is here described as new.

M. apodema Bouchet & Talavera, 1981 has a solid broad teleoconch and a multispiral larval shell.

M. alba (Jeffreys, 1873) and *M. gagei* **n.sp.** have a paucispiral larval shell and more hidden columellar folds. *M. gagei* is smaller, more slender and fragile than *alba.*

Metzgeria decorata (Locard, 1897) is a synonym of *Fusinus amiantus* (Fasciolariidae).

Metzgeria alba (Jeffreys in Wyville-Thomson, 1873) Figs 393, 677-678

Tritonium pusillum M. Sars, 1859:39 (nom. nud.).
Latirus albus Jeffreys in Wyville-Thomson, 1873:464, fig. 77.
Lathyrus albellus Dunker & Metzger, 1874:150.
Lathyrus albellus Dunker & Metzger, 1875:257, pl. 6, fig. 4.
Meyeria pusilla M. Sars in G.O. Sars, 1878:245, pl. 13, fig. 8.
Type material: L. albus, lectotype, here selected, USNM 188881; *L. albellus,* not found, not in ZMHU.
Type localities: L. albus, PORCUPINE 1869 st 74, 60°39 N, 03°09 W, 350 m; *L. albellus,* 2 miles WSW of Haugesund, SW Norway, 195—220 m.

Material examined: INGOLF st 32, 66°35 N, 56°38 W, 599 m, 5 shs; st 64, 62°06 N, 19°00 W, 1960 m, 1 sh; st 98, 65°38 N, 26°27 W, 260 m, 5 shs; E of the Faroes, 433 m, from stomachs of *Anarrhichas latifrons,* 2 spms, ZMC; E of the Faroes, 300 m, 1 sh, ZMC; between Norway and Shetland, 1 sh, ZMC; 64°45 N, 29°06 W, 1070 m, 1 sh, ZMC; 71°05 N, 20°00 E, 225 m, 1 sh; SMNH; 72°10 N, 20°37 E, 350-400 m, 3 shs; SMNH; Korsfjorden and off Korsfjorden, W Norway, 200-400 m, 50 shs and spms, coll. AW.

Distribution: On the shelf and upper continental slope, from Davis Strait (see above), Iceland (Oskarsson, 1962, 1967; Thorson, 1941), the Faroe Channel (Thomson, 1873) and along the Norwegian coast, N to Finmarken (G.O. Sars, 1878), in 100-1960 m.

Remarks: Metzgeria alba was recorded from the Azores (Locard, 1897), but the specimen in question proved to be an undeterminable fusinid, possibly *Fusinus amiantus.*

M. alba is quite a rare species, except possibly along the Norwegian west coast.

Metzgeria gagei **sp.n.** Figs 389, 679-681

Type material: Holotype RSM 1981089-13002.
Type locality: Challenger II 1981 st 30, 58°18 N, 14°31 W, 670 m.

Material examined: The type material and INGOLF st 10, 64°24 N, 28°50 W, 1484 m, 3 shs; st 81, 61°44 N, 27°00 W, 913 m, 1 sh; st 18, 61°44 N, 30°29 W, 2137 m, 2 spms.

Description: Shell whitish, fragile and slender. The larval shell consists of a little more than one, rather inflated whorl, sculptured with some indistinct traces of spiral lines and its height is 1.1 mm. The holotype has 7.3 postlarval whorls which are slightly shouldered and not very convex. The lower whorl lacks this shoulder and is evenly convex. The sculpture consists of low spiral ribs absent on the shoulder, and on the upper whorls rather strong, sharp axial ribs distinctly angled at the edge of the shoulder. On the body whorl the axial sculpture becomes much fainter and looks more like incremental lines. The columella is long and slender and sculptured by incremental lines. There are two distinct columellar folds, which are not visible when looking straight at the aperture, but only when the shell is rotated about 1/6 of a whorl clockwise. The outer lip is straight and thin.

Dimensions: Height of the shell 28.0 mm, diameter 8.1 mm, height of the aperture 13 mm, breadth 3.2 mm.

Remarks: The operculum is almost straight, rather thin and yellowish. This new species differs from *M. alba* in having a less solid shell, sharper apical axial ribs, a proportionally larger larval shell (compared with the subsequent whorl), and by having a more slender aperture. Comparison with specimens of *M. alba* from similar depths and adjacent localities from the Ingolf expedition, show the same differences, so it can be concluded that *M. gagei* is not a geographical or deep variety of *M. alba.*

Metzgeria costata (Dall, 1890), from the Lesser Antilles, 1220 m, has stronger columellar folds, easily visible in the apertue and a proportionally higher aperture.

Metzgeria apodema Bouchet & Talavera, 1981 Fig. 682

Metzgeria apodema Bouchet & Talavera, 1981:177.

Type material: holotype in MNHN.
Type locality: METEOR st 36-98, 25°31 N, 16°02 W, 700-900 m.

Distribution: Only known from the holotype.

Remarks: M. apodema differs from the two other species of *Metzgeria* from the area by its multispiral larval shell, and its broader teleoconch with shouldered whorls.

Genus *LATIROMITRA* Locard, 1897

Type species: L. specialis Locard, 1897, by monotypy.
Synonym: Cyomesus Quinn, 1981. Type species *Mesorhytis meekiana* Dall, 1889.
Remarks: The systematic position of *Latiromitra* has been changed several times. Locard placed it in Pisaniidae (i.e. Buccinidae!). Thiele (1929) transferred it to Costellariidae. Cernohorsky (1970) considered it a subgenus of *Volutomitra,* hence a volutomitrid.

The radulae of two conchologically very similar species, *Teramachia chaunax* Bayer, 1971 and *Mesorhytis meekiana* Dall, 1889 have been described by Bayer (1971). They are of turbinellid type and Bayer concluded that the species belonged to the Turbinellidae. He therefore moved *Teramachia* to Turbinellidae. The type species of *Teramachia*, however, is *T. tibiaeformis* Kuroda, 1931, of which the radula has been figured by Habe (1952). There seems to be no doubt that the type species is a volutid.

Rehder (1972) and Cernohorsky (1973) suggested that *T. chaunax, Mesorhytis meekiana* and two other species, *Mesorhytis costatus* Dall, 1890 and *Teramachia barthelowi* (Bartsch, 1942) should be placed in *Benthovoluta* Kuroda & Habe. Finally Quinn (1981) considered these species distinct enough to separate them from *Benthovoluta* and suggested a new genus, *Cyomesus,* with *meekiana* Dall as type species.

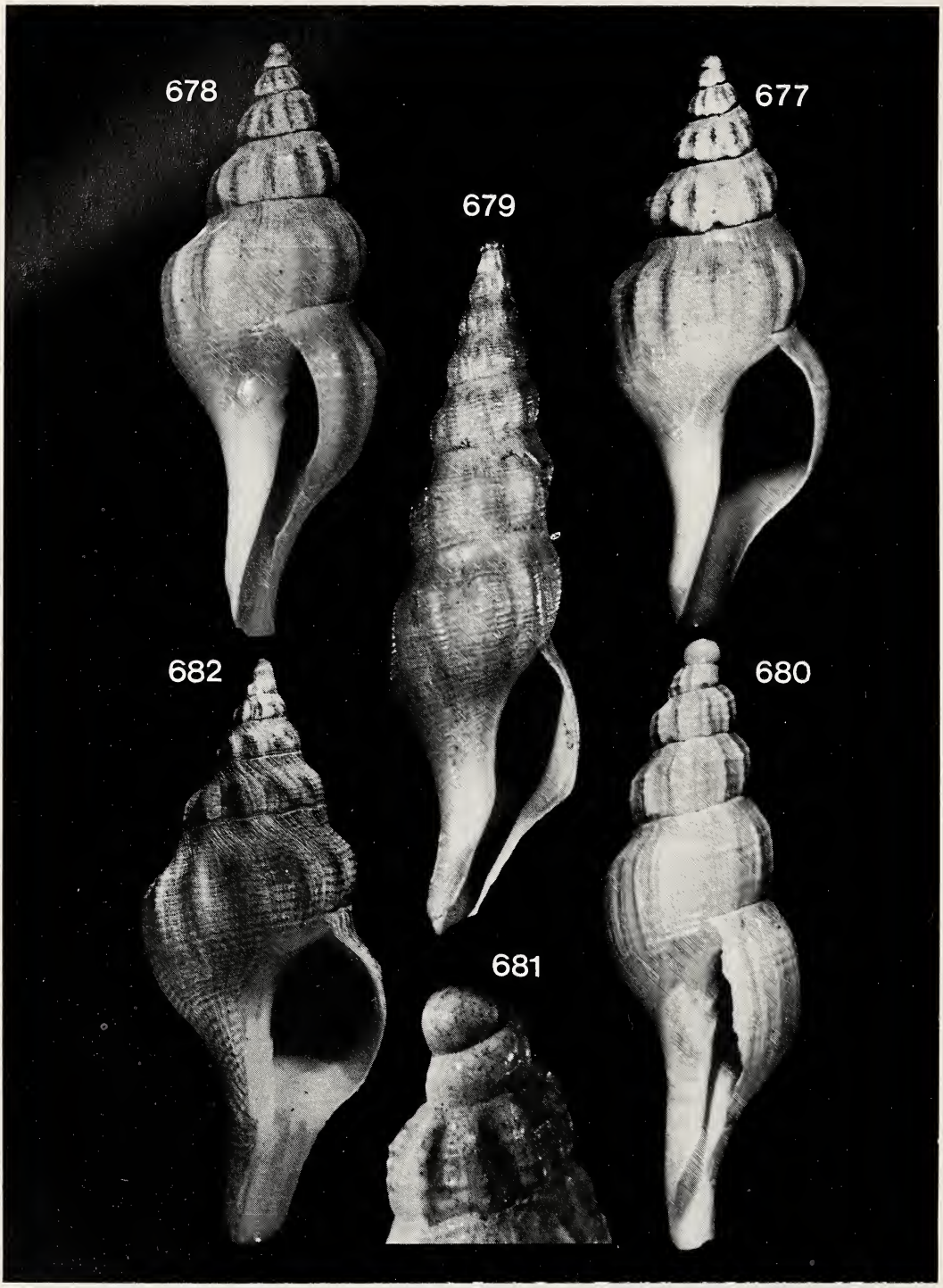
We have examined the radula of *T. barthelowi* (Fig. 390) from the Philippines and can confirm its affinity to *chaunax* and *meekiana.* We cannot, however, see any conchological differences between these four species and *Latiromitra* that can be used to maintain two genera, and consider *Cyomesus* a synonym of *Latiromitra.* Presumably no one considered *Latiromitra* as a genus for these species because it was considered a volutomitrid.

Mitra bairdi Dall, 1889, from the bathyal area off N Carolina and the Gulf of Mexico is a typical mitracean, as we found from examination of the radula.

Latiromitra cryptodon (P. Fischer, 1882) Figs 675-676

Mitra cryptodon P. Fischer, 1882:273.
Latiromitra specialis Locard, 1897:321, pl. 14, fig. 30-34.

Type material: The two names are based on the same two syntypes in MNHN.
Type locality: TRAVAILLEUR 1882, dr 40, 33°09 N, 09°38 W, 1900 m.
Material examined: The type material and MONACO st 683, 38°20 N, 28°05 W, 1550 m, 1 sh; st 116, 31°43 N, 10°47 W, 2165 m, 1 sh.
Distribution: Only known from the material examined.
Remarks: The larval shell is multispiral and probably indicates planktotrophic larvae.



Figs 677-682. Genus *Metzgeria*. 677 and 678, *M. alba*, INGOLF st 32, 19.8 mm and 21.4 mm. 679, *M. gagei*, holotype. 680 and 681, *M. gagei*, INGOLF st 18, 14.1 mm and apex 1.6 mm. 682, *M. apodema*, holotype.

Family CANCELLARIIDAE

Our collection of cancellarids is rather small. The family is not common in deep water, judging from the literature. Clarke (1962) cites five species from below 1830 m (of which *Admete aquilarum* (Watson) is a turrid). A few species have been described by Barnard (1960), Okutani (1964), Dall (1908), Verrill (1885) and Knudsen (1964).

Several cancellarids were originally described as trichotropids.

The genus *Benthobia* which previously has been placed in Cancellaridae is here transferred to Olividae (p.249).

Genus *ADMETE* Kröyer in Möller, 1842

Type species: A. crispa Möller, 1842 (= *Tritonium viridulum* Fabricius, 1780) by monotypy.

Remarks: There has been a controversy about the type species of *Admete,* since Dall (1887) wrote that *Tritonium viridulum* Fabricius and *Defrancia viridula* Möller, 1842 were based on the same specimen and suggested that *T. viridulum* was a turrid. European authors have continued to use the name of Fabricius, while American authors have used the name *Cancellaria couthouyi* Jay, 1839 (replacement name for *Cancellaria buccinoides* Couthouy, 1838, not Sowerby, 1832).

Dall (1887) pointed out that this had been mentioned by Mörch and that he had examined the specimen in Copenhagen. Mörch never mentioned this in any paper and even the last time he used the name *viridula* (1877) shortly before his death, he used it in the accustomed sense. Posselt (1895) mentioned Dall's doubts on the validity of the name *viridula* and that it was caused by a catalogue note by Mörch, but evidently Posselt considered it of no importance, because he continued to use the name *Admete viridula.* At this time there were no types of *Admete crispa* Möller or *Tritonium viridulum* Fabricius in the museum, because they were not mentioned by Posselt and he always listed the type material when it had been found. (There is, however, still alcohol material determined "*Admete viridula* Fabricius" by Möller.) Therefore we suppose that Möller (1842) had misidentified Fabricius's *Tritonium viridulum* and later, when he realized this, began to use this name for his former *Admete crispa.*

The original description (Fabricius, 1780) also supports our view that *T. viridulum* was not based on a turrid, especially the comparison with *Buccinum undatum* and the mention of a very short siphonal canal.

To stabilize the nomenclature, we have therefore selected one of Möller's specimens as neotype of *T. viridulum* (Fig. 683). This solution will make it possible to keep the name, which has been used in a single sense in Europe for 200 years.

The genus *Admete* contains a few species from high northern and southern latitudes. Many of the species which have been placed here, actually belong to other groups.

We have included three species in *Admete,* the type species and *A. nodosa* and *A. azorica.* The two last-mentioned species probably do not belong to *Admete,* but we have not been able to find a genus for them among the numerous cancellariid genera that have been described and we hesitate to introduce a new name before the other names have been thoroughly revised. Therefore we have kept them here.

Admete viridula (Fabricius, 1780) Figs 683-689

Tritonium viridulum Fabricius, 1780:402.
Murex costellifer Sowerby, 1818:225.
Cancellaria buccinoides Couthouy, 1838:105 (not Sowerby, 1832).
Cancellaria couthouyi Jay, 1839:77.
Admete crispa Möller, 1842:88.
Admete borealis A. Adams, 1855:122.
Admete viridula var. *grandis* Mörch, 1869:22.
Admete abnormis Gray in H. & A. Adams, 1858:278, *fide* Mörch 1869:22.
Admete undatocostata Verkrüzen in Kobelt, 1876:372.
Admete viridula var. *producta* G.O. Sars, 1878:217, pl. 13, fig. 2.
Admete viridula vars. *undata, laevior, elongata* and *distincta* Leche, 1878:47-48.
Admete contabulata Friele, 1879:276.
Admete sadko Gorbunov, 1946:310, pl. 1, fig. 5.

Type material: A. viridula, neotype in ZMC.
Type locality: A. viridula, W Greenland.

Material examined: INGOLF st 32, 66°35 N, 56°38 W, 599 m, 10 spms; st 95, 65°14 N, 30°39 W, 1416 m, 1 sh; st 98, 65°38 N, 26°27 W, 260 m, 1 sh; st 124, 67°40 N, 15°40 W, 932 m, 1 sh; st 126, 67°19 N, 15°52 W, 552 m, 1 sh, ZMC; several hundred shells and specimens from the Arctic Atlantic, USNM, SMNH, ZMC; several thousand specimens from S Scandinavia, 75—1000 m, coll. AW.

Distribution: From Massachusetts to Arctic Canada (Macpherson, 1971), E and W Greenland (Thorson, 1944, 1951), Iceland (Thorson, 1941), the Faroes (Spärck & Thorson, 1933), deep water off the British Isles (Jeffreys, 1885; Jordan, 1895; Sykes, 1911; Massy, 1930), along the Scandinavian coasts (G.O. Sars, 1878), Spitzbergen (Friele, 1886; Odhner, 1915), Kara Sea and Novaya Zemlya (Leche, 1878). In arctic areas *A viridula* occurs in shallow water, from intertidally, down to 1100 m (Friele, 1886), in the southern parts of its distribution considerably deeper, in S Scandinavia in 75-1200 m. Probably *A. viridula* has a panarctic circumpolar distribution.

Remarks: For discussion about the specific name, see under the genus.

Admete viridula is extremely variable, which is reflected in the large number of varieties that have been described. Probably also several names from the N Pacific should be added but that is beyond the intention of our work.

Young specimens of *A. viridula* may easily be confused with young *Oenopota* spp., but *Oenopota* has a more slender aperture, distinct siphonal canal, and an operculum. Nordsieck (1968) considered *A. inflata* (see *Iphinopsis*) as a subspecies of *A. viridula,* but that is not because they are similar, but because he had never seen *A. inflata.*

Thorson (1944) referred the egg capsules he had previously (1935) assigned to *Velutina undata,* to *Admete viridula.* We can confirm this observation and figure egg capsules and young from W Norway.

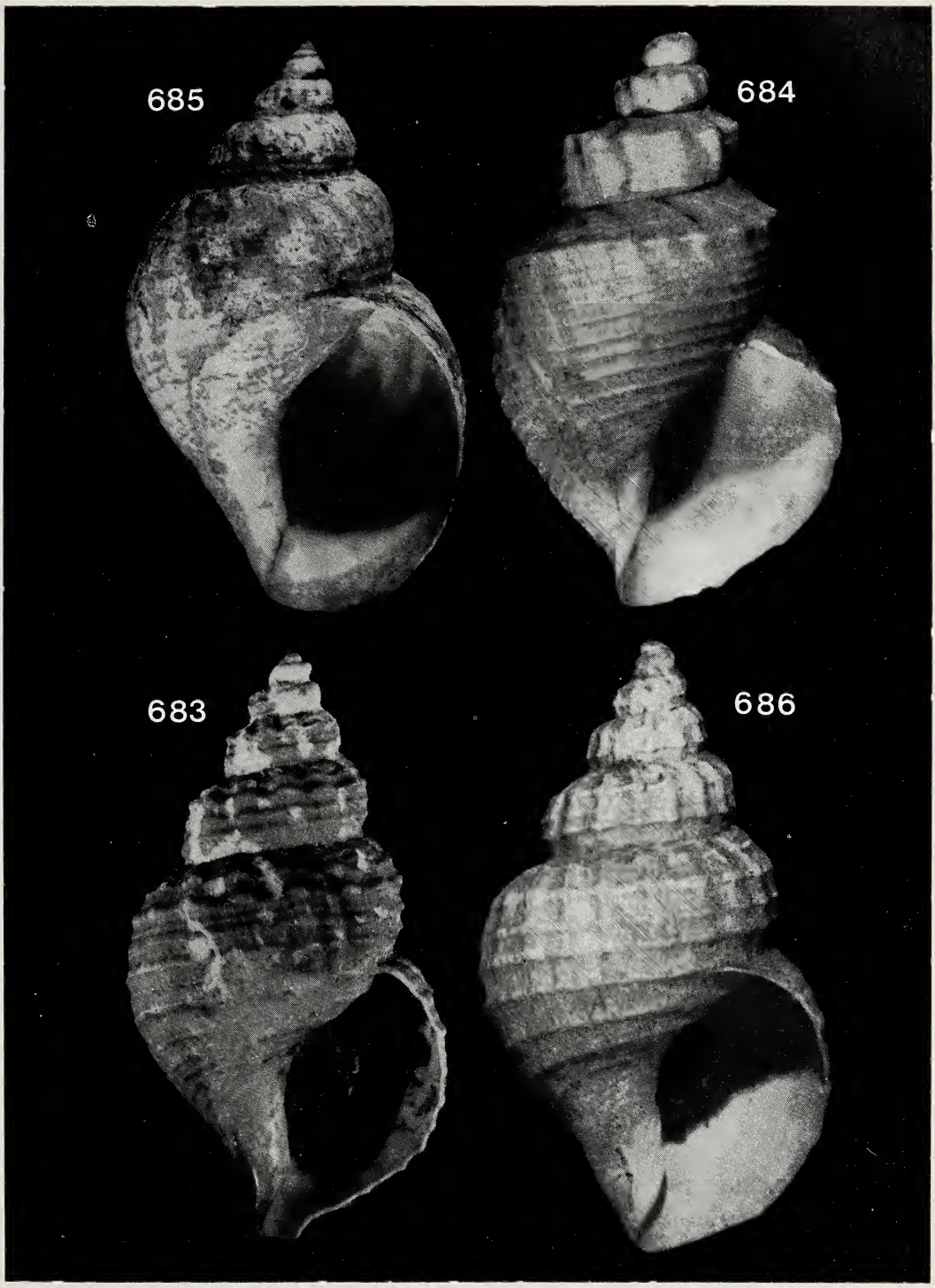
Admete nodosa Verrill, 1885 Fig. 691

Admete nodosa Verrill, 1885:419, pl. 44, fig. 9.

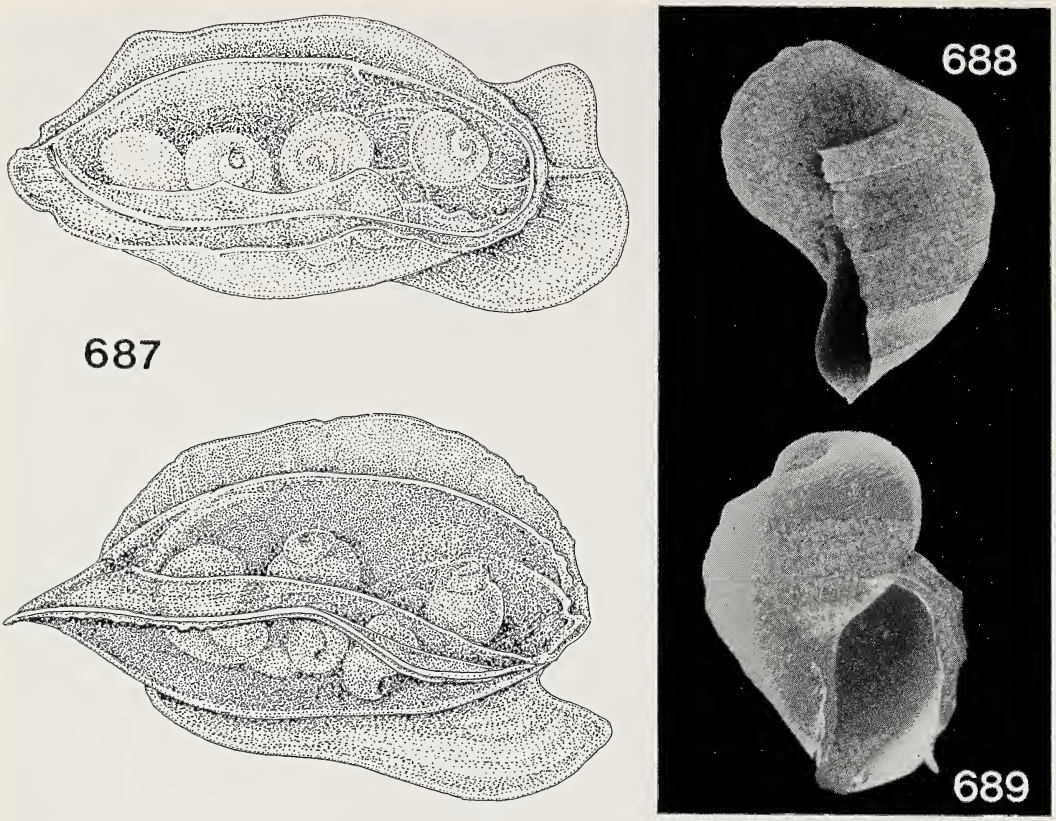
Type material: Holotype USNM 44646.
Type locality: USFC st 2234, 39°09 N, 72°03 W (off New Jersey), 1475 m.

Material examined: The holotype and THALASSA st X 333, 44°10 N, 04°32 W, 1925 m, 1 spm; st X 336, 44°11 N, 05°11 W, 1900 m, 1 spm; INCAL st DS 5, 56°28 N, 11°12 W, 2503 m, 1 spm; BIOGAS st CP 07, 44°10 N, 04°16 W, 2170 m, 2 shs; st CP24, 44°08 N, 04°16 W, 1995 m, 1 sh; POLYGAS st CV16, 44°06 N, 04°17 W, 1909 m, 2 spms.

Distribution: Only known from the material examined, from both sides of the N Atlantic, 1400-2500 m.



Figs 683-686. *Admete viridula*. 683, neotype, 13.7 mm. 684, holotype of *Admete contabulata*, VÖRINGEN st 192, 8.1 mm. 685, Spitzbergen, 26.0 mm. 686, Säcken, Swedish west coast, 10.6 mm.



Figs 687-689. *Admete viridula.* 687, Lieholmsrännan, Bergen area, 55-65 m, egg-capsule. Length 5 mm. 688, shell of an embryo from the same capsule, 870 μm. 689, Korsfjorden, Bergen area, 306 m. Very young specimen with postlarval growth, 1.0 mm.

Remarks: The larval shell is multispiral and indicates planktotrophic larvae.

A. nodosa does not resemble any N Atlantic gastropod known to us, except *A. azorica,* but that species is smaller, more slender and has a proportionally smaller aperture.

A. nodosa has no radula. The rectum and intestine of the specimen which was examined for a radula, were filled with droplets of some intensely red substance.

Admete azorica **sp.n.** Fig. 690

Type material: Holotype in MNHN.

Type locality: BIACORES st 53, 38°07 N, 28°18 W, 1820 m, SE of Pico, Azores.

Material examined: MONACO st 112, 38°34 N, 28°06 W, 1287 m, 1 sh; st 1349, 38°35 N, 28°06 W, 1250 m, 1 sh; TALISMAN dr 129, 38°00 N, 27°03 W, 2220 m, 1 sh.

Distribution: Only known from the material examined, from the Azores.

Description: Shell short, conical, rather broad, very solid, white. The larval shell consists of 2.25 whorls, sculptured by fine spiral lines and its height is about 850 μm. The holotype has 2.8 postlarval whorls which are rather flat and sculptured by strong axial ribs; 11 ribs occur on the body whorl. There are also numerous irregular growth lines. The spiral sculpture consists of three often interrupted spiral lines on the upper whorls and two additional ones on the body whorl. The aperture is rather small with two large columellar folds and a strongly oblique outer lip.

Dimensions: Height of the shell 7.6 mm, diameter 4.6 mm, height of the aperture 4.0 mm, breadth 2.1 mm.

Remarks: A azorica differs from *A. nodosa* by its more slender shell and possibly its larval shell has about half a whorl less, but this could not be positively ascertained because of the poor preservation of all larval shells of *A. nodosa.* Furthermore, it reaches only half the size of *A. nodosa.*

Genus *IPHINOPSIS* Dall, 1924

Type species: Iphinoe kelseyi Dall, 1908, by original designation (Fig. 694).

Synonym: Iphinoella Habe, 1958. Type species *I. choshiensis* Habe, 1958, by original designation.

Remarks: Iphinopsis has previously, from shell characters, been placed in Trichotropidae, but on evidence given below we transfer it to Cancellariidae.

There have been described several species resembling *I. kelseyi* in various families and genera:
Trichotropis inflata Friele, 1879, from deep water N of Norway.
Trichotropis nuda Dall, 1927, from deep water off Florida (Fig. 704).
Iphinoella choshiensis Habe, 1958, off Japan, 500-1500 m.
Tromina traversensis Clarke, 1959, from the abyssal S Atlantic.
Cancellaria euthymei Barnard, 1960, from off S Africa.

We have examined specimens of *kelseyi, inflata, nuda, traversensis* and two species that are described as new here, and found them to be very similar conchologically. We have also examined the anatomy of four of these, *inflata, traversensis* and the two new species. They were identical, except in the development of the eyes and sexual characters. The examination was made on dried specimens reconstituted by soaking in a water detergent solution, and we noticed that after soaking, all were extremely slimy and that the oviducts had swelled, producing a lot of mucus.

The foot is large and muscular and probably very large when the animal is crawling. The propodium is distinct and there is no operculum. The tentacles are short and rounded with eyes situated laterally at their base. The osphradium is large, bipectinate, of at least the same size as the gill. The animal has no snout, a long pleurembolic proboscis with two pairs of salivary glands, but no radula. No identifiable contents were found in the rectum or intestine. The diameter of the eyes of *I. traversensis* was 40 μm, of *alba* 100 μm, of inflata 130 μm and of *fuscoapicata* 150 μm, in specimens of the same size. The specimens of *inflata, traversensis* and *fuscoapicata* were females with a well-developed pallial oviduct, while two specimens of *I. alba* had both penis and pallial oviduct.

From these anatomical details and the presence of columellar folds, we conclude that the species belong to Cancellariidae. *Iphinopsis choshiensis* Habe is the type species of *Iphinoella* Habe and *I. kelseyi* Dall, is the type of *Iphinopsis.* Habe (1962) synonymized the two genera and considered them to belong to Trichotropidae, which we find untenable on the basis of absence of radula, absence of operculum, absence of snout, presence of pleurembolic proboscis and presence of columellar folds in the species we have examined. We admit that we have not examined the animal of either of the two type species, but conchologically they are very close to those which we have examined.

The species of *Iphinopsis* are easy to confuse with other groups of gastropods, as is evident from the known species being described in three different families. Clarke (1961) pointed out that *T. traversensis* could be confused with the young of *Oocorys,* but described it as a buccinid in the genus *Tromina* Dall, 1918 (Fig. 328), probably misled by Powell (1951) who used *Tromina* for certain antarctic buccinids. *Iphinopsis* can also be confused with the young of some cassids, some buccinids and trichotropids. The species of *Iphinopsis* can, however, be distinguished by having columellar folds, which may be very indistinct and visible only rather far back in the aperture. Some turrids of the genus *Lusitanops* also resemble *Iphinopsis,* but they have a less well developed umbilicus and a larval shell with cancellate sculpture.

Iphinopsis inflata (Friele, 1879) Figs 698-699

Trichotropis inflata Friele, 1879:275.
Admete inflata Friele, 1886:25, pl. 8, fig. 33.
Type material: Two syntypes, ZMB 20719.
Type locality: VÖRINGEN st 192, 69°46 N, 16°15 E, 1187 m.

Material examined: The type material and 20 shs from the type locality ZMB 20720; VÖRINGEN st 323, 72°53 N, 21°51 E, 408 m, 2 spms; st 312, 74°54 N, 14°53 E, 1203 m, 6 spms, ZMB 20721; INGOLF st 90, 64°45 N, 29°06 W, 1070 m, 1 sh; st 102, 66°32 N, 10°26 W, 1412 m, 3 shs; st 103, 66°23 N, 08°52 W, 1090 m, 2 spms, 1 sh; st 116, 70°05 N, 08°26 W, 699 m, 6 spms; st 124, 67°40 N, 15°40 W, 932 m, 1 sh, 2 spms; st 139, 63°36 N, 07°30 W, 1322 m, 16 spms, ZMC; 73°03 N, 18°30 E, 410 m, 1 spm, SMNH.

Distribution: Only known from between Norway and Spitzbergen and around Iceland, from the material examined. Verrill's (1884) record from off New England in 3200 m needs confirmation and we were not able to locate his material in USNM.

Remarks: I. inflata differs from *I. alba* by having less developed, almost invisible columellar folds, while those of *I. alba* are very distinct, especially the lowermost one. It differs from *I. fuscoapicata* by having a white larval shell of about one whorl, instead of a brownish, multispiral larval shell.

To see the columellar folds of *I. inflata* it is necessary to look rather obliquely into the aperture.

Iphinopsis fuscoapicata **sp.n.** Figs 700-703

Type material: Holotype in MNHN.
Type locality: INCAL st WS01, 50°19 N, 13°07 W, 2550 m (SW of Ireland).

Material examined: INCAL DS06, 56°26 N, 11°10 W, 2494 m, 5 spms; CP06, 55°02 N, 12°41 W, 2890 m, 1 spm; DS09, 55°08 N, 12°53 W, 2897 m, 1 spm; CP08, 50°15 N, 13°14 W, 2644 m, 1 spm; WS02, 50°19 N, 12°56 W, 2498 m, 1 spm; CHALLENGER 2 st 4, 56°52 N, 10°01 W, 1993 m, 1 spm; st ?, Rockall Trough, 2851 m, 1 spm.

Distribution: Only known from the material examined, off the British Isles, ca. 2500 m.

Description: Shell of medium size, fragile, inflated, dirty white. The larval shell is dark brownish and consists of about two whorls, sculptured by faint spiral striae, and its height is about 650 μm. The holotype has about three postlarval whorls of rather rapidly increasing diameter. The sculpture consists of equidistant spiral cords, weaker on the lower part of the body whorl and almost disappearing at the columella. The axial sculpture consists of a few stronger and numerous small, sharp incremental ribs. The stronger ribs appear at irregular intervals, the smaller ones are close set and regularly spaced. The outer lip, seen from the side, is slightly sigmoid. The inner lip forms a far-protruding, evenly-curved parietal callus, continuous with the reflected part of the columella and forming a deep umbilical chink behind it. There is no distinct siphonal canal.

Dimensions: Height of the shell 9.5 mm, diameter 6.0 mm, height of the aperture 6.0 mm, breadth 2.9 mm.

Remarks: The present species can be distinguished from the two other species known from the NE Atlantic by the larval shell, which is brownish in *I. fuscoapicata* and white in the others.

I. traversensis probably has a brownish larval shell, but the apex of the holotype is badly corroded, so we could see only traces of this, in the old sutures. It differs from *I. fuscoapicata* by having a finer and less distinct axial sculpture with more distant ribs and by having more convex and strongly shouldered whorls.

There is hardly any columellar fold visible in the specimens we have examined, but this may be because our specimens are not full grown.

Iphinopsis alba **sp. n.** Figs 695-697

Type material: Holotype in MNHN.
Type locality: BIOGAS st CP01, 47°35 N, 08°39 W, 2245 m, NW part of the Bay of Biscay.

Material examined: BIOGAS st DS26, 47°33 N, 08°36 W, 2147 m, 2 shs; st DS52, 44°06 N, 04°22 W, 2006 m, 3 spms; st DS62, 47°33 N, 08°40 W, 2175 m, 1 sh; st DS63, 47°33 N, 08°35 W, 2126 m, 1 sh; st CP08, 47°33 N, 08°38 W, 2177 m, 1 spm; st CP12, 47°32 N, 09°12 W, 2925 m, 1 spm; st CP25, 44°05 N, 04°17 W, 1894 m, 1 spm; st DS71, 47°34 N, 08°34 W, 2194 m, 1 spm, 2 shs; st DS64, 47°29 N, 08°31 W, 2156 m, 1 spm, 1 sh; THALASSA st X333, 44°10 N, 04°32 W, 1925 m, 1 sh; st X334, 44°10 N, 04°52 W, 1900 m, 1 sh; st X336, 44°11 N, 05°11 W, 1900 m, 1 sh; CHALLENGER 2, st 4, 56°52 N, 10°01 W, 1993 m, 1 spm.

Distribution: Only known from the continental slopes of the bay of Biscay and the Rockall Trough, 1900-2900 m.

Description: Shell of medium size, rather inflated, fragile, whitish, or dirty whitish. Larval shell white, sculptured by a few rather coarse spiral lines, consisting of about 1.2 whorls and of a height of 600 μm. The holotype has about 4 postlarval whorls, but this figure is uncertain because of corrosion of the spire. The sculpture is identical to that of *fuscoapicata,* possibly some specimens have coarser axial sculpture, but this is difficult to ascertain from our small sample. The shape of the aperture and the columella are also identical with *fuscoapicata.*

Dimensions: Height of the shell 14.5 mm, diameter 8.2 mm, height of the aperture 9.5 mm, breadth 3.8 mm.

Remarks: Iphinopsis alba can be separated from *I. fuscoapicata* only by the larval shell (Figs 697, 702), which in *I. alba* has coarser sculpture, about 3/4 of a whorl less, and is white instead of brown. Another difference, more difficult to see in juvenile specimens, is that *I. alba* has distinct columellar folds while *I. fuscoapicata* has no trace of them. This is also the only difference from *I. inflata* where only traces of one fold can be seen.

Genus *OLSSONELLA* Petit, 1970

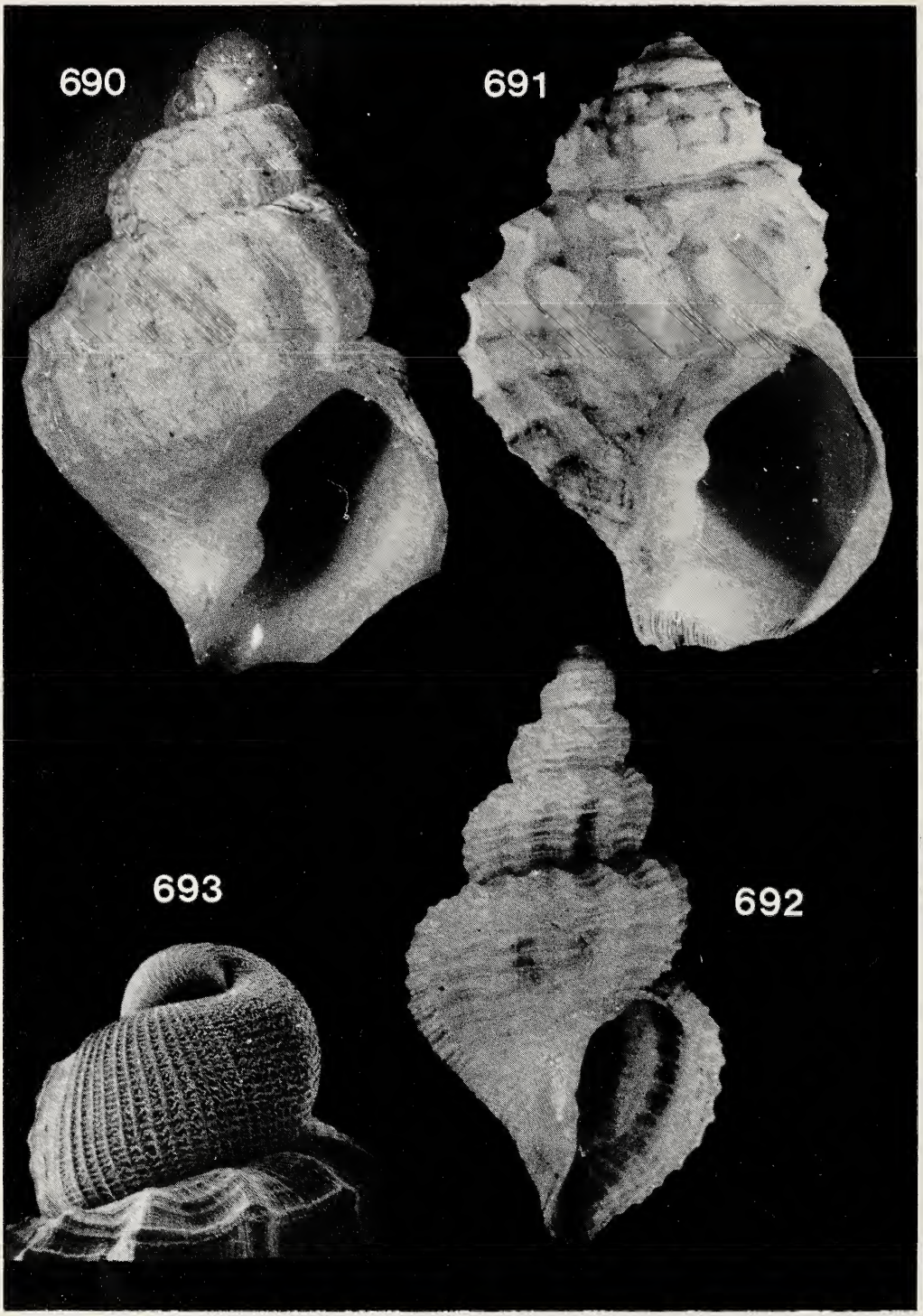
Type species: Cancellaria smithi Dall, 1883, by original designation.
Remarks: The type species was described from shallow water (35-80 m) off N Carolina. Dall (1889) compared this species with *Cancellaria minima* Reeve, because of their similarity. We have used the genus *Olssonella* on the advice of Mr R.E. Petit, with whom we have had valuable discussions about the cancellariids.

Olssonella minima (Reeve, 1856) Figs 692-693

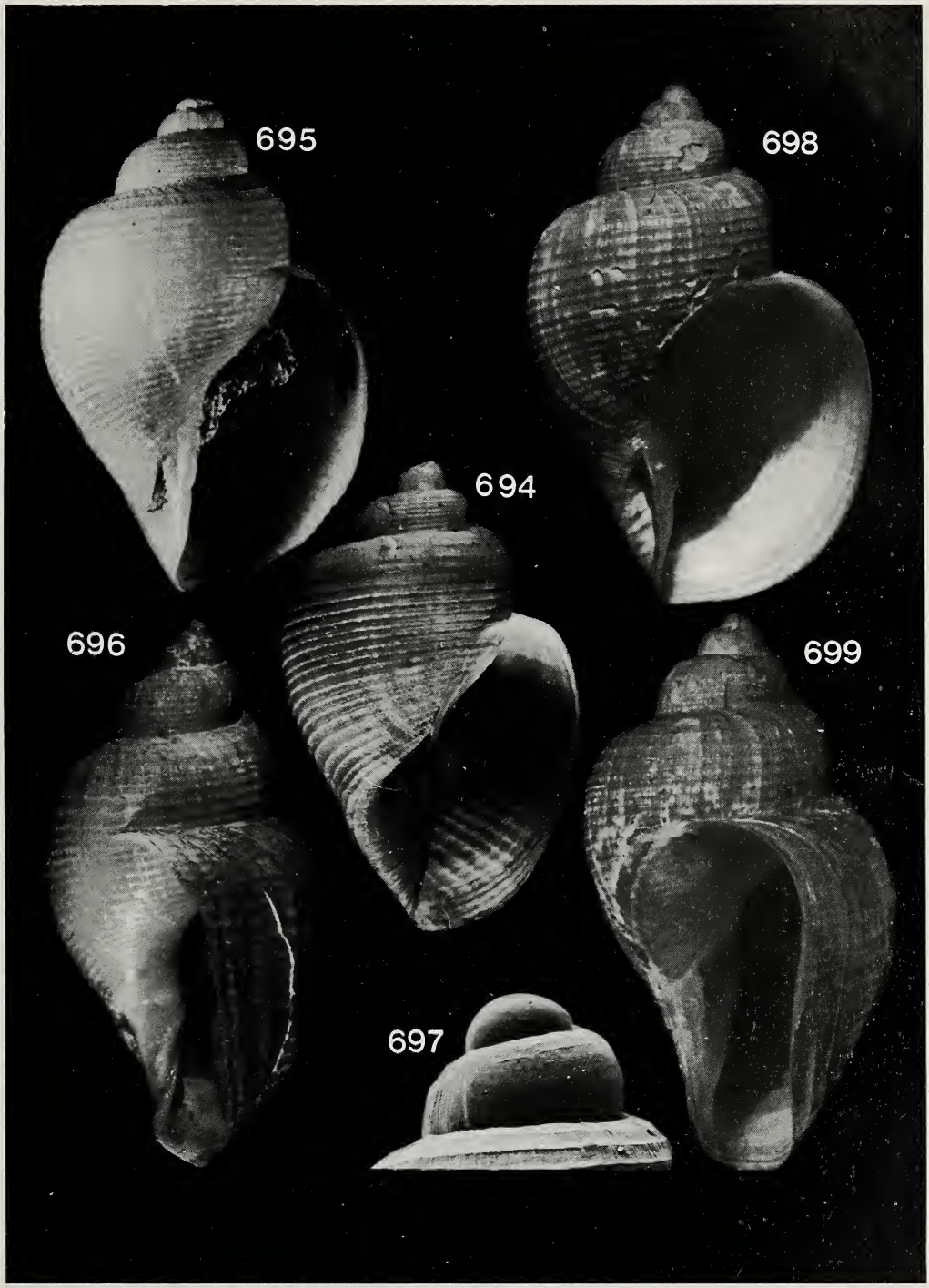
Cancellaria minima Reeve, 1856: sp. 77.
Type material: Syntypes in BMNH.
Type locality: No locality mentioned.
Material examined: The types and: off Madeira, 410-580 m, 1 sh, MNHN; PORCUPINE 1870, off Cadiz, SW Spain, 700 m, 7 shs, BMNH.

Distribution: The area W of Gibraltar, known from 600-700 m; Madeira, in shallow water (Watson, 1897).

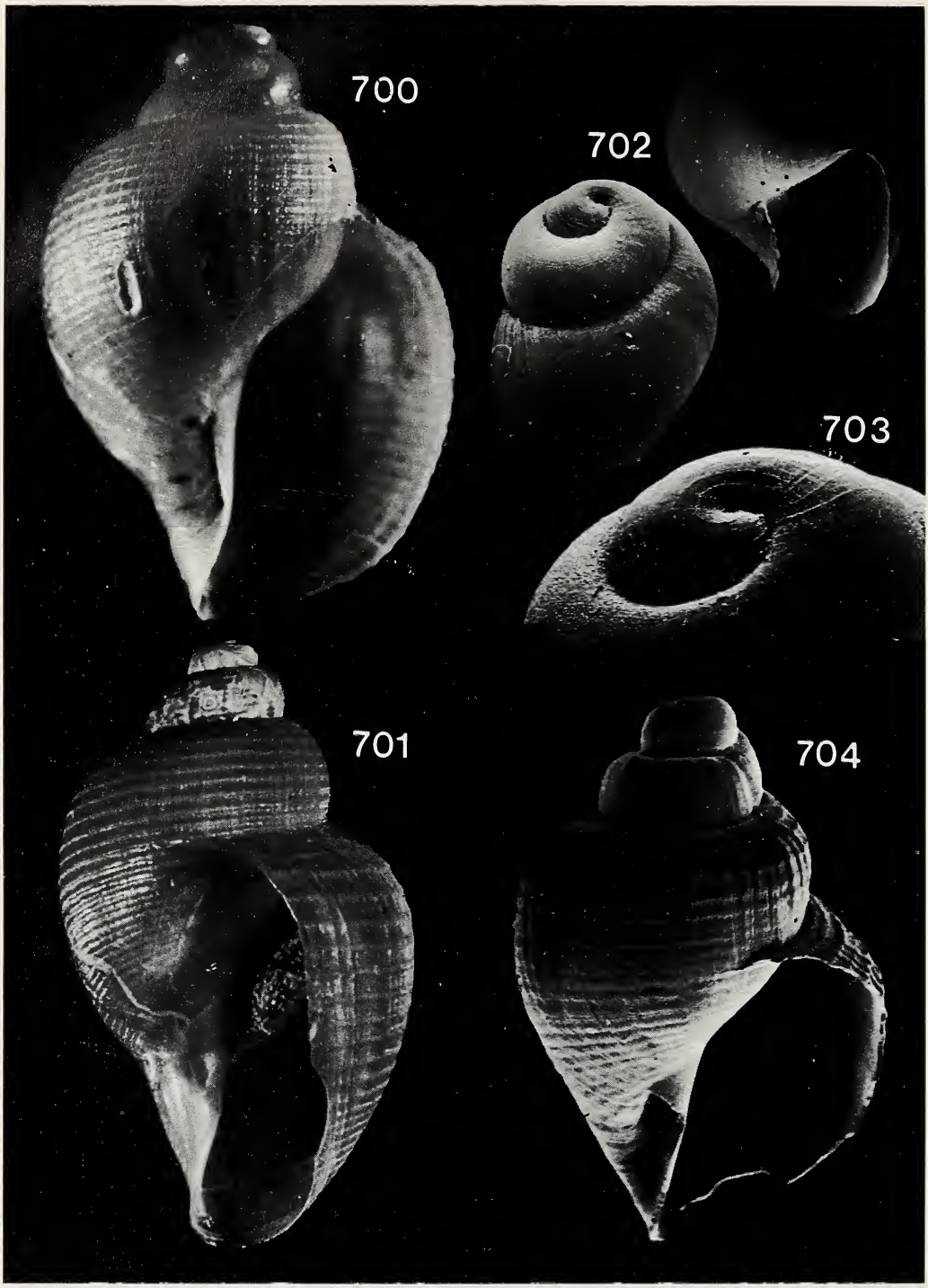
Remarks: Cancellaria minima was described by Reeve without giving the locality but Jeffreys (1885) said that the specimens originated from the dredgings of McAndrew and recorded it from Gibraltar and Madeira on the authority of McAndrew. McAndrew (1852, 1857) also listed undescribed cancellariids from Madeira and the Canaries. As Watson's (1897) records from Madeira indicate, this will probably prove to be a shallow-water species.



Figs 690-693. Genera *Admete* and *Olssonella*. 690, *A. azorica,* holotype, 7.8 mm. 691, *A. nodosa,* BIOGAS st CP24, 13.8 mm. 692, *O. minima,* syntype, 6.5 mm. 693, *O. minima,* off Madeira, apex 707 μm.



Figs 694-699. Genus *Iphinopsis*. 694, *I. kelseyi*, type species of *Iphinopsis*, holotype 6.4 mm. 695, *I. alba*, INCAL st CP8, 9.3 mm. 696, *I. alba*, BIOGAS st CP1, 14.9 mm. 697, *I. alba*, apex 0.5 mm. 698 and 699, *I. inflata*, INGOLF st 103, 7.5 mm and 7.9 mm.



Figs 700-704. Genus *Iphinopsis*. 700, *I. fuscoapicata*, INCAL st DS7, 3.9 mm. 701, INCAL st WS1 holotype, 9.5 mm. 702, Young postlarvae, INCAL st DS6, 870 μm. 703, Embryonic shell of the same specimen, diameter 390 μm. 704, *I nuda*, syntype of *Trichotropis nuda* Dall, 2.9 mm.

Family MARGINELLIDAE

Examination of literature suggests that marginellids seem to be scarce in deep water (Clarke, 1962 lists four species). Our experience, however, is that they are not rare on the upper part of the continental slopes, especially in tropical areas.

Several species of marginellids were described by Locard (1897) from just south of the area we are treating. No further material has since been found so we refer to his treatment of these species.

A key to the species likely to be encountered in the area covered is presented below.

A.	Spire visible	C
A.	Spire hidden *(Granulina)*	B
B.	Shell slender, breadth = 2/3 height	*G. parvulina*
B.	Shell broad, breadth = 4/5 height	*G. occulta*
C.	High spire, four or fewer equal columellar folds	E
C.	Short spire, more than four, unequal, columellar folds *(Gibberula)*	D
D.	Shell small (2-2.5 mm), 5-6 columellar folds	*G. vignali*
D.	Shell bigger (3-5 mm), 4-5 columellar folds	*G. abyssicola*
E.	Three columellar folds *(Volvarina)*	*V. ingolfi*
E.	Four strong columellar folds *(Marginella)*	F
F.	Outer lip thickened into a broad varix, shell white to yellowish white	G
F.	Outer lip not thickened into a varix, shell yellowish white to orange	I
G.	Shell small (less than 10 mm), with very convex whorls	*M. hesperia*
G.	Shell larger, with almost flat whorls	H
H.	Suture polished, indistinct	*M. marocana*
H.	Suture distinct	*M. arronax*
I.	Hire spire with very convex whorls	*M. subturrita*
I.	Shell broad, with almost flat whorls	*M. impudica*

Genus *GIBBERULA* Swainson, 1840

Type species: Gibberula zonata Swainson, 1840, by monotypy.

The genus *Gibberula* comprises small marginellids, 3-10 mm high, that live mainly on the continental shelf. Two species occur on the Atlantic slope of the Iberian peninsula, but do not enter the Mediterranean where only shallow-water species are found.

Gibberula abyssicola Monterosato in Locard, 1897 Figs 394, 705-708, 714

Gibberula abyssicola Monterosato in Locard, 1897:130, pl. 4, figs 22-25.
Gibberula monterosatoi Locard, 1897:131, pl. 4, figs 26-28.
Gibberula retusa Monterosato in Locard, 1897:128, pl. 4, figs 19-21.

Type material: G. abyssicola, lectotype in MNHN; *G. monterosatoi,* 4 syntypes in MNHN; *G. retusa,* 37 syntypes in MNHN.

Type localities: G. abyssicola, TRAVAILLEUR 1881 dr 40, 40°05 N, 07°05 W, 392 m; *G. monterosatoi,* TRAVAILLEUR 1881 dr 1, 43°01 N, 09°38 W, 2018 m; *G. retusa,* TRAVAILLEUR 1881 dr 30, 35°25 N, 08°00 W, 1205 m.

Material examined: The type material and TRAVAILLEUR 1881, dr 41, 44°02 N, 07°07 W, 1094 m, 2 shs; dr 42, 44°01 N, 07°05 W, 896 m, 8 spms +shs; THALASSA st W392, 44°07 N, 04°49 W, 600-1130 m, 1 spm; st X305, 44°05 N, 05°00 W, 463 m, 18 spms + shs; st X340, 44°07 N, 04°30 W, 860-910 m, 10 spms; st X341, 44°07 N, 04°31 W, 800-840 m, 2 spms; st X342, 44°08 N, 04°37 W, 700 m, 14 spms + shs; st X343,, 44°08 N, 04°39 W, 600-655 m, 16 spms + shs; st X345, 44°06 N, 04°41 W, 525-550 m, 31 spms + shs; st X347, 44°07 N, 04°44 W, 640-910 m, 36 spms + shs; st X348, 44°07 N, 04°44 W, 600-900 m, 4 shs; st X350, 44°04 N, 04°46 W, 505 m, 1 spm; st X352, 44°06 N, 04°45 W, 545-580 m, 5 spms; st X353, 44°07 N, 04°45 W, 635-655 m, 6 spms +

shs; st X360, 44°05 N, 04°50 W, 580-592 m, 1 sh; st X361, 44°06 N, 04°50 W, 582-595 m, 7 spms; st X362, 44°07 N, 04°51 W, 585-600 m, 18 spms + shs; st X363, 44°06 N, 04°54 W, 545-630 m, 8 spms; st Y377, 41°32 N, 09°14 W, 320 m, 3 shs; st T482, 44°02 N, 08°44 W, 490 m, 4 spms; MONACO st 2717, 36°42 N, 08°40 W, 750 m, 53 spms + shs.

Distribution: Only known from the material examined, NW and S of the Iberian Peninsula, on the upper part of the continental slope.

Remarks: G. abyssicola was reported from the Mediterranean (on the authority of Monterosato) by Locard (1897). It was however, not mentioned by Monterosato or D'Amico in any paper. G. Spada, who has examined the marginellids in the Monterosato collection has informed us that it is not present there, except two shells from the TRAVAILLEUR dredgings, nor are any specimens of *retusa* or *monterosatoi;* we conclude that there was some mistake behind Locard's statement. The material cited from shallow water in Madeira proved to belong to *Granulina.*

The name *G. monterosatoi* was based on young specimens without thickened outer lip.

The specimens examined from Le Danois Bank (THALASSA X stns) show a reduction in size with increasing depth. The average size from 450 m is 4.3 mm, in 880 m, 3.3 mm. The name *retusa* was based on more southern specimens, which have a more thickened outer lip and solid shell.

The egg capsule (Fig. 714) is a simple rounded capsule, slightly larger than the larval shell. It lies free on the bottom. The size of the young corresponds with our smallest specimens, and indicates direct development.

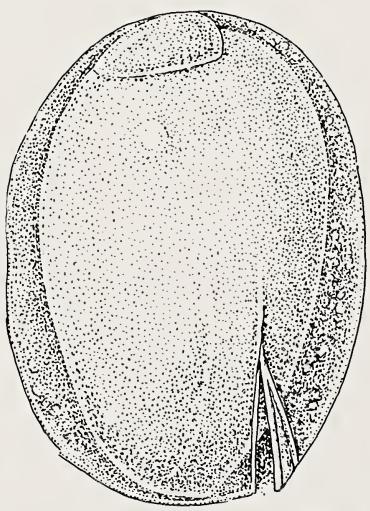


Fig. 714. *Gibberula abyssicola.* THALASSA st X315, egg capsule, length 1.9 mm.

Gibberula vignali (Dautzenberg & H. Fischer, 1896) Figs 709-710

Marginella vignali Dautzenberg & H. Fischer, 1896: 433, pl. 15, fig. 17.

Type material: lectotype in MOM.
Type locality: MONACO st 553, 37°43 N, 25°05 W, 1385 m.
Material examined: The type material and 7 shs from the type locality; MONACO st 112, 38°34 N, 28°06 W, 1287 m, 11 shs; st 1311, 37°37 N, 25°21 W, 1187 m, 2 shs; st 1349, 38°35 N, 28°06 W, 1250 m, 13 shs; TRAVAILLEUR 1882, dr 34, 35°42 N, 06°20 W, 112 m, 2 shs; THALASSA st Y400, 40°46 N, 09°19 W, 800 m, 5 spms; VANNEAU 1923, st 10, 29°54 N, 09°58 W, 110 m, 18 shs; st 35, 34°05 N, 07°40 W, 160 m, 9 shs.

Distribution: Only known from the material examined, off Portugal and Morocco, and the Azores, on the continental shelf and upper parts of the slope.

Remarks: Our experience from shallow-water species of *Gibberula* shows that there exists very little difference in shell characters between the species, and that living animals may be necessary to distinguish the species. We will therefore not exclude the possibility that we may have confused two species in *G. vignali.*

Gibberula vignali differs from *abyssicola* by being much smaller, about 2.5—2 mm instead of 3—4.5 mm, and by having five instead of four clearly visible columellar folds.

Genus *GRANULINA* Jousseaume, 1888

Synonym: Cypraeolina Cerulli-Irelli, 1911
Type species: *Voluta clandestina* Brocchi, 1814.

The group of marginellids treated here has consistently been called *Gibberulina* in the European literature. However *Gibberulina* Monterosato, 1884 is a new name ("nom.sost.") for *Bullata* Jousseaume, 1875 and therefore keeps the same type species, viz. *Voluta bullata* Born, 1778. *Bullata* is a valid name and *Gibberulina* is an objective synonym of it.

Granulina was introduced for *Marginella pygmaea* Issel, 1869 (type species by monotypy), non Sowerby 1846 (= *Marginella isseli* Nevill & Nevill, 1875) and can be used for the species formerly included in *Gibberulina* in Europe.

Granulina parvulina (Locard, 1897) Fig. 711

Volutella parvulina Locard, 1897:126, pl. 21, figs 3-5.
Volutella parvulina var. *curta* Locard, 1897:126.

Type material: Two syntypes in MNHN.
Type locality: TRAVAILLEUR 1881, dr 41, 44°02 N, 07°07 W, 1094 m.

Material examined: The type material and MONACO st 1713, 28°04 N, 16°49 W, 1340-1530 m, 1sh; VANNEAU 1923, st 10, 29°54 N, 09°58 W, 110 m, 2 shs.

Distribution: Only known from the material examined, off N Spain and Morocco.

Remarks: G. parvulina differs from the shallow-water species of the genus by being much more slender. *G. occulta* (Monterosato, 1869) is a deep-shelf species occasionally occurring on the upper slope in the Mediterranean and nearby Atlantic; it is figured here (Fig. 712) for comparison.

Genus *MARGINELLA* Lamarck, 1799

Type species: Marginella glabella (Linné) by monotypy.

The type species of *Marginella* as well as four of the species discussed here lack a radula. The shape of the shell of *M. glabella* resembles the four species, but the colour patterns are quite different. The fifth species included in our revision, *Marginella hesperia* differs in shell characters; no animal was available for examination for a radula, and it seems to be more closely related to certain deep shelf species from West Africa, e.g. *M. bojadorensis* Thiele, 1925.

Marginella hesperia Sykes, 1905 Fig. 716

Marginella hesperia Sykes, 1905: 316, pl. 17, fig. 7.

Type material: 10 syntypes in BMNH.

Type locality: PORCUPINE st 24, 37°19 N, 09°13 W, 531 m.

Material examined: The type material and some more shells from the type locality (USNM); JEAN-CHARCOT Madère st 29, 33°01 N, 16°15 W, 300-340 m, 2 shs; st 49, 32°27 N, 16°32 W, 450-500 m, 1 sh; st 58, 32°42 N, 16°41 W, 410-580 m, 1 sh.

Distribution: On the upper part of the continental slope, from off S Portugal and Madeira. Only known from the material examined.

Remarks: Marginella hesperia can be recognized by the thickenings of the outer lip, which are lacking in all other species known from the area treated. Attention must however, be drawn to *M. bojadorensis* Thiele, 1925 from West Africa, which has similar thickenings on the outer lip but is more slender.

Marginella subturrita P. Fischer, 1883 Fig. 717

Marginella impudica var. *subturrita* P. Fischer, 1883:392.

Marginella jousseaumei Locard, 1897: 11, pl. 3, figs 25-28.

Type material: M. impudica var. *subturrita* and *M. jousseaumei* are based on the same material. A single lectotype in MNHN is designated for both.

Type locality: Not known precisely, but between Morocco and the Canaries.

Material examined: The type material and TALISMAN dr 45, 29°08 N, 12°26 W, 1235 m, 5 spm + shs; dr 49,52,53 (mixed), 28°33-28°37 N, 13°02-13°19 W, 865-946 m, 6 spms + shs; MONACO st 1118, 29°06 N, 13°03 W, 1098 m, 1 spm.

Distribution: The continental slope of western Sahara. Only known from the material examined.

Remarks: The animals lack a radula. It has eye swellings at the base of the tentacles and the unpigmented eyes are 130 μm in diameter, while they are only 50 μm in *M. impudica. M. subturrita* differs from *M. impudica* by being more slender, by its much more convex whorls and white shell, while *M. impudica* is pinkish-orange when fresh.

Marginella marocana Locard, 1897 Figs 722-723

Marginella marocana Locard, 1897: 114, pl. 3, figs 29-31 (and var. *curta,* var. *elongata*).

Type material: Lectotype here selected in MNHN.

Type locality: TALISMAN st 49-52-53 (mixed lot), 28°33-28°37 N, 13°02-13°19 W, 865-946 m.

Material examined: The type material and 1 spm from the type locality; TALISMAN dr 44, 29°52 N, 11°47 W, 2083 m, 1 spm, 1 sh; dr 45, 29°08 N, 12°26 W, 1235 m, 3 shs.

Distribution: Only known from the material examined.

Remarks: See under *aronnax.*

Marginella impudica P. Fisher, 1883 Figs 718-719

Marginella impudica P. Fischer, 1883:392.
Marginella impudica var. *major,* var. *elongata* Locard, 1897:109, pl. 3, figs 19-24.

Type material: Lectotype, here selected, in MNHN.

Type locality: "Cotes du Sahara, 800-1139 m". Lectotype from TALISMAN dr 81, 23°50 N, 17°17 W, 1139 m.

Material examined: The type material and 4 spms from the type locality; TALISMAN dr 84, 22°54 N, 17°26 W, 860 m, 7 spms + shs; dr 85, 22°52 N, 17°23 W, 830 m, 1 sh, 5 spms; dr 86, 22°49 N, 17°21 W, 800 m, 5 spms, 1 sh; METEOR st 36-98, 25°31 N, 16°02 W, 700-900 m, 6 spms + shs.

Distribution: The continental slope of Mauretania and former Spanish Sahara. Only known from the material examined.

Remarks: The animal lacks a radula. There are eye swellings at the base of the tentacles and the unpigmented eyes measure 50 μm in diameter.

Neither *M. impudica* nor *M. subturrita* has a broad thickened labial varix when seen from the side. For differences see remarks under *subturrita.*

Marginella aronnax **n.sp.** Figs 720-721

Marginella impudica var. *minor,* var. *curta* and var. *marginata* Locard, 1897:110 (not: *Marginella curta* Sowerby, 1832, *Marginella marginata* Wood, 1828, *Marginella minor* C.B. Adams, 1852).

Type material: Holotype in MNHN.

Type locality: TALISMAN dr 84, 22°54 N, 17°26 W, 860 m.

Material examined: The type material and 1 sh from the type locality; TALISMAN dr 86, 22°49 N, 17°21 W, 800 m, 7 spms, 2 shs.

Description: Shell white, very solid, smooth, with a short blunt spire. The shell consists of 4.5 whorls which are very slightly convex, with a hardly visible suture. The body whorl occupies more than 3/4 of the total height. Aperture elongate, narrow with a broad thickened labial varix when seen from the side. There are four strong columellar folds of which the lowermost one is very oblique. No columellar callus. Dimensions of the shell: height 28.7 mm, breadth 14.8 mm; height of the aperture 21.2 mm, maximum breadth 3.3 mm.

Remarks: The animal is blind, without eye swellings on the tentacles. It lacks a radula.

Marginella aronnax is readily separated from *M. impudica* and *M. subturrita* which lack the broad thickening of the labial varix. *M. marocana* is smaller with a much more obtuse spire, nearly flat whorls and indistinct suture.

Genus *VOLVARINA* Hinds, 1844

Type species: Marginella (Volvarina) nitida Hinds, 1844.

Volvarina is here used in its conchological sense to include a new species that differs from *Marginella* s.s. by its more slender shell with 3 instead of 4 columellar plaits. *Volvarina* species have a radula while at least some of the *Marginella* spp. do not.

Volvarina ingolfi **n.sp.** Fig. 715

Type material: Holotype in ZMC.

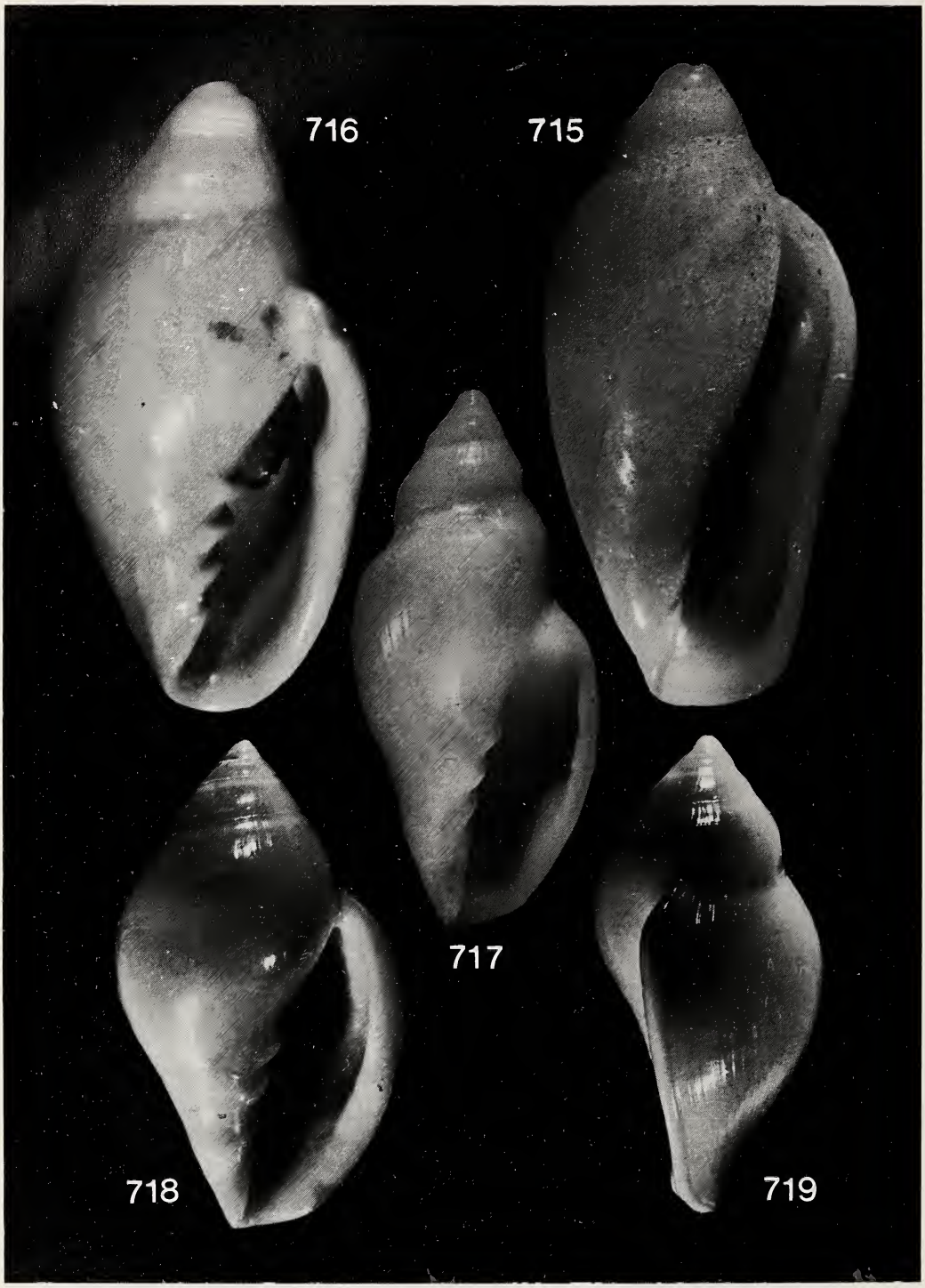
Type locality: INGOLF st 92, 64°44 N, 32°52 W, 1776 m.

Material examined: Only known from the holotype.

Description: Shell solid, white, glossy consisting of 3.75 whorls which increase very rapidly in size; apex blunt; spire low, the body whorl forming four fifths of the height of the shell; the penultimate whorl is convex, but forms a concave slope below the suture; there are three strong columellar folds; columellar callus very thin; outer lip regularly thickened, smooth, slightly constricted in the middle. Dimensions: height 14.5 mm, breadth 7.6 mm; height of the aperture 11.7 mm, breadth 2.2 mm.

Remarks: There are additional *Volvarina* species in deep water south of the Canaries; all of them however have a lower spire with less convex whorls, and hardly reach 10 mm. They also differ in colour patterns, the non-banded species being uniformly orange or yellowish. *Volvarina ingolfi* is the northernmost Atlantic marginellid.

Figs 705-713. Genera *Gibberula* and *Granulina*. 705, *Gibberula abyssicola,* MONACO st 2717, 2.9 mm. 706, THALASSA st X347, 3.3 mm. 707, THALASSA st T482, 4.3 mm. 708, MONACO st 2717, 2.9 mm. 709 and 710, *Gibberula vignali,* THALASSA st Y400, 2.3 mm and 2.2 mm. 711, *Granulina parvulina,* MONACO st 1713, 2.1 mm. 712, *Granulina occulta,* Porto Empedocle, Sicily, 2.5 mm. 713, MONACO st 2717, 2.1 mm.



Figs 715-719. Genera *Volvarina* and *Marginella*. 715, *Volvarina ingolfi*, holotype, 14.5 mm. 716, *Marginella hesperia*, PORCUPINE st 24, 7.2 mm. 717, *M. subturrita*, lectotype, 34.0 mm. 718 and 719, *M. impudica*, TALISMAN dr 86, 31.6 mm.

Figs 720-723. Genus *Marginella.* 720 and 721, *M. aronnax,* holotype, 28.7 mm. 722 and 723, *M. marocana,* lectotype, 19.3 mm.

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Italic type indicates valid taxa as used here.
Names in Roman type are synonyms or superseded names.
Names of valid genera are in CAPITAL letters.

Table 3. Distribution of the species.

The bathymetrical distribution is indicated in two ways, either by figures or lines. The heading indicates 100 metres intervals, and the figures the number of samples from the preceding interval. For some species of which numerous samples are known, a solid line indicates the normal distribution and a row of points scattered findings. In a few cases, there are two such lines. In these cases the upper line indicates the distribution in the northern part of the area, the lower one in the southern part. n is the number of samples examined. After the mean depth, the standard deviation is given. This gives some indication of the bathymetrical range.

Species	W Arctic	E Arctic	W Atlantic	Europe	Mediterr.	Azores	Max °S	Max °N	0	3	5	10	15	20	25	30	35	40	45	50	50+	n	Mean depth (m)	S.D.	Faunal assemblage
Trophon truncatus	+	+					52°N		—																shelf
Trophon clathratus	+	+					63°N		—																shelf
Trophon clavatus				+			58°N	65°N	—		—	—	—												shelf, bathyal
Trophon barvicensis				+	?		30°N	70°N	—		—														shelf
Trophon muricatus				+	+		52°N	32°N	—																shelf
Trophon fabricii	+	+							—																shelf
Trophon droueti						+	39°N	39°N			1	4	5	1								12	1051	325	bathyal
Trophon dabneyi				+		+	15°N	49°N				1	9	11	14	2						39	1835	457	bathyal
Trophon echinatus				+	+	+	35°N	58°N	—	—	—	—	7	8	9	4			1			100			shelf, bathyal
Pterynotus atlantideus						+	25°N	37°N			4				1							5	750	677	bathyal
Pterynotus leucas							25°N					1										1			bathyal
Orania fusulus				+	+		16°N	45°N	—	—															shelf
Orania grayi			+	+			25°N	32°N	—	—	—														shelf
Coralliophila richardi			+	+	+	+	35°N	44°N	—	—	2	4	2									6			shelf
Coralliophila squamosa			?	+	+		25°N	47°N	—	—	—	1	3	1											shelf
Coralliophila basileus						+	28°N	38°N			1	6	4	1								12	967	329	bathyal
Coralliophila sentix			+		+	+	35°N	38°N			2		1												shelf, bathyal
Coralliophila panormitana				+	+					—	—														shelf
Nassarius wolffi				?	?		20°S	15°N	—	—															shelf
Nassarius frigens							10°S	28°N	1	1	4	2										8	742	337	bathyal
Fusinus bocagei				+		+	15°N	48°N	19	20	39	5		1			1					85	765	683	bathyal
Fusinus amiantus			+	+		+	37°N	39°N				1	9	2								12	1350	175	bathyal
Fusinus sp.							34°N				2											2			bathyal
Amphissa acutecostata			+	+	+	+	31°N	69°N																	shelf, bathyal
Mitrella nitidulina				+		+	16°N	47°N					3	3	2	3	2					13	2246	648	bathyal
Mitrella sp.						+	39°N					1										1			bathyal?

Species	W Arctic	E Arctic	W Atlantic	Europe	Mediterr.	Azores	Max °S	Max °N	0	3	5	10	15	20	25	30	35	40	45	50	50+	n	Mean depth (m)	S.D.	Faunal assemblage
Anachis sp.				+			60°N			1												1			bathyal?
Liomesus ovum				+			48°N	68°N	—	·····															shelf
Buccinum undatum	+	+		+			40°N	?	—	·····															shelf
Buccinum humphreysianum				+	+		37°N	70°N	—	—	—	—													shelf
Buccinum abyssorum			+	+			55°N	64°N					—	—	—	—									bathyal
Buccinum oblitum				+			36°N	65°N		1		3	1									5	1167	516	bathyal
Buccinum kjennerudae				+			65°N	70°N			3	1										4	827	191	bathyal
Troschelia berniciensis		+		+			23°N	65°N	10	11	36	19	12	16	1							105	1117	644	shelf, bathyal
Kryptos koehleri				+			32°N	47°N			6	10	8	2			1					27	1472	569	bathyal
Beringius turtoni	+	+	+	+			57°N	83°N	—	—	·····														shelf, bathyal
Volutopsius norwegicus	+	+	+	+			57°N	80°N	—	—	—	—	—	—											shelf, bathyal
Neptunea brevicauda	+								—	—															shelf
Neptunea antiqua				+			41°N	?	—	—															shelf
Neptunea contraria				+			33°N	44°N	—	—	—	—													shelf, bathyal
Mohnia mohni		+					61°N	85°N	1	2	3	8	8	12	16	10						60	2289	833	abyssal
Mohnia parva		+	+				64°N	70°N	—	—	—	—	—	—											bathyal
Mohnia simplex		+	+				65°N		1	3		1										5	664	445	bathyal
Mohnia danielsseni		+					63°N	85°N	1?				1	10	15	5	4					36	2864	499	abyssal
Mohnia abyssorum			+	+		+	15°N	56°N					3	8	9	8	8	31	15			82	3807	814	abyssal
Mohnia blakei			+				37°N									1	1					2	3575		abyssal
Mohnia krampi	+						66°N	73°N		—	—	—	—	—											abyssal?
Mohnia carolinensis			+				35°N		—	—	—	—	—												bathyal
Mohnia caelata			+	+			60°N	62°N			—	—	—	—	—	—	—								bathyal
Mohnia glyptus	+		+	+			62°N	63°N	1	2	6	1										10	690	263	bathyal
Turrisipho dalli		+		+			58°N	70°N	2	5		1										8	431	277	shelf?
Turrisipho lachesis	+	+	+	+			66°N	73°N	4	9	7	4										24	647	359	bathyal
Turrisipho voeringi	+	+		+			63°N	74°N	6	1	9	3										19	605	410	bathyal
Turrisipho fenestratus		+		+			35°N	68°N	15	5	16	4										40	638	302	shelf, bathyal
Turrisipho moebii		+		+			57°N	72°N	3	3	8	1										15	581	336	shelf, bathyal
Belomitra quadruplex			+	+		+	23°N	64°N		2	6	5	8	15	2	1			8	2		49	2287	1224	bathyal, abyssal
Colus gracilis		+		+			42°N	71°N	79	17	26	15	3												shelf, bathyal
Colus holboelli	+	+					60°N	74°N	25	5	7	3	1									41	384	441	shelf, bathyal
Colus islandicus	+	+	+	+			32°N	78°N	—	—	—	—	—	—	—	—	—	—	—	—	—				shelf, bathyal

Species	W Arctic	E Arctic	W Atlantic	Europe	Mediterr.	Azores	Max °S	Max °N	0	3	5	10	15	20	25	30	35	40	45	50	50+	n	Mean depth (m)	S.D.	Faunal assemblage
Colus jeffreysianus		+		+	+		33°N	65°N	═	═	═	═	═	═											shelf, bathyal
Colus kroeyeri	+	+						80°N	—																shelf
Colus latericeus	+	+					70°N	80°N	– –																shelf
Colus pubescens			+				29°N	50°N	═	═	═	═													shelf, bathyal
Colus pygmaeus			+				35°N	48°N	═	═	═	═													shelf, bathyal
Colus sabini	+	+	+				?	82°N	═	═	═	═	═												shelf, bathyal
Colus stimpsoni	+		+				35°N	55°N	═	═	═	═													shelf, bathyal
Colus terraenovae			+				45°N	46°N	?																shelf?
Colus turgidulus		+	+				60°N	75°N			1	9	4									14	804	238	bathyal
Colus verkruezeni	+	+					70°N	80°N	═	═	═														shelf, bathyal?
Benthobia tryoni			+	+		+	33°S	37°N							2	2	1	2				7	2392	1355	bathyal, abyssal
Volutomitra groenlandica	+	+		+			56°N	82°N	—	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····	·····				shelf, bathyal?
Volutomitra sp.				+			48°N				1														bathyal?
Microvoluta superstes				+			36°N		1																bathyal?
Metzgeria alba	+			+			60°N	72°N	15	3	1	1	1									21	406	394	shelf, bathyal
Metzgeria gagei				+			58°N	64°N			2	1		1								4	1301	565	bathyal
Metzgeria apodema				+			25°N				1														bathyal?
Latiromitra cryptodon				+		+	31°N	38°N					2	1								3			bathyal
Admete viridula	+	+	+	+			55°N	82°N	═	═	═	═	·····	·····	·····	·····	·····	·····	·····	·····	·····				shelf, bathyal?
Admete nodosa			+	+			44°N	56°N					4	1	1							6	2067	215	bathyal
Admete azorica					+		38°N					2	1	1								4	1644	401	bathyal
Iphinopsis inflata		+		+			64°N	74°N		2	2	6										10	973	339	bathyal
Iphinopsis fuscoapicata				+			50°N	56°N					1	2	5							8	2062	280	abyssal?
Iphinopsis alba				+			44°N	53°N					5	8	1							14	2125	252	bathyal
Olssonella minima				+			33°N	37°N	═	═	═														shelf, bathyal?
Gibberula abyssicola				+			35°N	44°N		3	17	2		1								23	746	340	bathyal
Gibberula vignali				+			29°N	40°N	3		1	4										8	787	535	bathyal
Granulina parvulina				+			28°N	44°N	1			2										3	881	563	bathyal
Volvarina ingolfi				+			64°N						1									1			bathyal?
Marginella hesperia				+			32°N	37°N		4												4	455	81	bathyal
Marginella subturrita				+			28°N	29°N			1	2										3	1077	137	bathyal
Marginella impudica				+			22°N	31°N			4	1										5	886	128	bathyal
Marginella marocana				+			28°N	29°N		1	1		1									3	1407	496	bathyal
Marginella aronnax							23°N				2											2	830	30	bathyal


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