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A Revision of the Recent Triphoridae of Southern Australia (Mollusca:Gastropoda)

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CONTENTS

A Revision of the Recent Triphoridae of Southern Australia (Mollusca:Gastropoda)

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ABSTRACT. Sixty-eight nominate triphorids are recorded from Southern Australia, of which the following are described as new: *Inella obtusa, I. kimblae, I. carinata, I. intercalaris, Monophorus australica, Teretriphora ponderorum, Hedleytriphora basimacula, Viriolopsis occidua, Euthymella kosugei, Eutriphora pseudocana, Isotriphora simulata, I. vercoi, Bouchetriphora marrowi, Nototriphora vestita, N. unicarinata, Obesula profundior,* and *Aclophora hedleyi. Viriola truncata* n.sp. is described from north-western Australia. *Isotriphora amethystina* new name replaces *Triphora lilacina* Verco *non* Dall. The species are referred to the following genera: *Metaxia* Monterosato, *Seilarex* Laseron, *Inella* Bayle, *Hypotriphora* Cotton & Godfrey, *Subulophora* Laseron, *Magnosinister* Laseron, *Monophorus* Grillo (= *Notosinister* Finlay), *Sagenotriphora* n.gen., *Tetraphora* Laseron, *Teretriphora* Finlay (= *Distophora* Laseron), *Hedleytriphora* n.gen., *Latitriphora* n.gen., *Mesophora* Laseron (= *Coriophora* Laseron), *Viriola* Jousseaume (= *Solosinister* Laseron), *Viriolopsis* n.gen., *Euthymella* Jousseaume (= *Torresophora* Laseron), *Eutriphora* Cotton & Godfrey, *Isotriphora* Cotton & Godfrey, *Bouchetriphora* n.gen., *Nototriphora* n.gen., *Triphora* Blainville, *Obesula* Jousseaume, *Aclophora* Laseron, *Aclophoropsis* n.gen., *Nanaphora* Laseron and *Cheirodonta* n.gen. The concept of *Triphora* Blainville is based on *T. taeniolata* (Hervier), which is considered to be the most likely congener of *T. gemmatum* Blainville, the little-known type species of the genus. Iniforinae Kosuge and Mastoniinae Kosuge are synonymized with Triphorinae Gray. *Socienna* Finlay is transferred from Metaxiinae to Cerithiopsidae.

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The triphorids are unusual in being the only large group of marine gastropods in which the majority of species are normally sinistral. In other words most triphorids are effectively mirror images of their dextral counterparts and most other dextral gastropods in shell coiling direction and anatomical layout. Apart from their sinistrality, they are characterized by a combination of cerithioid shape and very distinctive radular morphology and anatomy, notably the presence of a peculiar glandular pouch that opens into the posterior oesophagus.

Triphorids occur world-wide in tropical to arctic seas from the intertidal zone to a depth of about 1000 m. The family has its maximum diversity on clean, hard substrates in tropical and temperate seas, from the intertidal zone to about 200 m. All species apparently normally feed on sponges (Porifera). Species unquestionably referable to this family are known from the Paleocene. Upper Cretaceous and possible earlier records require confirmation.

Approximately 600 names have been proposed for Recent species, and although there are many synonyms, my detailed study of large collections from Indo-Pacific localities revealed hundreds of undescribed species, so there are probably at least 1000 extant species, perhaps many more. An impression of the wealth of species involved is afforded by a single sand sample collected at 21 m below steep coral walls off Euston Reef, Queensland (AMS), which contains at least 80 specics, many of which are undescribed and/or represented by single specimens. Many fossil species have been described, but to judge from extensive collections from Australia and New Zealand, these constitute only a very small fraction of the extinct species (and genera).

Triphorids superficially resemble members of the Cerithiopsidae (Marshall, 1978) in general shell facies, and both groups exploit sponges in the same environment. Triphorids and cerithiopsids differ markedly in soft anatomy (Fretter, 1951; Kosuge, 1966) and radular morphology, cerithiopsids having

mesogastropod-style taenioglossate dentition with 7 teeth per cross row, triphorids having 5 to at least 63 teeth per cross row. Sperm is transferred by spermatozeugmata in at least some cerithiopsids (Fretter, 1951), but these structures are unknown in Triphoridae. Most triphorids are easily distinguished from cerithiopsids by their sinistral instead of dextral coiling and by the presence of the posterior siphonal canal. However, dextral triphorids lack the posterior canal and are extremely similar to some cerithiopsids. The dextral triphorids of the Adelacerithiinae (Marshall, 1983) resemble some cerithiopsids in protoconch sculpture, but differ in having peculiar teleoconch facies, notably a prominent columellar plait. Metaxiinae (Marshall, 1977b) with planktotrophic larval development are easily separable from cerithiopsids by the distinctive zigzag instead of granulate sculpture on the first whorl. However, metaxiines and cerithiopsids with lecithotrophic development are often so similar that it may be impossible to ascertain the family position of certain species without knowledge of their radulae.

Because of the bewilderingly large number of species and their small size and strong superficial similarity, taxonomic discrimination within the family is notoriously difficult. Consequently there have been few revisions of local faunas and all of these are more or less incomplete and contain many erroneous identifications and generic placements. Unfortunately many of the original descriptions by certain nineteenth century workers are grossly inadequate, are sometimes based on material from unknown localities, and are usually accompanied by poor illustrations or none at all. Disastrously, the great majority of workers failed to appreciate the full significance of protoconch characters, and many species were based on type specimens that lack the protoconch or on which it is incomplete. Fortunately many species have highly distinctive colour patterns and teleoconch facies, but there are numerous species with essentially identical teleoconchs, yet very different protoconchs, or with protoconchs that differ only subtly—for example in minute details of sculpture, or in the size of the first whorl. Consequently many species based on imperfect type specimens will be impossible to identify, at least until the faunas of particular type localities are sufficiently well known for topotypes to be identified with confidence. In cases where the type locality is unknown, or when a type specimen comes from a locality where two or more species with indistinguishable teleoconchs occur, species based on specimens lacking the protoconch or lacking even the first whorl may be permanently unrecognizable.

Together with colour and colour pattern, protoconch features are unquestionably the most valuable for species discrimination. At this point I cannot emphasize too strongly that under absolutely **no** circumstances should further new species be proposed unless a complete, unworn protoconch can be illustrated. Protoconchs should always be illustrated by scanning electron micrographs because certain important or potentially important details cannot be clearly resolved by conventional light microscopy. The protoconchs of even the best preserved adult specimens are frequently bored or somewhat worn, so for this revision I have frequently had to illustrate different specimens for the adult and protoconch facies. Micrographs of protoconchs of all illustrated specimens were carefully compared, and are permanently stored, mounted on annotated cards, at the National Museum, Wellington. Essential specific characters that were originally detected by SEM can be resolved subsequently with a binocular stereo microscope at about x 100, and most species can be discriminated accurately without recourse to SEM.

Before and during the present revision, all available type specimens of Indo-Pacific triphorids were examined and photographed in colour. Notable among type material not seen was that of Tapparone Canefri (1877) (apparently at Museo Civico, Genoa)—however the descriptions do not agree with the present material. To my knowledge the 12 taxa credited to Dunker, 1881 and listed by Jousseaume (1884, p.227) were never published and are thus nomina nuda.

Definitions, Abbreviations and Text Conventions

For this revision Southern Australia is defined as the region south of Geraldton in Western Australia (28°46′S, 114°36′E) and south of Coolangatta on the east coast at the Queensland/New South Wales border (28°10′S, 153°32′E).

AMS: Australian Museum, Sydney.
BMNH: British Museum (Natural History), London.
ICZN: International Code of Zoological Nomenclature, London, 1964.
MCZH: Museum of Comparative Zoology, Harvard.
MPM: Maxwell P. Marrow collection.
MNHN: Muséum National d'Histoire Naturelle, Paris.
MNHU: Museum für Natürkunde, Humboldt-Universität, East Berlin.
NMNZ: National Museum of New Zealand, Wellington.
NSMT: National Science Museum, Tokyo.
SAM: South Australian Museum, Adelaide.
SEM: Scanning electron microscope/micrograph.
TMAG: Tasmanian Museum & Art Gallery, Hobart.
USNM: United States National Museum, Washington.

Numbers following museum name abbreviations or prefixed by letters are museum registration numbers: C—AMS: D—SAM; M, MF—NMNZ.

For clarity, *Triphora, Triphoris* and *Triforis* are all abbreviated "*T.*" throughout much of the text, when the latter are obviously orthographic variants of *Triphora.*

N.B. *Triphora* Blainville, 1828 and Triphoridae Gray, 1847 are not to be confused with *Triforis* Deshayes, 1834 and Triforidae Jousseaume, 1884, which are phylogenetically distinct and nomenclaturally valid (Marshall, 1980).

Methods

See Cox (1960) for shell terminology. For convenience, spiral sculptural elements are numbered consecutively from the adapical to the abapical part of each whorl; i.e. the spiral nearest the apex on each whorl is designated spiral 1. Shells and teeth were measured by calibrated optical graticule in a stereoscopic microscope. The diameter of the first protoconch whorl and the number of axial costae on the penultimate whorl were determined by viewing along the vertical axis of the shell with the protoconch uppermost. Animals were extracted from shells by dissolution in nitric acid and radulae were dissected out after rendering the tissues translucent with potassium hydroxide. Radulae were then cleaned in potassium hydroxide, ultrasonically cleaned and divided transversely into two halves. One half was mounted on a stub and gold-plated for SEM, the other half was stained and mounted on a slide for examination with a compound microscope. All radulae are illustrated either by SEM or by direct tracings from enlarged SEMs. The number of teeth per radular cross-row was determined from SEMs of the basement membrane of cross-folded radular ribbons. Where possible, radulae of several specimens of each species were examined.

Characters used in Classification

Size relative to the number of whorls is interspecifically variable and infraspecifically rather constant. However, the absolute size of mature specimens (see below) is frequently infraspecifically very variable and specimens collected alive simultaneously in close proximity may differ in size by as much as 300%. Some species (e.g. *Aclophora hedleyi* n.sp.) are divisible into two roughly delineated size classes, suggesting that they are sexually dimorphic—presumably the larger specimens are females. Most species exhibit an even gradation between large and small specimens and evidently they simply attain maturity at different sizes. Large and small mature specimens differ somewhat in shell contour, especially when the body whorl is constricted. Incremental sculpture appears at about the same stage in large and small adults, and such sculpture is therefore better developed in large specimens.

Shape. Shell shape is rather conservative but infraspecifically rather constant. Some species are evenly conical throughout life, but in most the shell diameter increases regularly before stabilizing, and may subsequently decrease at maturity so that the body whorl is constricted. Once the body whorl has become constricted the shell cannot continue to be enlarged in normal fashion, and growth ceases at this stage in the majority of species. Some specimens of *Teretriphora distorta* (Laseron) (Laseron, 1958, fig. 135) and *Tetraphora iniqua* (Jousseaume) are most unusual in that after attaining what usually constitutes normal mature facies, they recommence growth by depositing whorls that are considerably broader and more convex than the preceding ones. In certain exceedingly attenuate sinistral species, e.g. *Liniphora* (s.l.) *asperrima* (Hinds), the spire whorl diameter may continue to decrease over as much as half the total length of the shell, so that specimens lacking the early spire whorls and the mature body whorl may seem to be dextral when inverted.

Mature specimens of all species differ from juveniles (which may be much larger) in having more evenly contracted bases, a thickened inner lip, a broader columella and a better developed, more nearly tubular anterior siphonal canal, and in having the outer lip more or less produced and flared basally, with the addition, in sinistral species, of a posterior siphonal canal.

Colour and colour pattern are interspecifically very diverse, often infraspecifically rather stable, and are among the best characters for preliminary discrimination of species. However, distantly related species may have identical colour patterns, or colour and pattern may be infraspecifically variable, so these characters must be used with caution. Nevertheless the very slightest difference in shade can be a stable species character in certain groups, notably the maculate species of *Opimaphora* Laseron and *Sagenotriphora* n.gen. The colours and patterns of the few animals studied alive are diverse and usually infraspecifically constant (Bouchet & Guillemot, 1978), being particularly diverse among tropical species (P. Bouchet, pers. comm.).

Protoconch. As in Cerithiopsoidea, planktotrophic and lecithotrophic larval development occur throughout the family, often in the same genus or species pair, though to my knowledge never in the same species. Note that by 'lecithotrophic' (see Thorson, 1950) I actually mean non-planktotrophic because it is yet impossible to ascertain whether non-planktotrophic triphorids have lecithotrophic or direct development using protoconch characters, though with further work this should ultimately prove possible. Although protoconch characters tend to be rather conservative, slight differences are often infraspecifically very stable, especially in species with planktotrophic development. Protoconchs of species with lecithotrophic development are inherently more variable: of 42 Southern Australian triphorids that are represented by five or more specimens with protoconchs, the first whorl has a minimum/maximum diameter ratio of 0–1.538 (mean 1.0798, SD 0.3468) in the 23 species with planktotrophic development; and 1.0811–2.0303 (mean 1.3419, SD 0.2003) in the 19 species with lecithotropic development. Among the 67 Southern Australian species for which the protoconch is known, 33 have lecithotropic development and 34 have planktotrophic development (24 excluding species that are evidently strays of tropical origin—see *Zoogeography*).

Several authors failed to appreciate the significance of protoconch differences associated with different types of larval development, and separated genera on the basis of these differences. Although the great differences between protoconchs of species with different types of larval development are certainly not available for

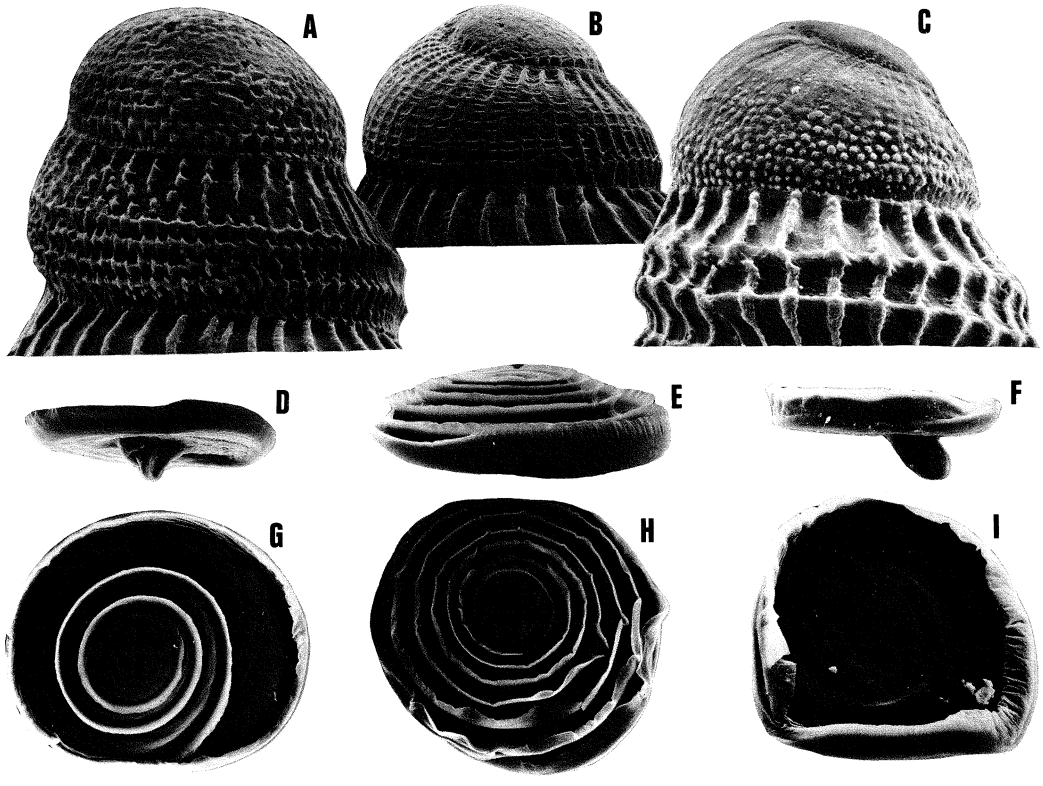

Fig. 1. **A–C**, principal types of sculpture on first protoconch whorls: **A**, 'T-shaped granules', *Monophorus australica* n.sp., holotype; **B**, 'reticulate', *Sagenotriphora ampulla* (Hedley); **C**, 'hemispherical granules', *Mastonia rubra* (Hinds). **D–I**, opercula: **D–G**, *Mesophora granosa* (Pease), Rocher à la Voile, Nouméa, New Caledonia; **E–H**, *Nototriphora aupouria* (Powell), Leigh, New Zealand; **F**, *Nanaphora albogemmata* (Laseron), Wilson I., Queensland; **I**, *Tetraphora granifera* (Brazier), Fluted Cape, Tasmania.

supraspecific discrimination, certain features of planktotrophic protoconchs evidently do reflect phylogeny. These include the sculpture of the first whorl, (Fig. 1A–C), which may comprise hemispherical or T-shaped granules, zigzag spiral lirae, or reticulate spiral and axial threads; and the sculpture of subsequent whorls, comprising axial riblets that may be entirely collabral or both collabral and non-collabral, and that may entirely traverse each whorl or be interrupted by a smooth zone, with or without the addition of one or two median spiral threads.

The planktotrophic larval protoconchs of all known Recent triphorines and metaxiines are traversed by collabral and non-collabral axial riblets that respectively occupy the adapical and abapical parts of each postembryonic whorl (Fig. 2C). Whereas these axial riblet zones are more or less smoothly interconnected in most Recent species, in most (all ?) Eocene and Oligocene species the riblets occupy discrete zones that are separated by a smooth band, the collabral riblets occupying a very narrow subsutural zone, the non-collabral riblets being entirely absent or occupying a suprasutural zone of variable width (Gründel 1975, figs 3–7; Gougerot & Le Renard 1979, figs 7–11; P.A. Maxwell, pers. comm.).

I suggested (Marshall, 1983) that Triphorinae and Metaxiinae have undergone progressive adapical broadening of the suprasutural riblet zone and abapical broadening of the subsutural riblet zone, culminating in contact of the two zones (Fig. 2C). I further suggested that the subsutural riblet zone of fossil triphorines represents a vestige of formerly more extensive collabral sculpture and concluded that Triphorinae (and Metaxiinae) probably arose from Adelacerithiinae, in which the protoconch is entirely traversed by collabral riblets. Non-collabral riblets evidently render the projecting sinusigera spur more effectively resistant to fracture than collabral riblets, and probably became increasingly selectively advantageous with progressive deepening of the sinusigera sinus and associated lengthening of the sinusigera spur. The existence of Recent species with virtually or entirely collabral riblets (Fig. 13G) over the abapical part of each whorl does not preclude this hypothesis because there is considerable interspecific variation in the degree of obliquity of the riblets relative to the collabral growth lines, so the riblets could easily become secondarily collabral. Moreover, the riblets of such species always exhibit the characteristic slight interruption near the middle of each whorl, which marks the junction of the

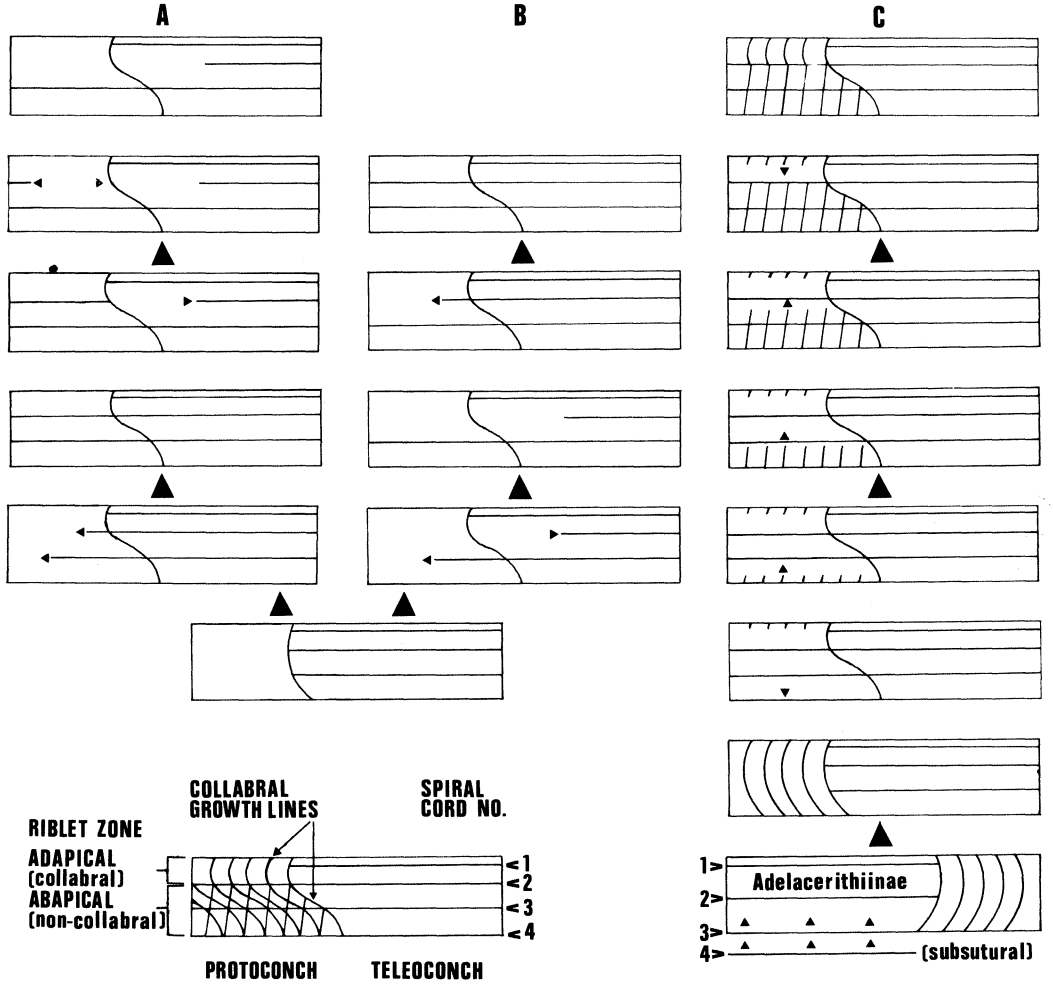

Fig. 2. Suggested origin of triphorid protoconch and teleoconch sculpture in progressing evolutionary sequences (arrow-heads). **A, B,** relationship between protoconch and teleoconch spirals (axials deleted for clarity): **A,** development of 2 protoconch spirals and transition to 1; **B,** development of 1 protoconch spiral and transition to 2. **C,** transition of axial protoconch sculpture from collabral to collabral and non-collabral (spiral sculpture standardized for clarity). Theoretically column A or B may be superimposed anywhere on column C. Note convergence in columns A and B. N.B. Adelacerithiinae are dextral; all others are sinistral (Triphorinae).

two riblet zones. Consequently, widely separated and more or less smoothly interconnected riblet zones are interrupted respectively as primitive and advanced character states. However, conservatism must be expected, and riblet zones must obviously have closed independently in many groups (Fig. 2).

The planktotrophic larval protoconchs of all known sinistral triphorids are encircled by one or two median spiral threads that usually surmount more or less prominent angulations. Another spiral surmounts the basal angulation and is usually completely covered by succeeding whorls. There are very strong correlations between the protoconch and teleoconch spirals, for without exception the suprasutural protoconch spiral develops into teleoconch spiral 4, and with one known exception (see below) the abapical median protoconch spiral merges into teleoconch spiral 3 (in protoconchs with only one median spiral it is always the adapical spiral that is absent—see below). With the same exception the adapical protoconch spiral merges into teleoconch spiral 2 when the latter commences immediately. No species are known in which teleoconch spiral 2 commences immediately and in which the adapical protoconch spiral is absent. The only known exception to these correlations is *Talophora subulata* (Laseron, 1958) in which the adapical protoconch spiral merges into teleoconch spiral 3, the abapical protoconch spiral vanishing immediately below this junction. Despite the exception, which I interpret as a peculiar secondary development, these correlations strongly suggest that protoconch spirals are 'precocious' teleoconch spirals that have commenced progressively earlier on the protoconch with progressing evolution (Fig. 2A, B). If correct this would further suggest that species with two median protoconch spirals and in which teleoconch spiral 2 develops late have evolved from

ancestors in which teleoconch spiral 2 commenced immediately, i.e. Adelacerithiinae and Metaxiinae (Fig. 2A) (see *Teleoconch*). Conversely, groups may be anticipated in which teleoconch spiral 2 began to commence late before the evolution of the adapical protoconch spiral (Fig. 2B). In other words it is assumed that a member of such a group (e.g. probably *Hedleytriphora* n. gen.) could not develop an adapical protoconch spiral until teleoconch spiral 2 commenced immediately, following its progressively earlier appearance.

Evidence that species with one median protoconch spiral have either lost or not yet acquired the adapical spiral (Fig. 2A, B) is suggested first by the position occupied by this spiral, and secondly by the fact that in many species, the adapical spiral vanishes shortly after its simultaneous appearance with the abapical spiral, and sometimes reappears on subsequent whorls (Fig. 22C). It is probably significant that species in which the adapical spiral vanishes are most commonly encountered in genera in which teleoconch spiral 2 commences exceptionally late—e.g. *Mastonia* Hinds and *Mastoniaeforis* Jousseaume. A significant aspect of these observations is that the number of protoconch spirals cannot be used alone for supraspecific discrimination, since without alternative evidence it is impossible to ascertain whether the absence of a spiral is a primary or secondary character state (Fig. 2A, B). Nevertheless, there are almost invariably clear correlations between the number, point of appearance, prominence and relative prominence of spiral threads, and other shell and radular characters, so variations in spiral sculpture certainly do have phylogenetic significance (see *Aclophora* Laseron).

The phylogenetic significance of first whorl sculpture is poorly understood because it is as yet impossible to ascertain which characters are of primary or secondary origin. If the hemispherical granules of Adelacerithiinae are a primary character state, and if, as I believe, they gave rise to Triphorinae through Metaxiinae, then presumably the zigzag threads and T-shaped granules of Metaxiinae and the *Inella* group respectively are of secondary origin. It is possible that the sinistral group is basically diphyletic, one group (unnamed) derived from ancestors with T-shaped granules (Fig. 1A), the other (Triphorinae) from ancestors with hemispherical granules (Fig. 1C). Reticulate sculpture must be a highly advanced condition, because species in which it occurs exhibit the greatest reduction in the number of teeth per radular cross-row. I have interpreted reticulation as the result of coalescence of T-shaped granules, but it may well result from precocious development of postembryonic axials, coupled with spiral coalescence of hemispherical granules. The latter seems to have occurred in *Mastoniaeforis* Jousseaume (see *Mesophora* Laseron).

Teleoconch. The virtually ubiquitous sculpture of four primary spirals (1–4) and strong nodular axial costae evidently represents an economical and thus highly conservative means of acquiring great shell strength in a small cerithiform gastropod. Judging from its widespread occurrence in the convergent or at least very distantly related Cerithiopsidae, extreme convergence is to be expected within Triphoridae. Despite this notorious conservatism, the often subtle differences are usually infraspecifically stable and often reflect generic affinities. In other words, protoconch and radular morphology can often be predicted from teleoconch facies, and vice versa.

Important features include shell thickness and opacity, spire shape and height, whorl number and shape; number, shape, spacing and relative size of spiral cords and axial costae; basal shape; and features of the inner, outer and parietal lips, and the posterior and anterior siphonal canals. Many species (e.g. of *Mastonia* and *Euthymella* Thiele) have a distinctive microsculpture that is clearly visible at about x 100 (Figs 20C, 21H). This sculpture (which has been overlooked by the majority of workers) may consist of smooth or granulate lirae, hemispherical granules, or reticulate spiral and axial threads. When confined to the exterior of the anterior canal, microsculpture may be very difficult to detect with light microscopy.

As discussed above, the adapical median spiral on planktotrophic larval protoconchs evidently represents a precocious development of teleoconch spiral 2. In other words it is assumed, for example, that a species with two median protoconch spirals and a late-developing teleoconch spiral 2 must have originated from an ancestor in which teleoconch spiral 2 commenced immediately after the protoconch (Fig. 2A, B). Spiral 2 commences immediately after the protoconch in Adelacerithiinae, Metaxiinae and most members of the *Inella* group, which are regarded as phylogenetically primitive members of the family. While the point of emergence of spiral 2 is a stable species character, it may appear early or late in closely related members of even advanced groups, so in the total absence of fossil records it is often yet impossible to ascertain whether early appearance of spiral 2 is a conservative or secondarily acquired condition. Therefore, although very early and very late appearance of teleoconch spiral 2 may be interpreted respectively as basically primitive and advanced character states, point of appearance clearly cannot be used alone for supraspecific discrimination. The strengthening function of spiral 2 and the axial costae in *Mastonia* and related genera has evidently been supplanted by enlargement and alternate staggering of the nodules on spirals 1 and 3.

Simultaneous appearance of spirals 1–3, with spiral 1 weak throughout, is a major difference separating most of the *Inella* group from other Triphorinae, in which spirals 1–3 commence and remain at more or less similar size, or in which spiral 2 commences late. This may indicate diphyletic origin for Triphorinae, one group (*Inella* and related genera) derived from an ancestor with T-shaped granules on the first whorl and a weak spiral 1, another group (other Triphorinae) from an ancestor with hemispherical granules on the first

whorl and with spirals 1–3 of similar size. However, without detailed knowledge of the fossil record it is impossible to ascertain whether or not similarity of spirals 1–3 results from enlargement of spiral 1.

Obsolescence or size reduction and multiplication of axial ribs has clearly occurred independently in *Seilarex* Iredale, *Viriola* Jousseaume, *Teretriphora* Finlay and *Sychar* Hinds. Evidence that rib size reduction and multiplication is a derived state is suggested by the radula of *Seilarex*, which is clearly derived by reduction from the type occurring in species of *Metaxia*, which have few, strong ribs: accordingly *Viriola* is considered to be derived from such possible ancestors as *Mesophora* or *Isotriphora* Cotton & Godfrey, whose Recent species have very similar radulae. Thus *Seilarex-Metaxia* and *Viriola-Mesophora* parallel the closely related cerithiopsid genera *Seila* A. Adams and *Cerithiopsis* Forbes & Hanley (Marshall, 1978).

Species of *Mastonia, Iniforis* Jousseaume and *Mastoniaeforis* can be arranged to demonstrate progressive development of the posterior canal from a simple notch, through an enclosed foramen, to a true tube, which may attain quite astonishing length in some species (Fig. 20E). Although the tubular canal is highly diagnostic of *Mastoniaeforis*, its degree of development within the genus is very variable and the condition has apparently evolved independently in *Triphora* (s.s. ?) and *Isotriphora*, possibly in *Mastonia*, and certainly in *Triforis* Deshayes, 1834 (Triforidae) and *Sherbornia* Iredale, 1917 (Triforidae ?).

Operculum. The triphorid operculum is horny and spiral, almost circular or elliptical, of 2–7 whorls, with an almost central or strongly eccentric nucleus. It is usually rather thin and externally shallowly convave, but may be thick and externally rather strongly convex with a shallowly concave interior. The periphery is thinner, sometimes projecting from the suture as an external spiral flange. The muscle attachment callus is minutely pitted, well defined, and usually thin and simple; some species have a small accessory boss or, rarely, a prominent peg (Fig. 1D, F.).

In groups comprising species with both few and many-whorled opercula it is generally accepted that species with the former are derived from the latter. This contention is seemingly supported by the fact that in *Viriola* and related genera, which are considered to be phylogenetically highly advanced, the opercula have fewer whorls with more strongly eccentric nuclei than in any other known triphorines. However species of *Triphora* (s.s.?), *Nanaphora* (s.s.?) Laseron, *Nototriphora* n.gen. and *Bouchetriphora* n.gen. have more tightly coiled opercula than living descendants of their presumed dextral ancestors. The presence of highly advanced dentition in *Bouchetriphora* and *Nanaphora* suggests that opercula have remained conservatively multispiral in some groups and have become independently paucispiral or perhaps secondarily multispiral in others. While the number of operculum whorls may not reflect the phylogenetic level of particular taxa, closely related genera and species certainly do tend to have similar opercula. The presence of a well-developed opercular peg is almost certainly a highly advanced condition.

Radula. Triphorid radulae exhibit an extraordinarily great diversity in tooth number, size and shape that is exceeded only by the nudibranchs. Their radulae are clearly adapted to the different textures and structures of the various sponge species upon which all are apparently obligate feeders. Many triphorids probably feed highly selectively, if not on a single species of sponge then perhaps on a phyletic group or several texturally similar species (see Bloom, 1976; Nybakken & McDonald, 1981). Some—e.g. *Bouchetriphora pallida* (Pease)—are known to feed on several species of sponges (pers. obs.). The long, narrow, acrembolic proboscis evidently enables the mouth parts to penetrate individual sponge osculae to feed on the soft tissues within, thus eliminating the need to tear through the tough supporting wall. However, *B. pallida* commonly excavates large holes in a soft-textured sponge in the intertidal zone of northern New Zealand.

The radular ribbon in triphorids seldom exceeds 2 mm in length, and is many times longer than broad, bearing usually hundreds of transverse rows of teeth that are firmly attached to a very thin basement membrane. Tooth number varies interspecifically from 5 to at least 63 per transverse row. With the exception of adelacerithines (Marshall, 1983), which have a reversed configuration, the transverse rows curve outwards in anteriorly concave lines from posteriorly situated central teeth. The individual teeth are usually so small that with the best compound microscopes it is frequently impossible to clearly resolve their shape or to unequivocally determine the number of cusps they bear. In many species with numerous, very small, similar teeth, it is often difficult to ascertain which cusps belong to which teeth, even with the use of greatly enlarged SEMs.

In all cases, each transverse row is considered to comprise one central tooth, one pair of lateral teeth, and one or more pairs of marginal teeth. Triphorid lateral and marginal teeth are almost certainly not homologous with those of mesogastropods, and certainly not with those of archaeogastropods. Despite the fact that the inner and outer marginal teeth are frequently markedly different, it is convenient to differentiate the lateral teeth from the marginals because they differ from the central and marginal teeth in the majority of species. Kosuge (1966) considered that radulae in *Iniforis* and *Risbecia* Kosuge have three central teeth per cross-row and separated Iniforinae from Mastoniinae primarily on this basis. However, I see no reason for considering that *Iniforis* and *Risbecia* have more than one central tooth, and interpret the so-called outer central teeth as lateral teeth that simply happen to resemble the central tooth (see *Triphorinae*).

The number of teeth per transverse row tends to be infraspecifically rather constant, but there may be variation by one or two pairs of teeth in some species, particularly those with large number of teeth per

transverse row. There is evidence to suggest that pairs of teeth are added with increasing age in some species. Although there is no obvious trend toward multiplication or reduction in tooth number between the sinistral species and direct descendants of their presumed dextral ancestors, there can be no doubt that the many-toothed condition is of very early origin. Species of *Tetraphora* Laseron and *Sagenotriphora* n.gen. have the least number (5 or 7) of teeth per transverse row, and have evidently undergone extreme reduction in tooth number. Conversely, species of *Viriola* and *Mastonia*, which are considered to have very highly advanced shell characters, often have among the highest recorded numbers of teeth. This, together with the fact that closely related genera and species often have very different numbers of teeth—e.g. *Viriola* and *Viriolopsis* n.gen.; *Eutriphora cana* (Verco) and *E. armillata* (Verco)—strongly suggests that tooth number has been multiplied and/or reduced independently in many if not all genera.

Many radulae exhibit striking abnormal local bilateral asymmetry in tooth shape, cusp number and relative cusp size (Fig. 8D), so that in some instances it is difficult or impossible to ascertain the normal tooth morphology from a single radular preparation. Such high frequency of presumed mutations suggests that relatively major, selectively advantageous, morphological changes may be readily assimilated into the gene pool. Because of the undoubtedly high morphological plasticity of the triphorid radula it is unlikely that we will ever be able to extrapolate many, if any, details of the tooth morphology of the earliest triphorids. However, accepting that metaxiines and the *Inella* group are of early origin, it seems reasonable to assume that radulae of their descendants are modified from a similar basic pattern. Accordingly, there may have been a general trend toward reduction in the number of cusps from five to three on the central tooth, from five or six to four on each lateral tooth, and from four or five to three or four on most marginal teeth. The adelacerithiine radula (Marshall, 1983) is accordant in having seven cusps on the central tooth and five on each lateral, but differs from all other known triphorids in having only two cusps on most marginal teeth, possibly resulting from tooth fission or cusp reduction. Accordingly it seems reasonable to assume that the broad teeth and multiple cusps exhibited in such genera as *Bouchetriphora* and *Cheirodonta* n.gen. are secondary adaptations.

Tooth elongation has been accomplished either by elongation of cusps alone (Fig. 5D) or, less commonly, by elongation of entire teeth (Fig. 5I). There is a general correlation between the mode of tooth elongation and the number of cusps on the lateral and/or short inner marginal teeth, most species with elongate cusps having three cusps on most marginal teeth, whereas all species with elongate teeth have more numerous cusps. Therefore it seems unlikely that tooth elongation by elongation of cusps could arise independently in species groups with multiple cusps, or conversely, that elongation of entire teeth could occur independently in species with few cusps.

In species with elongate cusps it is usually only one cusp on each tooth that is elongate, so with progressive elongation, the adjacent cusps must cease to function as raspers, and in conjunction with the basal plate, serve merely to maintain alignment and spacing of the elongate cusps. Certain species have evidently followed this path to an ultimate level by total loss of the bordering cusps, each outer marginal tooth being represented by a single elongate cusp with a broadened base (Bouchet & Guillemot, 1978, fig. 20).

Because tooth/cusp elongation has clearly proceeded inwards toward the central tooth after commencing in the outer marginals, it is reasonable to expect that the number of elongate teeth, their length, and their position relative to the central tooth, may vary among closely related species (see *Cheirodonta* n.gen.).

Zoogeography

A striking aspect of the southern Australian triphorid fauna is the occurrence of species pairs and conspecific form pairs (subspecies?) whose components have centres of distribution east and west of Bass Strait. These and similar distributions for other animal groups are largely the result of isolation of populations by the Bass Strait Land Bridge during the Pleistocene (Hedley, 1904; Gill, 1970; Dartnal, 1974). Evidently Pleistocene sea temperatures were so low that pelagic larvae of many species could not survive transportation around the Tasmanian Peninsula.

Yet more striking is the fact that most eastern counterparts have lecithotrophic instead of planktotrophic larval development or larger first (embryonic) protoconch whorls when both counterparts have planktotrophic larval development (Table 1). It is well known (Thorson's Rule) that adoption of lecithotrophy is usually a response to factors associated with low temperature environment, in which survival

Table 1. Triphorid species pairs and conspecific form pairs with centres of distribution east and west of Bass Strait. P/L = plankotrophic/lecithotrophic larval development. LEW/SEW = large/small embryonic whorl.

West		East	
Aclophoropsis festiva	P	*A. maculosa*	L
Nototriphora vestita	P	*N. sarcira*	L
Monophorus n.sp. aff. *nigrofusca*	P	*M. nigrofusca*	L
Hedleytriphora basimacula	P-SEW	*H. innotabilis*	P-LEW
Tetraphora granifera	P-SEW	*T. granifera*	P-LEW
Hedleytriphora scitula	P	*H. fasciata*	P
Obesula mamillata	L	*O. albovittata*	P
Obesula profundior	L		
Obesula albovittata	P		
Isotriphora tasmanica (few axials)		*I. tasmanica* (many axials)	

rate is enhanced by the production of smaller numbers of larvae with larger yolk supplies (Mileikovsky, 1971; Spight, 1976; Thorson, 1950; Vance, 1973). Accordingly, eastern planktotrophic counterparts with larger first whorls are interpreted as having approached lecithotrophy, because transition from planktotrophy to lecithotrophy is normally partly associated with enlargement of the first whorl. Therefore it seems reasonable to assume that Pleistocene upper water layers to the east of Bass Strait were cooler and/or carried less nutrient than those to the west.

The species of *Obesula* Jousseaume are anomalous because the lecithotrophic *O. mamillata* (Verco) and *O. profundior* n.sp. both have centres of distribution west of Bass Strait, yet the planktotrophic *O. albovittata* (Hedley) ranges from New South Wales to south-western Australia. Presumably *O. mamillata* and *O. profundior* evolved in relatively warm southern pockets west of Bass Strait Land Bridge when their planktotrophic ancestor tracked isotherms northward on the east and west coasts of the continent. If this interpretation is correct we cannot preclude the possibility that isolated eastern and western populations of *O. albovittata* underwent some genetic drift and may thus now represent distinct species or subspecies. I can, however, detect no significant differences in the limited shell material available (the animal is unknown).

As discussed below, the slight differences between western and eastern populations of *Tetraphora granifera* may have resulted from Pleistocene isolation, so it is possible that these too are distinguishable taxonomically. Unfortunately there is inadequate material from intermediate (Victorian) localities to ascertain the nature of the transition, so for the present I prefer not to separate them. Specimens of *Isotriphora tasmanica* from Tasmania and off Sydney differ markedly in the number of teleoconch axials, but the few specimens available from intermediate localities are roughly intermediate, suggesting clinal gradation within a single species.

Distributions on the east coast clearly demonstrate the marked transition between the northern tropical (Solanderian) and southern warm temperate (Peronian) faunas, which overlap in the vicinity of the Queensland-New South Wales border (Whitley, 1932). Several species that are regularly encountered in Queensland and/or in tropical waters to the north-east and east occur rarely off central and northern New South Wales: These include *Subulophora rutilans* (Hervier) *Tetraphora iniqua* (Jousseaume), *Mesophora granosa* (Pease), *Mesophora fusca* (Dunker), *Viriola* cf. *corrugata* (Hinds), *Euthymella elegans* (Hinds), *Euthymella kosugei* n.sp., *Bouchetriphora aspergata* (Laseron), *Talophora subulata* (Laseron), *Obesula tribulationis* (Hedley), *Aclophora xystica* (Jousseaume), *Nanaphora tricolor* Laseron, and probably *Latitriphora conferta* (Laseron) and *Latitriphora kesteveni* (Hedley). Additional tropical species are known from worn or fragmentary specimens and others are to be anticipated. With the possible exception of *Mesophora fusca*, these probably do not breed in New South Wales, entering as stray pelagic larvae transported in southward-moving water masses.

Collections from Western Australia are far from adequate and it is yet impossible to ascertain the northern distributional limits of south-western Australian species. However, probably few range north of Geraldton in the region of overlap between the northern tropical (Dampierian) and southern warm temperate (Flindersian) faunas. Additional strays of tropical origin are to be expected.

Of the 69 species recorded here, probably only *Bouchetriphora pallida* (Pease) has a fully circumcontinental distribution, ranging throughout much of the Indo-Pacific, including northern New Zealand. *Seilarex verconis* Cotton, and *S. turritelliformis* (Angas) have their centres of distribution in southern Australia but occur rarely in Queensland, the latter possibly ranging as far north as Hong Kong. *Sagenotriphora ampulla* (Hedley), which is unknown north of New South Wales, is not uncommon in northern New Zealand. Of the remaining 51 nominate species, which are apparently endemic to southern Australia, the following are unknown west of Bass Strait: *Inella obtusa* n.sp., *I. kimblae* n.sp., *Magnosinister hedleyi* Laseron, *Hedleytriphora innotabilis* (Hedley), *Nototriphora sarcira* (Laseron), *N. unicarinata* n.sp., *Bouchetriphora marrowi* n.sp., *Aclophoropsis maculosa* (Hedley), and *Cheirodonta labiata* (A. Adams).

A Key to the Recent Triphoridae of Southern Australia

1. Shell dextral 2

—— Shell sinistral 5

2. Spiral cords nodular, axials strong 3

—— Spiral cords smooth, axials much weaker 4

3. Protoconch narrowly conical and finely sculptured (planktotrophic) .... *Metaxia fuscoapicata* Thiele (Fig. 9A–C)

—— Protoconch short, broad, blunt-tipped and ruggedly sculptured (lecithotrophic) ..... *Metaxia protolineata* (Laseron) (Fig. 9D–F)

4. Protoconch very narrowly conical, of about 6 whorls (planktotrophic); teleoconch white ..... *Seilarex verconis* Cotton (Fig. 10A–C)

—— Protoconch rather broadly conical, of about 3 whorls, (lecithotrophic); teleoconch yellowish brown ..... *Seilarex turritelliformis* (Angas) (Fig. 9G–I)

5. Spirals 1–3 distinctly nodular (axially expanded), axials about as broad as spirals 6

—— Spirals 1–3 smooth or gently undulate over axials (not axially expanded), axials much weaker than spirals 64

6. Teleoconch spiral 2 commencing immediately after protoconch 7

—— Teleoconch spiral 2 commencing later than spirals 1 and 3 26

7. Summits of teleoconch nodules strongly depressed, their edges sharp and expanded across spiral interspaces to overhang sides of spirals 8

—— Teleoconch nodules evenly rounded or edges slightly shelved 10

8. Shell narrowly conical, with a pinkish hue ..... *Latitriphora kesteveni* (Hedley) (Fig. 19C,D)

—— Shell rather broadly conical, predominantly white or yellowish brown with maculations 9

9. Shell white with sparse pale yellowish brown maculations ..... *Latitriphora latilirata* (Verco) (Fig. 18G–J)

—— Shell yellowish brown with white maculations ..... *Latitriphora conferta* (Laseron) (Fig. 19A,B)

10. Protoconch narrowly conical, delicately spirally and axially ribbed, clearly demarcated from teleoconch (planktotrophic) 11

—— Protoconch narrowly conical, unicarinate and otherwise smooth, or sub-cylindrical with a broadly rounded, bulbous or flattened tip, ruggedly sculptured or smooth; often rather poorly demarcated from teleoconch (lecithotrophic) 14

11. Protoconch axials interrupted by a smooth adapical zone 12

—— Protoconch axials entirely traversing whorls 13

12. Smooth protoconch zone narrow, teleoconch nodules small and rounded ..... *Subulophora rutilans* (Hervier) (Fig. 12H–J)

—— Smooth protoconch zone broad, teleoconch nodules broad and flattened ..... *Teretriphora spica* (Verco) (Fig. 16A–C)

13. Protoconch with 1 median spiral thread ..... *Tetraphora granifera* (Brazier) (Fig. 14I–K)

—— Protoconch with 2 median spiral threads ..... *Talophora subulata* (Laseron) (Fig. 12E–G)

14. Protoconch strongly sculptured, whorls angulate 15

—— Protoconch more or less smooth, whorls evenly convex 24

15. Protoconch axially ribbed, with 2 median spiral threads 16

—— Protoconch spirally carinate, without axials 17

16. Shell white, 3.15–6.10 mm high ..... *Teretriphora novapostrema* (Verco) (Fig. 16G–I)

—— Shell maculate, 4.50–13.3 mm high ..... *Monophorus nigrofusca* (A. Adams) (Fig. 14A–C)

17. Protoconch with 2 median spiral cords 18

—— Protoconch with 1 median spiral cord 23

18. Shell 15–22 mm high at maturity 19

—— Shell 4–13 mm high at maturity 20

19. Shell massive, predominantly yellowish brown, spirals 3 and 4 most prominent ..... *Magnosinister hedleyi* (Laseron) (Fig. 13A–C)

—— Shell lightly built, predominantly white, spirals strongly shelved, spirals 2 and 3 most prominent ..... *Inella obliqua* (May) (Fig. 10E–G)

20. Shell very narrowly and evenly conical 21

—— Shell rather broadly conical, weakly cyrtoconoid 22

21. Teleoconch whorls angulate at spiral 3, axial costae obsolete, nodules very strong, spirals 1 and 2 similar, spiral 3 strongest ..... *Inella kimblae* n.sp. (Fig. 11D–F)

—— Teleoconch whorls flat-sided, axial costae strong, spirals 2 and 3 similar and strong, spiral 1 weak ..... *Hypotriphora subula* (Verco) (Fig. 12E–G)

22. Protoconch with a subsutural row of nodules. Teleoconch nodules weak, a spiral cord intercalating between spirals 2 and 3 well before body whorl ..... *Inella intercalaris* n.sp. (Fig. 12A–D)

—— No nodules on protoconch. Teleoconch nodules strong, no intercalary spiral before body whorl ..... *Inella carinata* n.sp. (Fig. 11G–I)

23. Protoconch narrowly conical. Teleoconch spirals 1 and 2 commencing very weak, no intercalary spiral before body whorl ..... *Inella spina* (Verco) (Fig. 10I–K)

—— Protoconch short, broad and blunt-tipped. Teleoconch spirals 1–3 similar throughout, a spiral cord intercalating between spirals 2 and 3 before body whorl ..... *Inella obtusa* n.sp. (Fig. 11A–C)

24. Protoconch short and broad. Teleoconch whorls convex ..... *Teretriphora gemmegens* (Verco) (Fig. 15I)

—— Protoconch subcylindrical 25

25. Teleoconch whorls flat-sided, first few whorls yellowish to reddish brown; subsequent whorls white, spiral 3 yellowish brown between nodules .. .. *Aclophoropsis univitta* (Laseron) (Fig. 32A–C)

—— Teleoconch whorls shallowly convex, buff white, irregularly maculate with yellowish brown ..... *Teretriphora ponderorum* n.sp. (Fig. 16D–F)

26. Protoconch narrowly and acutely conical, delicately spirally and axially ribbed or superficially smooth, clearly demarcated from teleoconch (planktotrophic) 27

—— Protoconch blunt-tipped, usually short and broad, ruggedly sculptured or smooth, often poorly demarcated from teleoconch (lecithotrophic) 49

27. Protoconch axials interrupted by a narrow or very broad smooth zone 28

—— Protoconch axials entirely traversing whorls 31

28. Smooth protoconch zone very broad, riblets occupying very narrow supra- and subsutural zones 29

—— Smooth protoconch zone narrow, riblets occupying abapical half of each whorl and a very narrow subsutural zone 30

29. Shell very narrowly conical, teleoconch spiral 3 very prominent, spiral 4 spotted ..... *Hedleytriphora scitula* (A. Adams) (Fig. 17D–F)

—— Shell rather broadly conical, teleoconch spirals 1 and 3 similar, spiral 4 spotted ..... *Hedleytriphora fasciata* (T. Woods) (Fig. 17A–C)

30. Shell rather uniform reddish to yellowish brown, spirals 1 and 3 of similar size ..... *Hedleytriphora innotabilis* (Hedley) (Fig. 17G–I)

—— Teleoconch pale yellowish brown and maculate, or reddish brown with spiral 1 a darker shade; always with a deeply pigmented blotch on and between spirals 1 and 2 behind outer lip. Spiral 3 usually higher than spiral 1 ..... *Hedleytriphora basimacula* n.sp. (Fig. 18A–C)

31. Protoconch with 2 median spiral threads, adapical spiral or both spirals sometimes weak 32

—— Protoconch with 1 median spiral thread 40

32. First 2 or 3 teleoconch whorls white, next 2 or 3 whorls yellowish, reddish or blackish brown, subsequent whorls white, with or without maculations or bands 33

—— Early teleoconch whorls not darker-coloured than subsequent whorls 34

33. Shell narrowly cyrtoconoid, last few whorls uniform white ..... *Eutriphora armillata* (Verco) (Fig. 22G–I)

—— Shell broadly cyrtoconoid, last few whorls maculate or banded ..... *Aclophora hedleyi* n.sp. (Fig. 30I–L)

34. Teleoconch boldly maculate 35

—— Teleoconch not maculate 36

35. White, maculate with yellowish brown, most deeply pigmented at sides of spirals 1–3 ..... *Nototriphora vestita* n.sp. (Fig. 28B–D)

—— White or buff white, maculate with uniform yellowish to reddish brown ..... *Sagenotriphora ampulla* (Hedley) (Fig. 14E–G)

36. Spiral 3 more deeply pigmented than rest of whorl 37

—— Spiral 3 not more deeply pigmented than rest of whorl 38

37. Spiral 1 white, spiral 2 orange or yellowish brown, spiral 3 deep reddish brown ..... *Nanaphora tricolor* Laseron (Fig. 32E–G)

—— White, spiral 3 yellowish brown ..... *Nototriphora regina* (Hedley) (Fig. 27G–I)

38. Uniform yellowish brown, whorls gently angulate at spiral 3 ..... *Monophorus australica* n.sp. (Fig. 13D–G)

—— Nodules or summits of spirals paler-coloured than spiral interspaces, whorls flat-sided 39

39. Reddish to blackish brown, nodules paler or white ..... *Aclophora xystica* (Jousseaume) (Fig. 31A–F,J)

—— Yellowish brown, summits of spirals paler ..... *Monophorus angasi* (Crosse & Fischer) (Fig. 13I–K)

40. Teleoconch boldy maculate 41

—— Teleoconch not maculate 42

41. Maculations yellowish brown, pigmentation confined mainly to sides of spiral 1 ..... *Aclophoropsis festiva* (A. Adams) (Fig. 31K–M)

—— Maculations evenly pigmented, reddish to yellowish brown ..... *Obesula tribulationis* (Hedley) (Fig. 30E–G)

42. Very boldly spirally banded or uniform white 43

—— Not boldly spirally banded, coloured 44

43. White or buff white, reddish to yellowish brown on spirals 4 and 5, below spiral 6, and either on summit or on sides of spiral 1 ..... *Tetraphora iniqua* (Jousseaume) (Fig. 15D–F)

—— Uniform white ..... *Bouchetriphora pallida* (Pease) (Fig. 26A–G)

44. Reddish brown 45

—— Yellowish brown 47

45. Axial costae orthocline ..... *Bouchetriphora marrowi* n.sp. (Fig. 27A–C)

—— Axial costae distinctly opisthocline before body whorl 46

46. Spirals 5 and 6 strong and similar ..... *Mesophora fusca* (Dunker) (Fig. 19I–K)

—— Spiral 6 markedly weaker than spiral 5 ..... *Hedleytriphora elata* (Thiele) (Fig. 18D–F)

47. Spirally banded 48

—— Yellowish brown, nodules white ..... *Mesophora granosa* (Pease) (Fig. 19E–G)

48. Pale yellowish brown or buff white, spiral 1 pure white on summit and usually yellowish brown on abapical side, base reddish brown on and below spiral 5 ..... *Obesula albovittata* (Hedley) (Fig. 29E–G)

—— Buff white or pale yellowish brown, nodules opaque white, reddish brown between axials on abapical sides of spirals 1 and 3 ..... *Bouchetriphora aspergata* (Laseron) (Fig. 25G–I)

49. Protoconch axially ribbed, spirally carinate or smooth, without nodules 50

—— Protoconch with 2 or 3 spiral rows of nodules 57

50. Protoconch axially ribbed throughout, or first whorl smooth and last whorl crisply axially ribbed 51

—— Protoconch spirally carinate or smooth 54

51. Protoconch axially ribbed throughout 52

—— First whorl smooth, last whorl axially ribbed 53

52. Protoconch white ..... *Eutriphora cana* (Verco) (Fig. 22D–F)

—— Protoconch yellowish brown ..... *Eutriphora tricolor* (Laseron) (Fig. 23A–C)

53. Teleoconch spiral 1 white, its abapical side yellowish brown, base reddish brown ..... *Obesula mamillata* (Verco) (Fig. 29H–J)

—— Teleoconch spiral 1 uniform white, base pale yellowish brown ..... *Obesula profundior* n.sp. (Fig. 30A–D)

54. Protoconch smooth, teleoconch maculate 55

—— Protoconch spirally carinate, teleoconch not maculate 56

55. Maculations most deeply pigmented on sides of spiral 1 ..... *Aclophoropsis maculosa* (Hedley) (Fig. 31G–I)

—— Maculations most deeply pigmented on sides of spirals 1–3 ..... *Nototriphora sarcira* (Laseron) (Fig. 28A)

56. Protoconch with 2 median spiral threads, shell deep reddish brown ..... *Cheirodonta labiata* (A. Adams) (Fig. 33A–C)

—— Protoconch with 1 submedian angulation, shell pale yellowish brown ..... *Nototriphora unicarinata* n.sp. (Fig. 28E–G)

57. Protoconch with 3 rows of nodules, adapical row weak, abapical rows strong and similar 58

—— Protoconch with 2 rows of strong nodules 59

58. Protoconch nodules connected by poorly-developed axials, teleoconch light yellowish or orange brown, spiral 3 white ..... *Triphora nivea* Verco (Fig. 29A–D)

—— Protoconch nodules discrete, shell uniform white ..... *Isotriphora vercoi* n.sp. (Fig. 25A–C)

59. Tip of first protoconch whorl drawn out, summit bluntly conical ..... *Eutriphora pseudocana* n.sp. (Fig. 23D–G)

—— Tip of protoconch not drawn out, summit bluntly rounded or flattened 60

60. Protoconch lilac 61

—— Protoconch white or brown 62

61. Shell 3.45–11.0 mm high, teleoconch yellowish brown or orange, spiral 3 lilac ..... *Isotriphora amethystina* new name (Fig. 24A–C)

—— Shell 2.50–3.90 mm high, colour variable, spiral 4 always deep yellowish brown ..... *Isotriphora aureovincta* (Verco) (Fig. 25D–F)

62. Teleoconch buff white, irregularly and sparsely maculate with very pale yellowish brown, whorls usually shallowly convex ..... *Isotriphora disjuncta* (Verco) (Fig. 24D–G)

—— Teleoconch whorls not maculate, flat-sided 63

63. Shell 5.50–10.8 mm high; teleoconch yellowish brown, never maculate, usually deeply pigmented between nodules on spiral 3, posterior canal often subtubular ..... *Isotriphora tasmanica* (T. Woods) (Fig. 23H–K)

—— Shell 3.55–5.55 mm high; teleoconch yellowish brown, deeply pigmented between nodules on spirals 1–3, posterior canal always notched ..... *Isotriphora simulata* n.sp. (Fig. 24I–K)

64. Protoconch short, broad, blunt-tipped and ruggedly sculptured ..... *Viriola truncata* n.sp. (Fig. 21A–C)

—— Protoconch narrowly conical, finely spirally and axially ribbed 65

65. Protoconch with 1 median spiral thread, shell 2.90–4.25 mm high 66

—— Protoconch with 2 median spiral threads, shell 7.00–16.0 mm high 67

66. Protoconch whorls evenly convex; teleoconch spiral 1 weaker than spirals 2 and 3 throughout, interspaces smooth ..... *Tetraphora mcgilpi* (Cotton) (Fig. 15A–C)

—— Protoconch whorls angulate, teleoconch spiral 2 weaker than adjacent spirals, interspaces finely axially ribbed ..... *Viriolopsis occidua* n.sp. (Fig. 21D-F)

67. Spiral cords smooth, interspaces with numerous fine, crisp axial riblets, no microsculpture ..... *Viriola* cf. *corrugata* (Hinds) (Fig. 20I-K)

—— Spiral cords undulate, microsculpture well developed 68

68. Teleoconch white with reddish or yellowish brown maculations .... *Euthymella elegans* (Hinds) (Fig. 21G-I)

—— Teleoconch yellowish or orange brown with white maculations, spiral 4 spotted a deeper shade ..... *Euthymella kosugei* n.sp. (Fig. 22A-C)

Systematics

Superfamily TRIPHOROIDEA

Family TRIPHORIDAE

TRIPHORIDAE Gray, 1847: 154. Type genus *Triphora* Blainville, 1828 (see Marshall, 1979).

Not TRIFORIDAE Jousseaume, 1884: 218. Type genus *Triforis* Deshayes, 1834 (see Marshall, 1980).

Members of the Triphoroidea, comprising Triphoridae alone, are sinistral (Triphorinae) or dextral (Adelacerithiinae and Metaxiinae). They are characterized by distinctive anatomy (Fretter, 1951; Kosuge, 1966), notably the presence of a peculiar glandular pouch in the posterior oesophagus, and rhiniglossate dentition. Shell cerithiform. Anterior canal subtubular or tubular (Triphorinae), subtubular (Adelacerithiinae), or a deep basal notch (Metaxiinae). Posterior canal a notch, foramen or tube (Triphorinae), or absent (Metaxiinae and Adelacerithiinae). Columella simple (Triphorinae and Metaxiinae) or with a prominent plait (Adelacerithiinae).

The relationships of the superfamily are obscure. Marshall (1983) discussed phylogenetic relationships within the superfamily and previous higher classifications, and suggested possible relationships with Triforidae and Cerithiopsoidea, and the Mesozoic Loxonematidae or Procerithiidae. Golikov & Starobogatov (1975) suggested a relationship with neogastropods, but this seems improbable (Marshall, 1983).

Subfamily METAXIINAE Marshall, 1977

METAXIINAE Marshall, 1977: 111. Type genus *Metaxia* Monterosato, 1884.

This subfamily contains all of the dextral triphorids apart from Adelacerithiinae, the single known Recent species of which differs widely in shell and radular morphology (see Marshall, 1983). Metaxiines are characterized by zigzag spiral threads on the first whorl of the planktotrophic larval protoconch, lack of basal spiral cords, lack of a posterior siphonal notch, and simple, notched anterior canal. The operculum is ovate with a strongly eccentric nucleus, and has about two whorls. The rather generalized radula is similar to those of some triphorines, notably *Inella* Bayle and related genera. For more detailed remarks see Marshall 1977b, 1979, 1983.

Marshall (1979) tentatively referred *Socienna* Finlay, 1927 to Metaxiinae because of close similarities in shell facies between its type species—*S. apicicosta* (May, 1920)—and *Metaxia*. However, the radula of *S. apicicosta* (off Cape Jaffa, 165 m, Verco Coll., SAM D.16322) proves to be taenioglossate, and very like that of *Laskeya* Iredale, 1918 and *Retilaskeya* Marshall, 1978. Accordingly, *Socienna* is returned to Cerithiopsidae.

Liometaxia laevigata Le Renard, 1980 (Le Renard, 1980, p.18, fig. 8; Dolin, Dolin & Le Renard, 1980, pl.3, fig. 36)—the type species of *Liometaxia* Le Renard, 1980—resembles a *Metaxia* in teleoconch whorl shape and apertural features, but differs markedly in having hemispherical granules on all protoconch whorls (and sometimes on the teleoconch). I am not convinced by Le Renard's (1980) argument that *L. laevigata* is related to *Metaxia*, but should it prove to be, the presence of granulate sculpture on its first whorl might support the contention that Metaxiinae originated from Adelacerithiinae.

Genus *Metaxia* Monterosato

Metaxia Monterosato, 1884:125. Type species (subsequent designation of Cossmann, 1906): *Cerithium rugulosum* C.B. Adams, 1850; Recent, West Indies.

Diagnosis. Dextral triphorids having a teleoconch with 5 spiral cords and strong axial costae with nodular intersections. Periostracum axially lamellar. Radula (Marshall, 1977b, fig. 2I-K) with the formula 8-9 + 1 + 1 + 1 + 9-8. Central tooth with 4 primary cusps and a vestigial median cusp; lateral and inner marginal teeth similar, each with 4 similar cusps, outermost marginals with 2 or 3 cusps.

Remarks. *Metaxia* occurs worldwide in tropical and temperate seas, probable congeners occurring in the Eocene of Europe (e.g. *Metaxia trachycosmeta* Cossmann, 1919). At least 14 nominate Recent species

are referable to *Metaxia* (s. s.) and I know of at least six that are undescribed. The New Zealand Recent *M. duplicarinata* (Powell, 1940) and *M. solitaria* Marshall, 1979 have only four teleoconch spirals but are otherwise similar to typical *Metaxia* (Marshall, 1979). A similar undescribed species recently obtained off northern New Zealand (NMNZ) has a planktotrophic larval protoconch very like that of *Prolixodens* Marshall, 1978, which suggests that the species are referable to Cerithiopsidae.

Metaxia fuscoapicata Thiele, 1930
Fig. 9A-C

Metaxia fuscoapicata Thiele, 1930, p.575, pl.4, fig. 26.

Description. Shell 4.10–6.10 (est.) x 0.95–1.40 mm, of 13–14½ (est.) whorls, lightly built, narrowly conical, spire up to 5.0 x higher than aperture. Periostracum very thin, pale buff, axially lamellar in spiral interspaces.

Colour of protoconch deep yellowish brown. Teleoconch predominantly white; yellowish or reddish brown on summits of spirals, either as occasional spots on random spirals or on spirals 1–5 in occasional, irregular axial bands.

Protoconch of planktotrophic larval type, clearly demarcated, narrowly conical, of 4½–4¾ convex whorls, diameter 270 μm, diameter of first whorl 130–150 μm. First 1½ whorls encircled by fine, crisp, similar zigzag threads. Subsequent whorls traversed by fine, crisp axial riblets that are opisthocline over adapical third and prosocline over abapical two thirds, riblets slightly offset at intersection of the two zones. Whorls encircled by 6 fine spiral threads: Spiral 1 distinctly angulating adapical quarter of last 2 whorls; spirals 2 and 3 closely spaced at middle of whorls, indistinct on last whorl, spirals 4–6 most strongly developed on last whorl, spiral 6 margining suture.

Teleoconch whorls convex, reticulately sculptured with spiral cords and axial costae, intersections rather weakly nodular. Fine, crisp, collabral growth lines and obscure spiral lines in interspaces of spirals 1–5, intersections faintly granulate. Spiral cords commencing immediately, crisply defined, numbering 5 per whorl, spiral 5 almost entirely exposed at suture on spire. Spiral 1 weakest, spirals 2–5 strong and similar. Axial costae low swellings with ill-defined margins, shallowly opisthocyrt, evanescent against spirals 1 and 5, numbering 17–18 on penultimate whorl. Base suddenly contracted below spiral 5. Columella tapering to a point, demarcated by a fine spiral thread. Aperture subquadrate. Outer lip thin and simple. Inner lip and parietal glaze very thin. Anterior siphonal canal a simple wide basal notch.

Animal unknown.

Type locality. Shark Bay, Western Australia.

Holotype. MNHU 67481.

Other material examined (13 specimens AMS). *Western Australia:* Quobba Point, Oct. 1969, F. Plant; Horrock's Beach, N of Geraldton, 9 Jan. 1972, W.F. Ponder; W side of Carnac I., off Fremantle, on sublittoral algae, 18 Dec. 1971, W.F. & J.M. Ponder, B.R. Wilson & N. Coleman.

Remarks. *M. fuscoapicata* very closely resembles the New Zealand *M. exaltata* (Powell, 1930) (Marshall, 1977b), but that species is more extensively pigmented and has a more broadly conical protoconch with a broader first whorl (diameter 170 μm vs 130–150 μm).

A single damaged specimen from Coffs Harbour, New South Wales, in 23 m (AMS C.123438) retains a vestige of a reddish brown protoconch, which suggests a species with planktotrophic larval development. It differs from *M. fuscoapicata* in having narrower teleoconch spirals and probably represents an undescribed species. I have SEMs of five unnamed *Metaxia* species from Queensland but it is evidently none of these.

Metaxia protolineata (Laseron, 1951)
Fig. 9D-F

Opimilda protolineata Laseron, 1951b: 331, fig. 81.

Description. Shell 3.00–4.50 x 0.80–1.00 mm, of 9–11 whorls, lightly built, narrowly conical, spire up to 6.4 x higher than aperture. Periostracum pale buff, thin, axially lamellar in spiral interspaces.

Colour uniform yellowish brown, fading through pale buff to white.

Protoconch of lecithotrophic larval type, clearly demarcated, of 2½–3 convex whorls, diameter 330–380 μm, diameter of first whorl 270–320 μm. First whorl rather evenly convex, encircled by 6–8 fine, crisp, straight or gently waved spiral threads. Subsequent whorls medially angulate, adapical half traversed by crisp collabral axial riblets, abapical half traversed by a zigzag spiral thread. A spiral thread is exposed at suture on last whorl.

Teleoconch whorls convex, reticulately sculptured with spiral cords and axial costae, intersections rather weakly nodular. Fine crisp collabral growth lines and obscure spiral lines in interspaces of spirals 1–5, intersections faintly granulate. Spiral cords commencing simultaneously, crisply defined, traversing axials, numbering 5 per whorl, spiral 5 almost entirely exposed at suture on spire. Spiral 1 weakest throughout, spirals 2–5 strong and similar, interspaces about 3 × as wide as each spiral. Axial costae low and rounded with ill-defined margins, evanescent against spirals 1 and 5, evenly developed between, numbering 16–17 on penultimate whorl. Base evenly contracted below spiral 5. Columella tapering to a sharp point, slightly twisted, demarcated by a fine spiral thread. Aperture subquadrate. Outer lip thin and simple. Inner lip and parietal glaze very thin. Anterior siphonal canal a simple wide basal notch.

Animal unavailable.

Type locality. Manly Beach, Sydney, New South Wales, shell sand.

Holotype. AMS C.103225.

Other material examined (4 specimens). *New South Wales:* E of Cape Byron, 203 m (AMS). *South Australia:* 40 miles S of Cape Wiles, 183 m (AMS); off Cape Borda, 101 m, Verco Coll. (SAM).

Remarks. Originally described as a pyramidellid, this species is almost identical to *M. metaxae* (Chiaje, 1828) and *M.exaltata* (Powell, 1940) in teleoconch facies and is undoubtedly congeneric. The specimens recorded here differ from the holotype in being pale buff (dead) or yellowish brown instead of uniform white, and in having a slightly smaller first protoconch whorl. However the lack of colour in the holotype, a slightly abraded beach shell, could easily result from bleaching, and protoconch size variation of this magnitude is common among triphorids with lecithotrophic larval development. Nevertheless identification is tentative pending more detailed knowledge of variation among New South Wales specimens. An undescribed species with lecithotrophic larval development is represented by a single immature specimen from off Cape Borda in 101m (Verco Coll., SAM D.16246). It differs from *M.protolineata* in being relatively larger, and in having two strong angulating spiral cords on the first whorl, and axial riblets that entirely traverse subsequent protoconch whorls. Other superficially similar species include the New Zealand *M. maoria* (Finlay, 1930) and the Kermadec *M. kermadecensis* Marshall, 1977 (Marshall, 1977b, 1979).

Genus *Seilarex* Iredale

Seilarex Iredale, 1924: 246. Type species (original designation) *Seila attenuata* Hedley, 1900 (= *Bittium turritelliformis* Angas, 1877); Recent, New South Wales.

Diagnosis. Dextral triphorids having a teleoconch with 5 or more smooth spiral cords, and finer closer-set interstitial axial riblets. Periostracum smooth. Radula with the fomula 10–15 + 1 + 1 + 1 +15–10. Central tooth with 3 cusps, lateral and marginal teeth with 3 subequal cusps.

Remarks. *Seilarex* has almost certainly undergone reduction in cusp number and development from the *Metaxia* pattern, and its species are evidently now losing the innermost cusp from each lateral and marginal tooth. The following species are the only known members of the genus.

Seilarex turritelliformis (Angas, 1877)

Fig. 9G–I, Table 2

Bittium turritelliformis Angas, 1877:174, pl. 26, fig. 14.
Cerithiopsis (Seila) multilirata Sowerby, 1894:154, pl. 12, fig. 7.—Yen, 1942:208, pl.15, fig. 82. New synonym.
Seila attenuata Hedley, 1900: 91, pl.3, fig.9.
Seila turritelliformis.—May, 1923, pl. 27, fig. 12; Iredale 1924:246.
Seilarex attenuatus.—Iredale, 1924:246.
Seilarex attenuata.—Cotton, 1951:394.
Seilarex turritelliformis.—Laseron, 1951a:364, fig. 32.

Table 2. *Seilarex turritelliformis.* Shell measurements (mm) and countings.

Height	Diameter	Diameter 1st whorl	No. whorls
3.95	1.00	0.25	9.50
5.50	1.65	0.23	10.00
7.45	2.15	0.27	11.50
8.20	2.15	0.27	12.00
14.0 (est.)	3.20	—	15 (est.)

Description. Shell 3.95–14.0 (est.) x 1.00–3.20 mm of 9½–15 (est.) whorls, lightly built, narrowly conical, spire up to 4.5 × higher than aperture. Periostracum pale buff, thin and smooth.

Colour of protoconch and first few teleoconch whorls reddish brown, lightening over subsequent whorls to yellowish brown or pale yellowish brown.

Protoconch of lecithotrophic larval type, clearly demarcated, narrowly conical, of 2¾–3¼ convex whorls, diameter 320–420 μm, diameter of first whorl 230–270 μm. First 1½ whorls ornamented with about 6 crisp irregular zigzag spiral threads. Subsequent whorls with crisp opisthocline axial riblets over adapical half, a prominent smooth submedian spiral that surmounts an increasingly prominent angulation, and a suprasutural spiral.

Teleoconch whorls strongly convex, sculptured with prominent narrow, crisp, smooth spiral cords, and numerous very fine, close-set, crisp, opisthocyrt interstitial axial lamellae that entirely traverse whorls to abapical spiral. Spiral cords in 2 series. Primary spirals similar throughout, commencing immediately, numbering 5 per whorl, abapical spiral entirely exposed at suture on spire. A single secondary spiral in each interspace of spirals 1–5, gradually enlarging to resemble primary spirals in large specimens, usually commencing more or less simultaneously, usually on first whorl after appearance of primary spirals, occasionally commencing later; one or two spirals sometimes absent. Base evenly contracted. Columella demarcated by a fine thread, narrow, tapering to a point. Aperture ovate or subquadrate. Outer lip thin and simple. Parietal glaze and inner lip very thin. Posterior siphonal canal a simple wide basal notch.

Operculum (as in Fig. 4A) horny, externally slightly convex, ovate, spiral, nucleus strongly eccentric, of 2 whorls. Muscle attachment scar simple.

Radula (from light microscope preparation) very like that of *S. verconis* (Fig. 6A), with the formula 10–13 + 1 + 1 + 1 +13–10. Central tooth 6.8 μm wide, lateral teeth each 6.8 μm wide, marginal teeth 4.8–2.9 μm wide.

Type localities. *B. turritelliformis:* Port Jackson, Sydney, New South Wales; *C. (S.) multilirata:* Hong Kong Harbour; *S. attenuata:* Balmoral Beach, Middle Harbour, Sydney.

Types. *B. turritelliformis:* Repository unknown, not at BMNH (M. K. Way, pers. comm.). *C. (S.)*

multilirata: HOLOTYPE BMNH 95.4.29.147. *S. attenuata:* HOLOTYPE AMS C.7850.

Other material examined (7 specimens AMS). *Queensland:* Facing I., Port Curtis, J. Voorwinde. *New South Wales:* Between Balls Head & Goat Island, Port Jackson, 33 m, 25 June 1884, J. Brazier; Sow & Pigs Reef, Port Jackson, J. Brazier; The Spit, Port Jackson, T.A. Garrard; Twofold Bay, C. Hedley. *Victoria:* Off Lakes Entrance, 34–46 m, T.A. Garrard.

Remarks. The rather crude original description and illustration of *B. turritelliformis* are in general agreement with immature specimens of the species later described as *S. attenuata.* The holotype of *C. (S.) multilirata,* described from Hong Kong, is indistinguishable from the present material. To my knowledge it has not been recollected from the China Sea and is possibly based on a mislabelled Australian specimen.

Seilarex verconis Cotton, 1951
Figs 4A, 6A, 10A–C

Seilarex verconis Cotton, 1951:394, pl. 28, fig. 4.

Description. Shell 8.70–14.5 mm x 2.00–3.00 mm, of 15–17 whorls, thin and translucent, narrowly conical, spire up to 5.3 x higher than aperture.

Colour of protoconch pale yellowish brown. Teleoconch uniform white or pale buff.

Protoconch of planktotrophic larval type, very narrowly conical, of 6 convex whorls, diameter 320 μm, diameter of first whorl 130 μm. First whorl ornamented with about 12 fine, crisp, similar, zigzag spiral threads. Subsequent whorls encircled by a fine, crisp, smooth median spiral thread that surmounts an increasingly prominent angulation, and a finely beaded suprasutural thread. Whorls traversed by fine crisp axial riblets that are opisthocline over adapical half and prosocline over abapical half, spirally dislocate at intersection.

Teleoconch whorls strongly convex, sculptured with prominent narrow, crisp, smooth spiral cords, and numerous very fine, close-set, crisp, opisthocyrt interstitial axial lamellae that entirely traverse whorls to abapical spiral. Spiral cords commencing immediately, in 2 series. Primary spirals, numbering 5 per whorl, similar throughout, abapical spiral entirely exposed at suture on spire. A single secondary spiral in each interspace of spirals 1–5, gradually enlarging to resemble primary spirals from about third whorl. Columella demarcated by a fine spiral thread, narrow, tapering to a point. Aperture ovate or subquadrate. Outer lip thin and simple. Parietal glaze and inner lip very thin. Anterior siphonal canal a simple wide basal notch.

Operculum (Fig. 4A) translucent pale yellow, externally slightly convex, ovate, spiral, nucleus strongly eccentric, of 2 whorls. Muscle attachment scar well defined, simple.

Radula (Fig. 6A) with the formula 15 + 1 + 1 + 1 + 15. Central tooth 8.7 μm wide, with 3 cusps, outer 2 cusps long, narrow and divergent; median cusp very small, vestigial. Lateral teeth each 7.8 μm wide, with 3 cusps, outer 2 long and narrow, innermost cusp much smaller. Marginal teeth 6.8–3.9 μm wide, with 3 cusps; innermost cusp smallest, outer 2 cusps long and narrow, median cusp longest and broadest, outermost cusp becoming progressively shorter than median cusp outward.

Type locality. Off Cape Borda, South Australia, 101 m.

Holotype. SAM D.14425.

Other material examined. (14 specimens). *Northern Territory:* Sandbar off Emery Point, Darwin, 25 Oct 1969, P.H. Colman (AMS). *Queensland:* Low Isles, T. Iredale (AMS). *South Australia:* Off Cape Borda, 101 m, Verco Coll. (SAM); SW of Neptune I., 190 m, Verco Coll. (SAM); off St. Francis I., 11 m, 27–37 m, & 64 m, Verco Coll. (3 lots SAM). *Western Australia:* SW of Eucla, 79–140 m, HMAS *Gascoyne* stn G2/96-97/62 (AMS).

Remarks. *S. verconis* differs from *S. turritelliformis* in protoconch facies, in being paler coloured or white and more finely sculptured, and in the much earlier attainment of similarity between the primary and secondary teleoconch spirals. Specimens from northern and southern Australia are indistinguishable, suggesting that *S. verconis* probably has a continuous distribution off Western Australia.

Subfamily TRIPHORINAE Gray, 1847

TRIPHORINAE Gray, 1847:154. Type genus *Triphora* Blainville, 1828.

INIFORINAE Kosuge, 1966:314. Type genus *Iniforis* Jousseaume, 1884. New synonym.

MASTONIINAE Kosuge, 1966:315. Type genus *Mastonia* Hinds, 1843. New synonym.

This subfamily contains all of the known sinistral species.

Kosuge (1966) separated Iniforinae from Triphorinae primarily on the basis of the occurrence of three central radular teeth instead of one in species of their type genera. He separated Mastoniinae from Iniforinae primarily because its species have only one central tooth, and separated Mastoniinae from Triphorinae primarily because the latter have broader central and lateral teeth with more numerous cusps.

As discussed above, I consider that the so-called outer central teeth of Iniforinae (Fig. 4G) are strictly homologous with the lateral teeth of Mastoniinae and Triphorinae, the lateral teeth simply happening to resemble the central teeth. In fact the type species of *Mastonia (M. rubra* Hinds, 1843) and *Iniforis (I. malvaceous* Jousseaume, 1884) both happen to have similar central and lateral teeth (Fig. 4G,J), so separation of Mastoniinae and Iniforinae on this criterion requires no further consideration. Compared with *Mastonia*, species of *Iniforis* and *Mastoniaeforis* (= *Iniforis* sensu Kosuge, 1966) differ in having enclosed or tubular posterior siphonal canals. However, species in these genera exhibit a smooth transition from a notched to a fully tubular canal, so it is evidently

impossible to separate subfamilies on the basis of degree of development in this structure. In fact species of *Mastonia, Iniforis* and *Maśtoniaeforis* have so many features in common (see *Mesophora* Laseron) that there can be little doubt that the genera are closely related. Accordingly, I cannot justify continued separation of Mastoniinae from the prior Iniforinae.

Kosuge's (1966) concept of the radula of *Triphora* was based on that of *T. otsuensis* (Yokoyama, 1920), which he unjustifiably regarded as being congeneric with *T. gemmatum*. However *T. otsuensis*, herein referred to *Bouchetriphora* n.gen., differs very markedly from *Triphora* (s.s.?) in radular morphology. Although the radula of *Bouchetriphora* is strikingly different from those of *Triphora, Mastonia* and *Iniforis*, there is a rather smooth morphological gradation through other genera, so it is clear that radular differences of this magnitude cannot be used for subfamilial discrimination. Indeed, there are no single or combined radula characters by which even the Metaxiinae may be distinguished from the Triphorinae. Accordingly, Iniforinae is placed as a synonym of the prior Triphorinae.

As indicated in the general discussion under *Teleoconch* and *Protoconch*, the *Inella* group may ultimately prove worthy of subfamily status. However, as presently understood, triphorines exhibit a character mosaic of such intricate complexity that it would be unwise to attempt separation of further subfamilies with our present limited state of knowledge.

Genus *Inella* Bayle

Ino Hinds, 1843, p.17. Type species (subsequent designation of Jousseaume, 1884:230): *Triforis (Ino) gigas* Hinds, 1843; Recent New Guinea (**not** *Ino* Samsuelle, 1817).

Inella Bayle 1879, p.35. New name for *Ino* Hinds (preoccupied).

The limits of this genus are uncertain. *Inella gigas* (Fig. 10D,H) is one of a hundred or more species (many undescribed) in which the planktotrophic larval protoconch is sculptured on the first whorl with T-shaped granules, and on subsequent whorls with axial riblets that are usually interrupted by a smooth adapical zone. In most species teleoconch spirals 1–3 commence simultaneously and spiral 1 is weak at first, usually remaining weaker than spirals 2 and 3 throughout. The group thus differs markedly from other triphorines, in which the first whorl is always either reticulately sculptured or ornamented with more or less evenly hemispherical granules, the subsequent protoconch whorls are usually entirely traversed by axial riblets, and teleoconch spiral 2 usually commences later than spirals 1 and 3. The group includes the type species of *Monophorus* Grillo, 1877 (*T. perversa* Linné, 1758) (= *Notosinister* Finlay, 1927); *Strobiligera* Dall, 1924 (*T. ibex* Dall, 1881); *Hypotriphora* Cotton & Godfrey, 1931 (*T. subula* Verco, 1909); *Magnosinister* Laseron, 1954 (*M. hedleyi* Laseron, 1954); *Subulophora* Laseron, 1958 (*S. exporrecta* Laseron, 1958 = *T. rutilans* Hervier, 1897); *Liniphora* Laseron, 1958 (*L. restis* Laseron, 1958); and *Norephora* Gründel, 1975 (*T. granulata* Strauch, 1967). Judging from illustrations of their Eocene type species, *Epetrium* Harris & Burrows, 1891 (= *Stylia* Jousseaume, 1884—preoccupied) and *Ogivia* Harris & Burrows, 1891 (= *Metalepsis* Jousseaume, 1884—preoccupied) probably belong here as well; unfortunately their protoconchs are unknown.

Monophorus species are exceptional in having T-shaped granules on the first whorl yet a late-developing teleoconch spiral 2. In *M. perversa* (Linné, 1758) the adapical and abapical riblet zones are well separated as in *Inella* species, but other species exhibit a transition to smoothly interconnected riblet zones. As discussed in the introduction, there have evidently been general trends throughout Triphorinae toward late development of spiral 2 and a closing together of the adapical and abapical protoconch riblet zones. Accordingly, *Monophorus* is regarded as an advanced genus of the *Inella* group. The Upper Oligocene type species of *Oriforina* Gründel, 1975 (*O. praeversa* Gründel, 1975) has a late-developing teleoconch spiral 2 and smooth protoconch zone as in *M. perversa,* and *Oriforina* may prove to be a synonym of *Monophorus.* However, confirmation must await knowledge of the sculpture of the first protoconch whorl of *O. praeversa.*

Simultaneous appearance of teleoconch spirals 1–3 is exhibited by species in the following genera, but for various reasons (see below) they are not considered to be closely related to *Inella: Sychar* Hinds, 1843, *Teretriphora* Finlay, 1927, *Cautor* Finlay, 1927, *Cautotriphora* Laws, 1940, *Cinctriphora* Olsson & Harbison, 1953, *Tetraphora* Laseron, 1958, *Talophora* Gründel, 1975, *Latitriphora* n.gen., and *Aclophoropsis* n.gen. Species of *Tetraphora* and *Hedleytriphora* n.gen. have smooth protoconch zones but they too are excluded from this group (see below).

The type species of *Hypotriphora* and *Subulophora,* and *Inella obtusa* (Verco), have similar teleoconchs to *T. brychia* Bouchet & Guillemot, 1978, which Bouchet (1983) referred to *Strobiligera.* The radulae of *Subulophora rutilans* (Fig. 6B), *Inella obtusa* (Fig. 4D) and *Strobiligera brychia* (Bouchet, 1983, fig. 15) differ quite markedly in the number and relative sizes of cusps on each tooth, but with so few radulae for comparison it is impossible to ascertain the significance of the differences. The radulae of *Hypotriphora subula* (Verco) and *Strobiligera ibex* Dall are as yet unknown.

After long and careful study of specimens and SEMs of many species, I am certain that *Inella* (s.l.) contains a number of natural groups that are worthy of genus-group status, most of which are as yet unnamed. However, most of these groups seem to overlap in a complex mosaic of characters, and clearly we will have to study many species in conjunction with radulae before group limits can be ascertained.

In addition to the species described below I know of at least five more from mid-shelf depths off South Australia, Victoria and New South Wales, which are

distinct but unfortunately too poorly preserved for description.

Inella obliqua (May, 1915)
Figs 4D, 6E-G

Triphora obliqua May, 1915:91, pl.4, figs 21, 21a; May, 1923, pl. 27, fig. 23.
Notosinister (Cautor) obliqua.—Finlay, 1927:384.
Cautor obliqua.—Cotton & Godfrey, 1931:54, pl.1, figs 9, 10.

Description. Shell 15.2–19 (est.) mm x 2.75–3.70 mm, of 19½–20½ whorls, stout, very narrowly conical, spire up to 6.5 x higher than aperture plus canal.

Colour: Protoconch translucent white. Teleoconch either uniform translucent white, or white with scattered irregular patches of pale yellowish brown.

Protoconch of lecithotrophic larval type, subcylindrical, demarcated by teleoconch nodules, of 2½–3 whorls, diameter 520–630 μm, diameter of first whorl 330–670 μm. First whorl broadly rounded, smooth or very finely granulate, frequently bulbous and considerably broader than succeeding whorls. Subsequent whorls with 2 similar, smooth, crisp, median spiral cords, and a low subsutural swelling that may be smooth or faintly beaded. A suprasutural spiral is exposed on last whorl.

Teleoconch whorls flat-sided or very shallowly convex, reticulately sculptured with spiral cords and axial costae, intersections strongly nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 3 or 4 on base, spiral 4 well exposed at suture on spire. Spirals 1–4 commencing simultaneously, spiral 1 very weak at first, gradually enlarging to resemble spirals 2 and 3, which are strongest and similar throughout. Spirals 1–3 strongly nodular, subtriangular in section, adapical margins sharply defined, abapical margins ill-defined. Spirals 4–8 rounded in section, spiral 4 strong, weakly undulate, spirals 5–8 weak and smooth. Axial costae straight, strongly opisthocline, evenly traversing whorls, evanescent against spiral 4, numbering 14–18 on penultimate whorl. Base rather evenly contracted. Aperture subquadrate. Outer lip prominently flared and produced, inner extremity shallowly infolded and distant from base of inner lip; profile prosocyrt-opisthocline below a simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 4B) rather thin, pale yellow, spiral, oval, nucleus eccentric, of about 3 whorls. Muscle attachment scar simple.

Radula (Fig. 4D) with the formula 11 + 1 + 1 + 1 + 11. Central tooth 2.9 μm wide, with 5 cusps; lateral teeth each 2.9 μm wide, with 4 cusps; marginal teeth 2.9–2.4 μm wide, each with 3 cusps.

Type locality. Off Port Arthur, Tasmania, 91–128 m.

Types. Two syntypes in TMAG, both illustrated by May (1915 pl.4, figs 21, 21a). The specimen with intact protoconch (fig. 21a) is here selected as lectotype (TMAG E529a).

Other material examined (41 specimens). *Tasmania:* off Cape Forestier (42°10′S, 148°34.7′E), 205 m, 19 Mar 1973, MT *Sprightly,* B.M.R. stn S73-2017 (AMS); off Schouten I., 146 m, W.L. May (COTYPES, AMS); 10 miles off Schouten I., 146 m (SAM). *South Australia:* off Beachport, 549 m, Verco Coll. (SAM); off Cape Jaffa, 549 m, Verco Coll. (SAM); between Cape Jaffa & Kangaroo I., 75–155 m, 26 June 1962, HMAS *Gascoyne* stn G2/77/62 (AMS); off Cape Borda, 101 m & 113 m, Verco Coll. (2 lots SAM); 40 miles S of Cape Wiles, 183 m, Fisheries Bureau, *Endeavour* & T.A. Garrard Coll. (3 lots AMS). *Western Australia:* "Great Australian Bight", 146–220 m, Verco Coll. (SAM); 100 miles E of Salisbury I. (34°13′S, 125°04′E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS).

Remarks. *I. obliqua* is distinguished by its large, predominantly white shell, bulbous protoconch, shelved teleoconch spirals, and very oblique axial costae. Placement in *Inella* is tentative pending comparison of the radula with that of *I. gigas* (Hinds). The dimensions of the only known intact adult specimen (C.65935) are 15.2 x 2.75 mm (20½ whorls).

Inella spina (Verco, 1909)
Fig. 10I–K, Table 3

Triphora spina Verco, 1909:280, pl.22, figs 2–4; May, 1923, pl.27, fig. 24.
Triphora subula Verco, 1909:280 (in part).
Notosinister spina.—Cotton & Godfrey, 1931:54.

Description. Shell 6.95–13.0 mm x 1.50–2.00 mm, of 14–24 whorls, very narrowly conical, spire up to 6.74 × higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white. Subsequent whorls either uniform pale yellowish brown, or white and sparsely and irregularly maculate with pale yellowish brown; base white or pale yellowish brown.

Protoconch of lecithotrophic larval type, narrowly conical, demarcated by appearance of teleoconch axials, of 3–4 smooth, submedially strongly angulate whorls, diameter 520–620 μm, diameter of first whorl 330–470 μm.

Teleoconch whorls flat-sided, reticulately sculptured with strong spiral cords and considerably weaker axial costae, intersections weakly nodular, suture very shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 or 2 on base, spiral 4 well exposed at suture on spire, a rapidly enlarging secondary spiral

Table 3. *Inella spina.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	9	9.22	6.95–13.0	2.12
Diameter	9	1.66	1.50–2.00	0.17
Height/diameter	9	5.49	4.63–6.66	0.76
Diameter 1st whorl	9	0.38	0.33–0.47	0.04
No. whorls	9	18.11	14.00–24.00	2.95
No. axials	6	19	18–21	1.26

between spirals 2 and 3 on last whorl of mature specimens. Spirals 3 and 4 commencing immediately and strong, spiral 3 continuing from protoconch angulation; spirals 1 and 2 commencing slightly later, very weak at first, gradually enlarging so that spiral 2 is as large as spiral 3; spiral 1 remaining slightly weaker than spirals 2 and 3 throughout. Spirals 1–3 rather weakly nodular, spiral 4 gently undulate, spirals 5 and 6 smooth. Axial costae weak, straight, opisthocline, evenly traversing whorls, evanescent against spiral 4, numbering 18–21 on penultimate whorl. Base rather suddenly contracted. Aperture subquadrate. Outer lip produced and slightly flared basally, inner extremity shallowly infolded and distant from base of inner lip; profile prosocyrt-opisthocline below simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Animal unavailable.

Type locality. Off Beachport, South Australia, 201 m.

Holotype. SAM D.13449.

Other material examined (51 specimens). *South Australia:* Off Beachport, 201 m, Verco Coll. (SAM, AMS); off Beachport, 366 m, Verco Coll. (SAM); off Cape Jaffa, 165 m & 238 m, Verco Coll. (SAM); Gulf St. Vincent, 18 m, Verco Coll. (ex paratypes of *H. subula*, SAM); off Neptune I., 190 m, Verco Coll. (SAM).

Additional record. Tasmania, 73–128 m (May, 1923, pl. 27, fig. 24).

Remarks. *I. spina* is distinguished from all other known southern Australian triphorids by its very narrowly conical shape, narrowly conical, unicarinate protoconch, weak nodules, and by the weakness of teleoconch spirals 1 and 2 on the first few whorls. Verco's (1909) description of the basal features of *Hypotriphora subula* (Verco) is based on a specimen of this species.

Inella obtusa n.sp.

Fig. 11A–C

Description. Shell 7.00–9.05 mm x 1.60–1.75 mm, of 14–16 whorls, stout, very narrowly conical, spire up to 6.5 x higher than aperture plus canal.

Colour: Uniform deep yellowish brown.

Protoconch of lecithotrophic larval type, blunt-tipped, broadly conical, of 2¾–3 whorls, diameter 570–720 μm, diameter of first whorl 470–670 μm, second whorl sometimes broader than succeeding whorl. Sculptured throughout with a prominent smooth, submedian carina; second and third whorls with the addition of a low, rounded subsutural swelling, otherwise smooth.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and weak axial costae, intersections weakly nodular, suture indistinct, no microsculpture. Spiral cords numbering 5 on body whorl and 1 or 2 on base, spiral 4 almost entirely exposed at suture on spire (the additional spire spiral is termed spiral 2A). Spirals 1–3 commencing immediately, spirals 1 and 3 continuing from protoconch spirals; spiral 2A appearing as a thread between spirals 2 and 3 on 9th or 10th shell whorl, gradually enlarging to resemble adjacent spirals on last few whorls. Spirals 1–4 of similar size throughout, spirals 1–3 and 2A rather weakly nodular, spiral 4 more weakly nodular, spirals 5 and 6 weak and smooth. Spiral interspaces considerably narrower than each spiral on later whorls. Axial costae weak, straight, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering about 21 or 22 on penultimate whorl. Base rather suddenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity damaged but evidently shallowly infolded; profile opisthocline below a shallow, simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Animal unavailable.

Type locality. Off North Head, Sydney, New South Wales, 33 m, 23 May 1972, Shelf Benthic Survey.

Holotype. AMS C.116240 (7.00 x 1.60 mm; 14 whorls).

Other material examined (1 PARATYPE). Reef off Avalon, Sydney, New South Wales, 37 m, among sponges and ascidians, 31 Jan 1973, P. Hutchings (AMS) (9.05 × 1.75 mm; 16 whorls).

Remarks. *I. obtusa* is closest to *I. spina* (Verco), differing primarily in having a shorter, broader protoconch with the addition of a subsutural swelling, in the more even size of spirals 1–3 on the earliest teleoconch whorls, and in the much earlier development of the secondary spiral (2A).

Inella kimblae n.sp.

Fig. 11D–F

Description. Holotype 8.00 x 1.70 mm, of 16 whorls, rather lightly built, very narrowly conical, spire 6.3 x higher than aperture plus canal. Periostracum thick, smooth and glossy, tending to peel away.

Colour: Chalky white beneath yellowish brown periostracum.

Protoconch of lecithotrophic larval type, demarcated by disappearance of adapical spiral, of 3 convex whorls, diameter 470–480 μm, diameter of first whorl 370–380 μm. First whorl smooth and bulbous. Subsequent whorls with 2 smooth, prominent, narrow, median spiral cords, abapical spiral surmounting an increasingly prominent angulation on last whorl and adapical spiral vanishing. A suprasutural thread is exposed on last whorl.

Teleoconch whorls prominently angulate at spiral 3, sculptured with prominent spiral cords and almost absolete axial costae, intersections nodular, suture well-defined, no microsculpture. Spiral cords numbering 4 on body whorl, none on base, spiral 4 partly exposed at suture on spire. Spirals 3 and 4 commencing immediately and strongly, spiral 3 continuing from protoconch angulation, spiral 4 continuing from suprasutural spiral. Spirals 1 and 2 appearing soon after disappearance of adapical protoconch spiral, weak on first few whorls, gradually enlarging but never as strong as spiral 3. Spirals 1–3 nodular, spirals 1 and 2 similar

throughout; spiral 3 broadest, highest and most strongly nodular; spiral 4 smooth. Interspace of spirals 1 and 2 about as broad as each spiral, interspace of spirals 2 and 3 considerably broader than each spiral. Axial costae almost obsolete, conspicuous only as nodules at intersections with spirals, strongly opisthocline, numbering 15 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip damaged. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, short.

Animal unavailable.

Type locality. Off Sydney, New South Wales (34°04.2'S, 151°37.2'E), 384 m, 3 Nov. 1976, HMAS *Kimbla* stn S.2.

Holotype. AMS C.130014 (8.00 x 1.70 mm; 16 whorls).

Other material examined (3 PARATYPES). Off Sydney, New South Wales (34°04.2'S, 151°37.4'E), 393 m, 3 Nov 1976, HMAS *Kimbla* stn S.1 (AMS).

Remarks. *I. kimblae* is well characterized by its bulbous protoconch, angulate teleoconch whorls, and almost obsolete axial costae. The presence of a conspicuous periostracum that easily peels away is most unusual for a triphorine.

Inella carinata n.sp.

Fig. 11G–I, Table 4

Description. Shell 3.90–8.75 mm, 1.25–2.50 mm, of 9–12¾ whorls, rather thick, stout, narrowly cyrtoconoid, spire up to 3.7 × higher than aperture plus canal.

Colour: Protoconch and early teleoconch whorls white; subsequent whorls uniform white or white and sparsely maculate with pale yellowish brown; base white.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 2¾–3 whorls, diameter about 720–770 μm, diameter of first whorl 370–400 μm. Sculptured throughout with a low, smooth, subsutural spiral swelling, and 2 strong, smooth, rounded, median, angulating spiral carinae, abapical carina slightly stronger.

Teleoconch: First whorl flat and parallel-sided, subsequent whorls shallowly convex. All whorls reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 or 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–3 commencing immediately, continuing from protoconch spirals. Spirals 1–3 strongly nodular, similar on all whorls except start of first whorl where spiral 1 weakest; spiral 4 more weakly nodular, spirals 5 and 6 smooth, spiral 6 weak if present. Axial costae straight, more or less orthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17–23 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity shallowly infolded and distant from base of inner lip, indented below insertion, profile prosocyrt-opisthocline below an open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, short.

Animal unavailable.

Type locality. Gulf St. Vincent, South Australia, 26 m.

Holotype. SAM D.16239 (ex paratype of *T. nivea* Verco).

Other material examined (7 PARATYPES). *South Australia:* Gulf St. Vincent, 26 m, Verco Coll. (SAM). *Western Australia:* Windy Harbour, beach drift, 3 Feb 1972, W.F. & J.M. Ponder (AMS); Margaret River, shell sand, Nov. 1975 (MPM); Ellenbrook, near Cowaramup, Verco Coll. (SAM); Yallingup, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. *I. carinata* is rendered very distinctive by the combination of blunt-tipped, strongly bicarinate protoconch, parallel-sided first teleoconch whorl, and immediate appearance of teleoconch spiral 2. Placement in *Inella* (s.l.) is tentative pending knowledge of the radula. It may well prove referable to *Teretriphora* Finlay.

Table 4. *Inella carinata.* Shell measurements (mm) and countings.

Height	Diameter	Height/ Diameter	Diameter 1st whorl	No. whorls	No. axials
8.75	2.50	3.50	0.40	12.75	23
4.10	1.60	2.56	0.37	9.00	17
4.00	1.40	2.85	0.40	9.00	18
3.90	1.25	3.12	0.40	8.50	17

Inella intercalaris n.sp.

Fig. 11A–D

Description. Shell 5.00–9.40 (est.) mm x 1.40–2.15 mm, of 11½–17 (est.) whorls, stout and rather heavy, narrowly cyrtoconoid, spire up to 5.4 × higher than aperture plus canal.

Colour: Protoconch and early teleoconch whorls white; subsequent whorls uniform white or white and irregularly maculate with pale yellowish brown, base white.

Protoconch of lecithotrophic larval type, blunt-tipped, merging insensibly into teleoconch but of about 2¾ whorls, diameter about 470 μm, diameter of first whorl 370 μm. Sculptured throughout with 2 prominent, rounded, median, angulating spiral carinae that are finely beaded at adapical margins; last two whorls with a subsutural row of axially elongate nodules.

Teleoconch whorls shallowly convex at first, then flat-sided, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture very shallow, no microsculpture. Spiral cords numbering 5 on body whorl and 2 or 3 on base, spiral 4 slightly exposed at suture on spire (the additional spiral is termed spiral 2A). Spirals 1–3 commencing immediately, spirals 2 and 3 continuing from protoconch carinae; spiral 2A appearing as a thread between spirals 2 and 3 on about

10th shell whorl, rapidly enlarging until almost as large as adjacent spirals in large specimens. Spiral 1 weaker than spirals 2 and 3 on earliest whorls, enlarging until slightly broader than spirals 2–4 and 2A, which are similar on later whorls. Spirals 1–4 and 2A nodular, summits of nodules depressed, sharp-edged; spirals 5–7 smooth. Axial costae more or less straight, orthocline or weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19–c.28 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded and distant from base of inner lip, indented below insertion, profile prosocyrt-opisthocline below open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, open, short.

Animal unavailable.

Type locality. West of Eucla, Western Australia, 148 m.

Holotype (ex Verco Coll.). SAM D.16240 (5.00 × 1.40 mm; 11½ whorls).

Other material examined (3 PARATYPES). *South Australia:* Gulf St. Vincent, c.46 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off Point Brown, 8 m, Sept 1972, D. Pearsons (MPM).

Remarks. *I. intercalaris* is immediately distinguishable from the superficially similar *I. carinata* n.sp. by its beaded protoconch carinae, depressed teleoconch nodules, convex first teleoconch whorl and the additional spiral on mature whorls. Like *I. carinata,* it may ultimately prove to be better placed in *Teretriphora.*

Genus *Hypotriphora* Cotton & Godfrey

Hypotriphora Cotton & Godfrey, 1931:56. Type species (original designation): *Triphora subula* Verco, 1909; Recent, South Australia.

Although otherwise rather similar to *Inella gigas* (Hinds, 1843) (Fig. 10D,H), *H. subula* differs markedly in being relatively and absolutely smaller, in having much weaker axial costae, and in having spiral 4 slightly instead of almost entirely exposed on the spiral whorls. However, the differences between them seem no greater than between most species herein referred to *Inella* (s.l.), and without knowledge of their radulae, and shells and radulae of many other species, it is impossible to ascertain yet which if any of the observed differences have generic significance. While I have little doubt that *Hypotriphora* is distinct from *Inella*, confirmation of its status must await a more detailed study of the group as a whole.

Hypotriphora subula (Verco, 1909)
Fig. 12E–G

Triphora subula Verco, 1909:279, pl. 23, figs 5, 6.
Triphora spina Verco, 1909:279 (in part).
Hypotriphora subula.—Cotton & Godfrey, 1931:56, pl.1, figs 11, 12.

Description. Shell 1.05–12.0 mm x 1.65 mm, of 20½–23 whorls, very narrowly conical, spire up to about 8.6x higher than aperture plus canal.

Colour uniform brownish yellow, spiral 1 sometimes darker.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 3½ whorls, diameter about 470–570 μm, diameter of first whorl 380–450 μm. Sculptured throughout with 2 similar, strong, rounded, median spiral cords, and a low subsutural swelling.

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed at suture on spire. Spirals 1–3 continuing from protoconch spirals, spirals 2–4 of similar size, spiral 1 lower and slightly broader, spirals 1–3 strongly nodular, spiral 4 more weakly nodular. Axial costae strong, rather straight, gently opisthocline, evenly traversing whorls, numbering about 18 on penultimate whorl of large specimens. Mature apertural and basal features unknown.

Animal unavailable.

Type locality. Gulf St. Vincent, South Australia, dredged, depth not recorded.

Holotype. (ex Verco Coll.) SAM D.13454 (12.0 x 1.65 mm; 23 whorls).

Other material examined (3 specimens). *South Australia:* Gulf St. Vincent, 18 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off Point Brown, Smoky Bay, 40 m, Jan. 1972, D. Pearsons (MPM).

Remarks. Compared with the superficially similar *Inella spina* (Verco), *H. subula* differs primarily in having a subcylindrical instead of narrowly conical protoconch with two median spiral cords instead of a single submedian angulation, and in having teleoconch spirals 1–3 more similar in size on the early whorls. The paratype (SAM) on which Verco (1909) based his description of the basal features of *H. subula* is in fact a well-preserved, perfectly typical specimen of *I. spina.* A very similar species is not uncommon at the Kermadec Islands (NMNZ MF.14588).

Genus *Subulophora* Laseron

Subulophora Laseron, 1958:610. Type species (original designation): *Subulophora exporrecta* Laseron, 1958 (= *Triforis (Inella) rutilans* Hervier, 1897); Recent, Indo-Pacific.

S. rutilans is so similar to *Hypotriphora subula* in teleoconch facies that it is likely that *Subulophora* will ultimately prove to be a synonym of the prior *Hypotriphora.* The differences between the protoconch of *S. rutilans* and *H. subula* simply reflect planktotrophic and lecithotrophic larval development respectively. *Subulophora* is maintained as distinct from *Hypotriphora* pending comparison of radulae of their type species. The adult basal features in *Subulophora*

(unknown in *Hypotriphora*) are essentially similar to those of *Inella* (s.l.).

Operculum (as in Fig. 1I) horny, thin, externally shallowly concave, translucent, pale yellow, subcircular, nucleus subcentral, spiral, of about 4 whorls. Periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (*S. rutilans*, Fig. 6B) with the formula 7 + 1 + 1 + 1 + 7. Central and lateral teeth similar, each 1.9 μm wide, with 5 cusps; marginal teeth 1.2 μm wide, each with 4 cusps.

Subulophora rutilans (Hervier, 1897)

Figs 6B, 12H-J; Table 5

Triforis (Inella) rutilans Hervier, 1897:255.—1898:286, pl. 16, figs 4, 4a.

Notosinister stramentia Laseron, 1954:154, fig. 22. New synonym.

Subulophora exporrecta Laseron, 1958:611, figs 125, 126. New synonym.

Subulophora stringera Laseron, 1958:642 (nomen nudum).

Inella verrucosa.—Kosuge, 1962a:119, pl.7, fig. 1; 1962b:87. pl.8, fig. 2; Habe & Kosuge, 1966:107, pl.41, fig. 34 (**not** Adams & Reeve, 1850).

Triphora peasi.—Kay, 1979:148, fig. 52C (**not** Jousseaume, 1884).

Description. Shell 2.70–7.70 mm x 0.75–1.70 mm, of 12½–22 whorls, sometimes larger, lightly built, very narrowly conical, spire up to 7.1 × higher than aperture plus canal.

Colour of protoconch reddish brown when fresh, fading to yellowish brown. Teleoconch rather uniform light yellowish, reddish or orange brown, sometimes light yellowish brown on earliest whorls and uniform white on later whorls.

Protoconch of planktotrophic larval type, very narrowly conical, of 7–7¼ convex whorls, diameter 430–470 μm, diameter of first whorl 120–130 μm. First whorl sculptured with minute T-shaped granules that are interconnected to form spirals. Subsequent whorls traversed by fine, very crisp axial riblets that are interrupted, immediately above abapical spiral, by a narrow smooth zone; and encircled by 2 fine, crisp median spiral threads. First half of second whorl with 2 similar weak spiral threads, abapical spiral surmounting a prominent, sharp angulation on all subsequent whorls. Adapical spiral more gradually enlarging, surmounting a weak angulation after third protoconch whorl, angulation gradually increasing in prominence to resemble abapical angulation on last 2 whorls only.

Table 5. *Subulophora rutilans*. Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls	No. axials
2.70	0.75	3.60	0.12	12.50	16
2.90	0.80	3.63	0.12	13.50	16
3.20	0.85	3.76	0.12	14.00	17
4.25	1.00	4.25	0.12	16.50	18

Teleoconch whorls very shallowly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, a secondary spiral between spirals 2 and 3 on body whorl behind outer lip, and later, sometimes between spirals 1 and 2. Spirals 1–3 commencing immediately, spirals 2 and 3 continuing from protoconch spirals. Spirals 2 and 3 strong and similar throughout; spiral 1 weak at first, gradually enlarging to resemble spirals 2 and 3 on body whorl only. Spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 weakest, similar, smooth. Axial costae shallowly prosocyrt and almost orthocline, or straight and gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 16–18 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip flared and produced basally, inner extremity very shallowly infolded to almost contact base of inner lip; profile prosocyrt-opisthocline below a broad, shallow, simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Operculum and radula (Fig. 6B) described under *Subulophora*.

Type localities. *T. rutilans*: Lifu, Loyalty Islands. *N. stramentia*: Hawkes Bay, Port Stephens, New South Wales. *S. exporrecta*: Port Moresby, Papua New Guinea.

Types. *T. rutilans*: HOLOTYPE MNHN. *N. stramentia*: HOLOTYPE AMS C.65853. *S. exporrecta*: HOLOTYPE AMS C.8525.

Other material examined (c.100 specimens). Comoro Is, Mozambique Channel (several lots MNHN); off NE Point, Christmas I., Indian Ocean, 183 m, R. Kirkpatrick (AMS); Kepuhi, Oahu, Hawaii, 33 m, Apr. 1977, R. Salisbury (E.A.Kay coll.); Plantation Reef, Marau Sound, Guadalcanal, Solomon Is, intertidal stone washings, 24 Sep. 1965, R.K.Dell (NMNZ); off Sambulo I., Marovo Lagoon, Vangunu I., Solomon Is, 4 m, 14 Nov. 1965 (NMNZ); Yandina, Banika I., Russell Is, Solomon Is, 24 Oct. 1965, R.K. Dell (NMNZ); Kuia I., Lusancay Is, Papua New Guinea, intertidal on reef, 10-14 June 1970, W.F. Ponder & P.H. Colman (AMS); Lifu, Loyalty Is, C. Hedley (AMS); Euston Reef, off Cairns, slope below steep coral walls, 21 m, 30 Nov. 1972, P.H. Colman (AMS).

Remarks. *S. rutilans* is superficially similar to many species of *Inella* (s.l.) (mostly undescribed), but it is certainly by far the most frequently encountered species in shallow water. Throughout much of its range *S. rutilans* frequently occurs sympatrically with another species that appears to differ only in having a uniform lavender teleoconch and similar, strongly angulating spiral threads on all but the first protoconch whorl. This is almost certainly *T.(I.) rutilans* var. *violacea* Hervier, 1897, which, if correctly identified, should be allocated species rank (*Inella subfenestrata* Kosuge, 1962 may be

a synonym). Unfortunately, this identification could not be verified because syntypes of Hervier's nominate varieties are not segregated in his collection (MNHN—P. Bouchet, pers. comm.). *S. rutilans* is superficially very similar to *S. kanaina* (Jousseaume, 1884)and *S. peasi* (Jousseaume, 1884), with which it occurs sympatrically in Hawaiian waters. *S. kanaina* is lavender like *S.* cf. *violacea,* and both *S. kanaina* and *S. peasi* are more broadly conical than *S. rutilans* (and *S.* cf. *violacea*), with markedly cyrtoconoid instead of narrowly conical spires. By comparison with syntypes (MCZH 50058) *T. kanainus* was misidentified as *Triphora tubularis* (Laseron, 1958) by Kay (1979, p.151, fig. 52M). Besides other differences *Coriophora tubularis* Laseron, has a late-developing teleoconch spiral 2 and is certainly not closely related.

The present specimens are indistinguishable from Kosuge's (1962a, 1962b) and Habe & Kosuge's (1966) illustrations of a species they identify as *Inella verrucosa* (Adams & Reeve,1850). Their conspecificity is suggested by Habe & Kosuge's (1966) contention that *S.exporrecta* is a synonym. Judging from the original illustration, *T. verrucosus* Adams & Reeve (1850, pl. 11, fig.32a, b) is certainly very similar, having teleoconch spiral 1 weak throughout. However, the only known syntype (BMNH 1878.1.28.483) is certainly neither the illustrated specimen nor even conspecific, differing in being smaller (length 5.10 mm vs c.8.50 mm), and in having teleoconch spiral 2 commencing late, with spirals 1–4 of similar size on mature whorls. While *T. verrucosus* is almost certainly related to *Inella*, the original illustration could represent any one of a great number of superficially similar species. Consequently *T. verrucosus* must remain a nomen dubium until the original illustrated specimen is discovered.

The type specimens of *T. rutilans*, *N. stramentia* and *S. exporrecta* have incomplete and/or worn protoconchs but are indistinguishable in teleoconch facies and remaining protoconch details.

Compared with Western Pacific and Indian Ocean specimens, Hawaiian specimens consistently have slightly broader first protoconch whorls (diameter 130 μm vs 120 μm) but are otherwise identical. Hawaiian specimens may ultimately prove to represent a distinct subspecies or a very closely related species, but for the present I prefer to regard them as a local population of *S. rutilans*.

Genus *Magnosinister* Laseron

Magnosinister Laseron, 1954: 157. Type species (original designation): *Magnosinister hedleyi* Laseron, 1954; Recent, New South Wales.
Macrosinister Laseron, 1954: 158 (error).

M. hedleyi differs from *Inella gigas* (Hinds) and *Hypotriphora subula* (Verco) in shell sculpture and in being relatively larger, attaining smaller absolute size than *I. gigas* and much greater absolute size than *H. subula*. They are otherwise rather similar. Although *M. hedleyi* seems very distinctive, as with *Hypotriphora* Cotton & Godfrey, confirmation of the status of *Magnosinister* must await a more detailed knowledge of the *Inella*-group.

Magnosinister hedleyi Laseron, 1954
Fig.13A-C

Magnosinister hedleyi Laseron, 1954: 157.
Macrosinister hedleyi.—Laseron, 1954: 158, fig. 28.

Description. Shell 14.0-22 (est.) mm x 4.10–6.10 mm, of 16¼-18 (est.) whorls, thick and heavy, narrowly conical, spire up to 4.3 × higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white. Subsequent whorls buff white, sparsely and irregularly spotted and maculate with yellowish brown, most deeply pigmented between nodules on spirals.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 2½–3 whorls, diameter of first whorl 430 μm. First whorl smooth and evenly convex, subsequent whorls with 2 similar, prominent, smooth, rounded spiral cords on abapical half; last whorl with a low subsutural swelling and a suprasutural spiral cord.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and weaker axial costae, intersections weakly nodular, suture very shallow. Most specimens with fine, rather poorly developed spiral threads in spiral interspaces and on base. Spiral cords continuing from protoconch spirals, numbering 4 on body whorl and 1 on base, spiral 4 entirely exposed at suture on all spire whorls; a secondary spiral between spirals 2 and 3 on mature body whorl behind outer lip, sometimes 2 secondary spirals on base below spiral 5. Spirals 1 and 2 similar throughout; spirals 3 and 4 strongest, the most crisply defined on later whorls, similar on body whorl, spiral 3 highest on spire; spirals 1–3 weakly nodular, spiral 4 more weakly nodular, spiral 5 weakest, weakly undulate. Interspaces of spirals 1 and 2 and 3 and 4 about as wide as each spiral, interspace of spirals 2 and 3 considerably broader. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 26–28 on penultimate whorl. Base rather suddenly contracted below spiral 4. Aperture subquadrate. Outer lip produced and flared, inner extremity shallowly infolded to almost contact base of inner lip, profile opisthocline below shallow, simple posterior siphonal notch. Inner lip very thick, produced. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Animal unavailable.

Type locality. Little Coogee Bay, Sydney.

Holotype. AMS C.31445.

Other material examined (17 specimens). *New South Wales:* Shelly Bay, S of Angourie, 1976, D. Tarrant (MPM); Clarence River, A.A. Cameron (AMS); Catherine Hill Bay, S of Newcastle, R.L. Cherry (AMS); Palm Beach, N of

Sydney, J. Kerslake (AMS); E of Long Bay, Sydney (33°58.42'S, 150°16.0'E), 37–40 m, 23 Aug. 1973, Shelf Benthic Survey Stn 6 (AMS); Woolgoolga, 1950–60, J. Voorwinde (AMS); Woolgoolga, J. Kerslake (AMS); Woolgoolga, Dec. 1947, N. Jackson (AMS); Twofold Bay, R.S. Bell (AMS).

Remarks. *M. hedleyi* is the most massive triphorid known from Southern Australia and cannot be confused with any other species. Apart from the size, distinctive characters include the few-whorled spirally carinate protoconch, the colour pattern, and the presence of four spiral cords on all spire whorls. Laseron (1954, p.158) incorrectly stated that the two most crisply defined spirals (i.e. 3 and 4) lie on either side of the suture instead of above it. Furthermore his illustration of the axial sculpture is surprisingly inaccurate and quite misleading. The dimensions of the only known intact adult specimen (Fig. 13A–C) are 14.0 x 4.10 mm (16.25 whorls).

Genus *Monophorus* Grillo

Monophorus Grillo, 1877: 58. Type species (by monotypy): *Trochus perversus* Linné, 1758; Recent, Mediterranean.
Biforina Bucquoy, Dautzenberg & Dollfus, 1884: 209. Type species (by monotypy): *Trochus perversus* Linné, 1758.
Notosinister Finlay, 1927: 384. Type species (original designation): *Triphora fascelina* Suter, 1908; Recent, New Zealand. New synonym.

Diagnosis. Triphorines with T-shaped granules on 1st whorl, and with or without a smooth spiral zone on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Sculpture evenly reticulate, with nodular intersections. Central tooth with 5 cusps, lateral teeth with 5–7 cusps, most marginal teeth with 4 or 5 cusps.

Description. Shell up to 14.5 mm high, narrowly conical, spire up to 5.6 x higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with minute T-shaped granules on first whorl. Subsequent whorls encircled by 2 median spiral threads and a suprasutural thread. Axial riblets entirely traversing whorls or interrupted by a broad or narrow, smooth adapical zone. Lecithotrophic larval protoconch with a prominent submedian angulation.

Teleoconch of up to 12½ flat-sided or shallowly convex whorls that are usually slightly but distinctly angulate at spiral 3, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow or very shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 commencing later, enlarging to resemble adjacent spirals or remaining weak. Spirals 1–4 or 1, 3 and 4 similar. Spirals 1–3 or 1 and 3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 smooth. Axial costae about as strong as spirals 1–4, straight or shallowly opisthocyrt, orthocline, or gently opisthocline, evenly traversing whorls, evanescent below spiral 4. Base rather evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip, posterior siphonal notch open and simple or partly enclosed. Inner lip thick. Parietal glaze thick or thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (as in Fig. 1I) rather thick, flat, pale brownish yellow, nucleus subcentral, of about 3 whorls: periphery thin, upturned, slightly projecting from suture externally. Muscle attachment scar well-defined, no accessory peg.

Radula (Fig. 6C; Bouchet, 1983, figs 5–9) with the formula 8–12 + 1+ 1 + 1 +12–8. Central tooth with 3 or 5 cusps. Lateral teeth with 5 or 6 cusps. Marginal teeth with 4 cusps, outermost pair of teeth with 2 or 3 cusps.

Remarks. The type species of *Monophorus* and *Notosinister* are distinctive in combining T-shaped granules on the first whorl of the planktotrophic larval protoconch with a late developing teleoconch spiral 2. Their radulae are similar and distinctive, particularly the marginal teeth, and they are undoubtedly very closely related (see Fig.6C and Bouchet, 1983, figs 5–7). Judging from protoconch facies, the group had a direct origin from the *Inella* group. The protoconch of *N. fascelina* differs from that of *M. perversa* (Bouchet, 1983, figs 20, 21) in having the adapical and abapical riblet zones smoothly interconnected instead of interrupted by a narrow to broad adapical zone. However, *M. thirioti* Bouchet, 1983 (Bouchet, 1983, fig. 22), *M. erythrosoma* Bouchet & Guillemot, 1978 (Bouchet, 1983, fig. 23), and *M. angasi* (Crosse & Fischer) (Fig. 13K) have riblet zones that are almost in contact yet spirally dislocate to some extent, and are thus morphologically intermediate. Therefore it is impossible to justify maintenance of *Monophorus* and *Notosinister* as distinct genera, so *Notosinister* is placed as a synonym of the prior *Monophorus*. Incidentally *Monophorus* Grillo, 1877 is not a homonym of *Monophora* Quoy & Gaimard, 1824 (see ICZN Article 56 [a]), so *Biforina* Bucquoy, Dautzenberg & Dollfus, 1884 is an unnecessary substitute.

M. angasi is atypical in having three cusps on most of its marginal teeth (some teeth have four), but is otherwise closer to *Monophorus* species than to the type species of any other genus group taxa. *M. nigrofusca* is atypical in having three cusps on all of its marginal teeth and in that teleoconch spirals 1–3 commence simultaneously, but it is tentatively placed in *Monophorus* because of general similarity of its radula to that of *M. angasi*. If *M. nigrofusca* is indeed referable to *Monophorus*, its teleoconch sculpture might be supporting evidence for derivation of *Monophorus* from the *Inella* group. The presence of three cusps on each marginal tooth coupled with (apparently) primitive teleoconch morphology might suggest that there has been cusp multiplication in *Monophorus*, but the reverse could equally well be true.

Monophorus australica n.sp.

Fig. 13D-G

Description. Shell 7.05-9.00 (est.) x 1.65-1.85 mm, with 16.5-20 (est.) whorls, narrowly conical, rather stout, spire up to 6 x higher than aperture plus canal.

Colour of protoconch reddish brown, teleoconch uniform buff white or pale yellowish brown.

Protoconch of planktotrophic larval type, narrowly conical, of 3¾ convex whorls, diameter 370 μm, diameter of first whorl 200 μm. First 1½ whorls sculptured with minute, spirally aligned, T-shaped granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 2 fine crisp median spiral threads that surmount low angulations, adapical spiral highest; a suprasutural spiral is exposed on last half-whorl.

Teleoconch whorls shallowly convex, slightly but distinctly angulate at spiral 3, reticulately sculptured with strong, well-defined spiral cords and axial costae, intersections nodular, suture shallow but well-defined, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical protoconch spiral; spiral 2 appearing as a thread on 8th shell whorl, gradually enlarging to resemble spiral 1 by about 11th whorl. Spirals 1-3 strongly nodular, spiral 4 more weakly nodular, spiral 5 weakly nodular on last half whorl, spiral 6 smooth. Spirals 1 and 2 similar, spiral 3 highest and broadest, spiral interspaces about as wide as each spiral. Axial costae straight or shallowly opisthocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17-20 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity moderately infolded to contact base of inner lip; profile opisthocline below a deep, partly enclosed, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin, thickened beside posterior notch. Anterior siphonal canal oblique, tubular, rather long.

Animal unavailable.

Type locality. Off Neptune I., South Australia, 190 m.

Types. HOLOTYPE (ex Verco Coll.) SAM D.16241 (7.05 x 1.65 mm; 16.5 whorls); 3 PARATYPES SAM.

Remarks. *M. australica* is rendered distinctive by its uniformly coloured teleoconch, strong spiral 3, and well developed basal characters. The extremely distinctive sculpture on the first 1½ whorls can be resolved with a stereo microscope at about x 100.

Monophorus angasi (Crosse & Fischer, 1865)

Figs 4E, 13I-K, table 6

Triphoris angasi Crosse & Fischer, 1865: 46, pl. 1, figs 12, 13.
Triphora angasi.—Hedley, 1903: 610.
Teretriphora angasi.—Cotton & Godfrey, 1931: 56.
Notosinister fulvalinearis Laseron, 1954: 153, figs 20, 20a. New synonym.

Description. Shell 3.25-8.15 mm x 1.00-2.15 mm, of 12½-17½ whorls, rather lightly built, narrowly cyrtoconoid, spire up to 4.9 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch yellowish or reddish brown, base a darker shade on and below spiral 5, summits of spirals 1-4 greyish or buff white, region between spirals 2 and 5 usually white on body whorl behind outer lip.

Protoconch of planktotrophic larval type, narrowly conical, of 3½-4½ convex whorls, diameter 320-400 μm, diameter of first whorl 150-170 μm. First whorl ornamented with minute T-shaped granules. Subsequent whorls encircled by 2 similar, fine, crisp, weakly angulating spiral threads, and traversed by fine crisp axial riblets that are interrupted on last whorl by a very narrow smooth zone above the adapical spiral. Adapical spiral vanishing on last half whorl and abapical spiral surmounting a prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with crisp spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 appearing as a thread on 8th or 9th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1-4 of similar height, spirals 2-4 of similar size, spiral 1 slightly broader, spirals 1-3 strongly nodular, spiral 4 strongly or weakly nodular, spiral 5 weakly nodular or smooth, spiral 6 smooth. Spiral interspaces about as wide as each spiral or wider. Axial costae about as strong as spirals 2-4, straight, orthocline or gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19-24 on penultimate whorl. Base evenly contracted. Aperture subquadrate or ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip; profile prosocyrt-opisthocline below a simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) thin, externally shallowly concave, subcircular, nucleus almost central, of about 3½ whorls. Periphery thinner, not conspicuously

Table 6. *Monophorus angasi*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	14	4.91	3.25-8.15	1.38
Diameter	14	1.46	1.00-2.15	0.31
Height/diameter	14	3.32	2.73-3.79	0.32
Diameter 1st whorl	14	0.16	0.15-0.17	0.01
No. whorls	14	14.04	12.00-17.50	1.69
No. axials	14	21	19-23	1.44

projecting from suture externally. Muscle attachment scar simple.

Radula (Fig. 4E) with the formula 11 + 1 + 1 + 1 + 11, all cusps narrowly conical and rather similar. Central tooth 4.8 μm wide, with 4 cusps. Lateral teeth each 4.8 μm wide, with 5 cusps. Marginal teeth decreasing in size outwards, 3.4–2.9 μm wide, inner 6 pairs each with 3 or 4 cusps, outer 5 pairs each with 3 cusps. The only available preparation is bilaterally asymmetrical in the central region so it is impossible to ascertain the normal number of cusps per tooth.

Type localities. *T. angasi*: Gulf St. Vincent, South Australia; *N. fulvalinearis*: Little Coogee Bay, Sydney, New South Wales.

Types. *T. angasi*: repository unknown—apparently originally in the collection of the Journal de Conchyliologie but not received by the MNHN, the present repository of this collection (P. Bouchet, pers. comm.). *N. fulvalinearis*: HOLOTYPE AMS C.65858.

Other material examined (314 specimens). *New South Wales*: Port Stephens, M. Ward (AMS); off Broughton I., 64 m, J. Brazier (AMS); Long Reef, Collaroy, 1950-60, J. Voorwinde (AMS); off Long Reef, 15 m, 28 Apr. 1972, Shelf Benthic Survey (AMS); off Long Reef, 29 m, Apr. 1972, P. Hutchings (AMS); off North Head, 33 m, 25 May 1972, Shelf Benthic Survey (AMS); Middle Harbour, Sydney, C. Hedley (AMS); Kurnell, L. Woolacott (AMS); off Chinaman's Beach, Sydney, 27 Apr. 1952, J. Kerslake (AMS); 1 km E of Little Bay, Sydney (33°58.43′S, 151°15.51′E), 35 m, 16 May 1972, Shelf Benthic Survey (AMS); off Sow and Pigs Reef, Port Jackson, 11 m, T.A. Garrard (AMS); Shell Harbour, J. Voorwinde, (AMS); Twofold Bay, 18 m, T.A. Garrard (AMS). *Tasmania*: East Cove, Deal I. (39° 30′S, 147°20′E), 6–15 m, 3–10 May 1974, S.A. Shepherd (AMS); E of King I., (40°00.1′S, 144°13.7′E), 33 m, 30 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2161 (AMS); E of Grassy, King I., c.58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); W of West Point (41°01.2′S, 144°21.5′E), 80 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2117 (AMS); Fluted Cape, *Macrocystis* washings, 13–15 m, Feb. 1972, N. Coleman (AMS). *Victoria*: Off Lakes Entrance, 37–46 m (AMS); Bears Gully, Waratah Bay, shell sand, 30 July 1977 (MPM); Port Fairy, alive under intertidal rocks, 10 Mar. 1975 (MPM); Point Lonsdale, under stones 18 Sept. 1973, W.F. Ponder & R. Burn (AMS). *South Australia*: Off Beachport, 73 m & 201 m, Verco Coll. (2 lots SAM); Gulf St. Vincent, dredged Verco Coll. (SAM); SE of Kangaroo I. (37°00′S, 138°33′E), 77 m, HMAS *Gascoyne* stn G2/76/62 (AMS); Investigator Strait, 37 m, Verco Coll. (SAM); Hardwick Bay, H.L. Kesteven (AMS); off St. Francis I., 15–37 m, 7 Jan. 1971, N. Coleman (AMS); off St. Francis I., 11–37 m, Verco Coll. (SAM); SW of Cape Adieu, 79 m, 4 July 1962, HMAS *Gascoyne* stn G2/90/62 (AMS). *Western Australia*: S of Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); 80 miles W of Eucla, 148 m, Verco Coll. (SAM); E of Salisbury I. (34°13′S, 125°04′E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS); King George Sound, beach and 22–26 m, Verco Coll. (2 lots SAM); Windy Harbour, beach, 3 Feb. 1972, W.F. & J.M. Ponder (AMS); Margaret River, shell sand, 20 Dec. 1971 (MPM), Feb. 1973, W. Anson (AMS); off Peppermint Grove Beach, between Bunbury and Busselton, 4.6–7.6 m, 28 Dec. 1971, W.F. & J.M. Ponder (AMS); Ellenbrook, near Cowaramup, Verco Coll. (SAM); Yallingup, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. Despite the absence of type material I have no doubt that the species recorded as *T. angasi* by Hedley (1903, p.610), was correctly identified. *N. fulvalinearis* is a later name for the same species. Crosse & Fischer's (1865) description of the colour pattern—"brown", last whorl with a "transverse white zone"—and the description and illustration of the gross shell morphology and relative size (7.0 x 1.70 mm; 15 whorls) agree well with the present material and match no other known Southern Australian triphorid. Crosse & Fischer's statement that the acuminate protoconch is smooth probably indicates that their specimen was worn or that they used insufficient magnification. *M. angasi* is one of the most common triphorids on southern Australian beaches, including Gulf St. Vincent, the type locality.

Monophorus nigrofusca (A. Adams, 1851)
Figs 4F, 14A–C, Table 7

Triphoris nigrofuscus A. Adams, 1851: 278.
Triphora nigrofusca.—Hedley, 1903: 611, pl.33, figs 34, 35.
Triphora cinerea Hedley, 1903: 612, pl. 33, figs 36, 37. New synonym.
Teretriphora cinerea.—Cotton & Godfrey, 1931: 56.
Notosinister cinerea.—Laseron, 1954: 154, figs 21, 21a.
Aclophora cinerea.—Laseron, 1958: 627.

Description. Shell 4.50–13.3 mm x 1.70–3.30 mm, of 9½–17½ whorls, narrowly conical, slightly cyrtoconoid, spire up to 5 x higher than aperture plus canal.

Colour of protoconch and earliest teleoconch whorls pale yellowish brown or white. Subsequent whorls either alternately maculate with buff white and yellowish brown, yellowish brown with buff white spirals, or rather uniform buff white or reddish to yellowish brown. Base a darker shade below spiral 4.

Protoconch of lecithotrophic larval type, blunt-tipped, clearly demarcated, of 2½–2¾ convex whorls, diameter 430–570 μm, diameter of first whorl 330–400 μm. Whorls entirely traversed by variably flexuous axial riblets and encircled by 2 median spiral threads, adapical spiral frequently becoming obsolete on last half whorl, and abapical spiral becoming increasing prominent. A suprasutural spiral thread is exposed on last whorl.

Teleoconch whorls shallowly but distinctly convex, sculptured with well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Often a single spiral in each interspace of spirals 1–3 on body whorl behind outer lip. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–4 commencing immediately, spirals 3 and 4 continuing from abapical median and suprasutural protoconch spirals, spirals 1 and 2 commencing simultaneously after disappearance of adapical protoconch spiral. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 weakly nodular,

Table 7. *Monophorus nigrofusca.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	22	8.48	4.50–13.3	2.58
Diameter	22	2.50	1.70–3.30	0.52
Height/diameter	22	3.33	2.64–4.29	0.43
Diameter 1st whorl	22	0.36	0.33–0.40	0.02
No. whorls	22	13.41	9.50–17.50	2.22
No. axials	22	21	19–24	1.39

spirals 5 and 6 weakest, smooth. Interspaces of spirals 1–4 about 2 x as wide as each spiral. Axial costae straight or slightly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–24 on penultimate whorl. Base rather evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded but overhanging base of inner lip; profile prosocyrt-opisthocline below a simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (as in Fig. 1I) pale yellow, thin, externally shallowly concave, subcircular, nucleus slightly eccentric, of about 3 whorls. Periphery thinner, not projecting from suture externally. Muscle attachment scar simple.

Radula (Fig. 4F) with the formula 8 + 1 + 1 + 1 + 8. Central tooth 7.3 μm wide, with 3 similar cusps; lateral teeth each 9.7 μm wide, with 4 similar cusps; marginal teeth 7.3–3.9 μm wide, each with 3 subequal cusps.

Type localities. *T. nigrofuscus*: Sydney, New South Wales, low water, under stones; *T. cinerea*: Middle Harbour, Sydney.

Types. *T. nigrofuscus:* LECTOTYPE (here selected from 2 syntypes) BMNH 196557. *T. cinerea*: HOLOTYPE AMS C.13513.

Other material examined (c.300 specimens). *New South Wales*: Shelley Bay, S of Angourie, D. Tarrant (MPM); Clarence River, A.A. Cameron (AMS); Woolgoolga, J. Kerslake (AMS); SW of Solitary I., 15 m, 17 May 1972, Hutchings & Weate (AMS); off Port Stephens, 91 m, J. Voorwinde (AMS); Port Stephens, T.A. Garrard (AMS), M. Ward (AMS); Sydney area (44 lots AMS); Shell Harbour, J Voorwinde (AMS); Ulladulla, shell sand, 1950-60, J. Voorwinde (AMS); Twofold Bay, 27–128 m, R.S. Bell (AMS), 18 m, T.A. Garrard (AMS), R.S. Bell (AMS), J. Voorwinde (AMS); off Twofold Bay (37°22′S, 150°02′E), 75 m, 19 June 1962, HMAS *Gascoyne* stn G2/58/62 (AMS); Eden Harbour, 1950-60, J. Voorwinde (AMS); Disaster Bay, 33 m (AMS). *Tasmania*: SE of King I., (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2111 (AMS). *Victoria*: SE side Gabo I., alive on algae & detritus, 15–18 m, Feb. 1973, P. Hutchings (AMS—destroyed for animal); SSE side of Gabo I., on red algae, 28 m, Feb. 1973, S.A. Shepherd (AMS); 36 km S of Cape Conran (39°08.5′S, 148°43.5′E), 107 m, *Esso-Gipps* stn 8 (AMS); between Eagle and Crawfish Rocks, Western Port Bay, 3.6–5.5 m, 15 Jan. 1969, W.F. Ponder & B.J. Smith (AMS); off Tankerton Jetty, French I., Western Port Bay, 7–10 m, Jan. 1979 (MPM); Flinders, 1956–7, J. Kerslake (AMS); Rye, Port Phillip Bay, shell sand, 27 May 1975 (MPM). *South Australia*: off Beachport, 201 m, Verco Coll. (SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); Gulf St. Vincent, dredged, Verco Coll. (SAM); off Ardrossan, 26 m, Verco Coll. (SAM); off Victor Harbour, 25 m, 12 May 1973, S.A. Shepherd (AMS); S of Cape Carnot (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62 (AMS).

Remarks. *M. nigrofusca* is well characterized by its very distinctive protoconch and the almost simultaneous appearance of teleoconch spirals 1–3. It is one of the most commonly encountered shallow water triphorids in New South Wales, and is frequently conspicuous by its rather large size and maculate colour pattern. The lectotype is a well-preserved specimen lacking the rim of the outer lip.

M. nigrofusca differs from all other species of *Monophorus* in the almost simultaneous appearance of teleoconch spirals 1–3, and is tentatively referred to *Monophorus* because its radula is somewhat similar to that of *M. angasi*. It superficially resembles species of *Inella* and related genera in teleoconch sculpture but differs in having uninterrupted axial riblets on the protoconch. Although it is dangerous to postulate relationships on the basis of lecithotrophic larval protoconch sculpture, the validity of this contention is supported by an extremely similar (undescribed) species from off South Australia, which has uninterrupted axial riblets on its planktotrophic larval protoconch. Unfortunately the first protoconch whorl of this species is unknown and it should remain undescribed until perfect specimens are available.

Sagenotriphora n.gen.

Type species (here designated): *Triphora ampulla* Hedley, 1903; Recent, southern Australia and northern New Zealand.

Diagnosis. Triphorines with reticulate sculpture on 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3, sculpture evenly reticulate, intersections nodular. Radula with 5 teeth per cross-row.

Description. Shell 2.25–4.90 mm high, narrowly cyrtoconoid, body whorl usually markedly constricted, stout, spire up to 4.3 x higher than aperture plus canal.

Protoconch: First whorl of planktotrophic larval protoconch reticulately sculptured with spiral threads and axial riblets. Subsequent whorls entirely traversed by axial riblets and encircled by 2 median spiral threads. Lecithotrophic larval protoconch unknown.

Teleoconch of up to 8¾ flat-sided whorls, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3

continuing from abapical protoconch spiral; spiral 2 appearing as a thread on subsequent whorls, gradually enlarging to resemble spiral 3. Spirals 1–4 rather similar on mature whorls, strongly nodular; spirals 5 and 6 weaker, distinctly nodular. Axial costae straight, more or less orthocline, evenly traversing whorls, evanescent below spiral 6. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) thin, translucent, pale yellow, externally shallowly concave, subcircular, nucleus almost central, of about 3½ whorls. Periphery thinner, upturned, slightly projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (*S. ampulla*, Fig. 6D) with the formula 1+1+1+1+1. Central tooth 4.8 μm wide, with 4 cusps, outer pair almost obsolete. Lateral teeth each 6.8 μm wide with 7 cusps, outer 4 or 5 cusps larger. Marginal teeth each 2.4 μm wide, with 5 small cusps.

Remarks. *Sagenotriphora* is undoubtedly closely related to *Tetraphora* Laseron (see below), their species having similar radulae and distinctive reticulate sculpture on the first protoconch whorl. *Sagenotriphora* species differ in having two median protoconch spirals instead of one, a more deeply infolded outer lip, and axial costae that are evanescent below spiral 6 instead of immediately below spiral 4. Both genera have undergone the most extreme reduction in the number of marginal teeth, *S. ampulla* and *T. granifera* (Brazier) having fewer teeth than any other known triphorid. A particularly striking aspect of the radulae of *S. ampulla* and *T. granifera* is the presence of a prominent articulatory boss on each lateral tooth. Since bosses are absent from species with more numerous teeth, it seems reasonable to assume that these structures have evolved independently to counteract lateral shear resulting from extreme reduction in tooth number.

Although the phylogenetic relationships of *Sagenotriphora* and *Tetraphora* are unknown, I suspect that the reticulate sculpture on the first protoconch whorl may result from coalescence of T-shaped granules, suggesting derivation from the *Inella* group.

There are numerous species of *Sagenotriphora* and *Tetraphora* in the Indo-Pacific, several of which are undescribed.

Sagenotriphora ampulla (Hedley, 1903)

Figs 1B, 6D, 14E–G, Table 8

Triphora ampulla Hedley, 1903: 615, pl.33, figs 38, 39.—Suter, 1913: 255, pl.15, fig.2; Powell, 1979: 255, fig. 59.
Notosinister ampulla.—Finlay, 1927: 386; Laseron, 1954: 148, fig. 9.
Cautor ampulla.—Cotton & Godfrey, 1931: 55.

Description. Shell 2.25–4.90 mm x 0.85–1.70 mm, of 9¾–14 whorls, stout, narrowly cyrtoconoid, spire up to 4.3x higher than aperture plus canal.

Table 8. *Sagenotriphora ampulla*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	12	3.40	2.25–4.90	0.82
Diameter	12	1.25	0.85–1.70	0.25
Height/diameter	12	2.71	2.41–2.96	0.17
Diameter 1st whorl	12	0.16	0.14–0.17	0.02
No. whorls	12	11.40	9.75–14.00	1.29
No. axials	12	18.5	16–22	—

Colour of protoconch yellowish brown. Teleoconch alternately boldly maculate with deep reddish brown and white or buff white, base reddish brown on and below spiral 5.

Protoconch of planktotrophic larval type, narrowly conical, of 4–4¾ convex whorls, diameter 320–400 μm, diameter of first whorl 130–170 μm. First whorl reticulately sculptured with similar, fine, crisp, spiral threads and axial riblets. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 2 similar, fine, crisp, angulating, median spiral threads, adapical spiral vanishing on last quarter whorl and abapical spiral surmounting an increasingly prominent carina.

Teleoconch whorls flat-sided, reticulately sculptured with strong, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, spiral 6 at top of columella. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina, spiral 2 appearing as a thread on 8th–10th shell whorl, gradually enlarging to resemble spiral 4 on body whorl. Spirals 2–4 of similar size, spiral 1 slightly broader on body whorl, spirals 1–4 strongly nodular; spirals 5 and 6 similar, weakest though strong, distinctly nodular. Axial costae straight, more or less orthocline, evenly traversing whorls, evanescent below spiral 6, numbering 16–22 on penultimate whorl. Base very evenly and gently contracted. Columella broad. Aperture ovate. Outer lip produced and flared basally, inner extremity deeply infolded to overhang base of inner lip, indented below insertion; profile prosocyrt below a shallow U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum and radula (Fig. 6D) described under *Sagenotriphora* n.gen.

Type locality. Watsons Bay, Sydney, New South Wales.

Holotype. AMS C.13514.

Other material examined. AUSTRALIA (84 specimens): *New South Wales*: N side of Black Head, Nadgee, among coralline algae on exposed rocks, 8 Jan. 1970, W.F. Ponder & P.H. Colman (AMS); inside breakwater, S side of Ulladulla, intertidal, 5 Jan. 1970, W.F. Ponder & P.H. Colman (AMS); Ulladulla, shell sand, 1950-60, J. Voorwinde (AMS); Ocean

Beach, Kurnell, 1950-60, J. Voorwinde (AMS); off Sow and Pigs Reef, Port Jackson, 11 m, T.A. Garrard (AMS); Little Coogee Bay, Sydney, Jan. 1895, J. Brazier (5 lots AMS); Middle Harbour, Sydney, C. Hedley (AMS); Long Reef, Collaroy 1950-60, J. Voorwinde (2 lots AMS); Woolgoolga, T. Iredale (AMS). *Victoria*: Yambuck Lake Entrance, 16 Jan. 1979 (MPM); Port Phillip Heads, living under intertidal rocks, 5 Mar. 1978 (MPM). *South Australia*: off Beachport, 73 m, Verco Coll. (SAM).

NEW ZEALAND: 60 specimens in NMNZ.

Remarks. *S. ampulla* is rendered extremely distinctive by its bottle-shaped shell and boldly maculate colour pattern. Among known southern Australian species *S. ampulla* most closely resembles *Obesula tribulationis* (Hedley) (see below) in shape and colour pattern, but differs primarily in having two protoconch spirals instead of one, and in having reticulate instead of granulate sculpture on the first protoconch whorl. There are numerous (many undescribed) superficially very similar tropical and subtropical species, which differ, often very subtly, in relative size, shape and sculpture, and in depth and shade of pigmentation.

Genus *Tetraphora* Laseron

Tetraphora Laseron, 1958: 625. Type species (original designation): *Tetraphora mapoonensis* Laseron, 1958; Recent, Queensland.

Diagnosis. Triphorines with reticulate sculpture on 1st whorl, and 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spirals 1-3 commencing simultaneously or spiral 2 commencing later than 1 and 3. Sculpture either evenly reticulate with nodular intersections, or axials and nodules almost obsolete. Radula with 5 or 7 teeth per cross-row.

Description. Shell 2.05-7.80 mm high, of 9-19 whorls, narrowly cyrtoconoid, lightly built, spire several times higher than aperture plus canal.

Protoconch: First whorl of planktotrophic larval protoconch reticulately sculptured with spiral threads and axial riblets. Subsequent whorls entirely traversed by axial riblets and encircled by 1 median spiral thread. Lecithotrophic protoconch unknown.

Teleoconch whorls flat-sided or shallowly convex, reticulately sculptured with spiral cords and axial costae, intersections nodular. Microscopic spiral lirae sometimes present on exterior of anterior canal. Spiral cords numbering 4 or 5 on body whorl and 2 or 3 on base, spiral 4 partly exposed at suture on spire (5th body whorl spiral numbered 2A). Spirals 1 and 3 commencing immediately; spiral 2 commencing either immediately though weaker than spirals 1 and 3 at first, or appearing on later whorls; spiral 2A, if present, appearing later than spiral 2, between spirals 1 and 2. Spiral cords rather similar on mature spire whorls. Axial costae straight or shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4. Base evenly contracted. Aperture subquadrate. Inner extremity of outer lip shallowly infolded and distant from base of inner lip. Posterior siphonal notch simple. Anterior siphonal canal oblique, open, short.

Operculum (Fig. 1I) horny, thin, flat, spiral, nucleus subcentral, of about 3 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, without accessory peg.

Radula (Fig. 6E & F) with the formula 1-2 + 1 + 1 + 1 + 2-1. Central tooth 6.3-8.7 μm wide, with 4 cusps. Lateral teeth each 5.0-8.7 μm wide, with 4 cusps, with or without a prominent anterior articulatory boss between and below the median cusps. Marginal teeth 3.0-4.0 μm wide, each with 3 cusps.

Remarks. Members of this genus are rendered distinctive by the reticulately-sculptured first whorl, lightly built shells and greatly reduced numbers of teeth per radular cross-row. Laseron (1958) separated *Tetraphora* (from *Notosinister* sensu Laseron, 1958) primarily because of the presence of four instead of three spire spirals in *T. mapoonensis* (Fig. 14D, H). Although having only three spire spirals, *T. granifera* (Brazier) and *T. iniqua* (Jousseaume) are otherwise so similar to *T. mapoonensis* that I have no hesitation in referring them to *Tetraphora* (see below). Accordingly their radulae are taken as representative of the genus. The genus occurs throughout the tropical and warm temperate Indo-Pacific, where it is represented by a number of undescribed species.

Tetraphora granifera (Brazier, 1894)

Figs 1I, 6E, 14I-K, Table 9

Triforis graniferus Brazier, 1894: 173, pl.14, fig. 10.
Triphora granifera.—Hedley, 1903: 610, pl.33, figs 28, 29; Verco, 1909: 286.
Triphora adela Thiele, 1930: 577, fig. 38. New synonym.
Triphora albina Thiele, 1930: 577, fig. 39. New synonym.
Notosinister granifera.—Cotton & Godfrey, 1931: 53, pl.1, figs 5, 6; Laseron, 1954: 148, figs 10, 10a.
Notosinister pocula Laseron, 1954: 148, fig. 8. New synonym.
Notosinister topazica Laseron, 1954: 149, figs 11, 11a. New synonym.
Notosinister jacksonensis Laseron, 1954: 150, figs 14, 14a, 25, 25a. New synonym.
Triforis fasciata.—Tate & May, 1901: 388, pl.23, figs 10, 11. (**Not** T. Woods, 1879.)

Description. Shell 2.05-5.80 mm x 0.80-1.65 mm, of 9-14¼ whorls, rather thin, narrowly cyrtoconoid, spire up to 5 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch colour and colour pattern very variable, usually shades of yellowish or reddish brown, paler specimens usually sparsely and irregularly maculate in darker shades; base a darker shade below spiral 4, nodules often a paler shade or white, especially on spiral 1; occasional specimens buff white or pure white with yellowish brown base. Specimens from Western Australia to Tasmania more variably and usually more brightly coloured than New South Wales specimens.

Protoconch of planktotrophic larval type, of 4½-5½ convex whorls, diameter 350-500 μm, diameter of first

Table 9. *Tetraphora granifera.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	43	3.66	2.05–7.50	1.18
Diameter	43	1.22	0.80–1.90	0.27
Height/diameter	43	2.93	2.47–3.94	0.33
Diameter 1st whorl	43	0.14	0.13–0.15	0.01
No. whorls	43	11.63	9.00–16.5	1.60
No. axials	43	20	16–24	2.14

whorl 130–150 μm. First whorl markedly depressed, reticulately sculptured with fine crisp spiral threads and axial riblets. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 1 fine crisp submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls at first submedially angulate, subsequently flat-sided or very shallowly convex, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–4 commencing immediately or spiral 2 commencing slightly later, spirals 3 and 4 continuing from protoconch spirals; spiral 2 commencing weaker than adjacent spirals, gradually enlarging to resemble spiral 3. Spirals 1–4 of similar size on all but earliest whorls, interspaces usually markedly narrower than each spiral, occasionally as wide as each spiral. Spirals 1–3 strongly nodular, margins sharply defined; spiral 4 weakly nodular, abapical margin seldom defined; spirals 5 and 6 low, broad and smooth, abapical margin of spiral 5 seldom defined, abapical margin of spiral 6 not defined. Axial costae straight or shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 16–24 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded and distant from base of inner lip; profile prosocyrt-opisthocline below a simple, broad, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Operculum (Fig. 1I) pale translucent brownish yellow, flat, rather thin, subcircular, nucleus almost central, of about 3 whorls; periphery upturned, not projecting from suture externally. Muscle attachment scar well-defined, without accessory peg.

Radula (Fig. 6E) with the formula 1 + 1 + 1 + 1 + 1. Central tooth 8.7 μm wide, with 4 short cusps; lateral teeth each 8.7 μm wide, with 4 short cusps and a strong anterior articulatory boss below and between the two pairs of cusps; marginal teeth each 4.0 μm wide, with 3 small cusps, median cusp long and very narrow, bordering cusps short and conical.

Type localities. *T. graniferus*: Watsons Bay, New South Wales; *T. adela*: Surf Point, Outer Bar, at entrance to South Passage, Shark Bay, Western Australia; *T. albina*: NW of Middle Bluff, Shark Bay, Western Australia; *N. pocula*: Yamba, Clarence River, New South Wales; *N. topazica*: Cronulla, Sydney, New South Wales; *N. jacksonensis*: North Harbour, Sydney.

Types. *T. graniferus*: LECTOTYPE (here selected from 2 syntypes) AMS C.2901. *T. adela* and *T. albina*: HOLOTYPES MNHU 67493, 67494. *N. pocula*: HOLOTYPE AMS C.65850. *N. topazica*: HOLOTYPE AMS C.103143. *N. jacksonensis*: HOLOTYPE AMS C.103076.

Other material examined. About 1000 specimens (c.150 lots—AMS, SAM, NMNZ, MPM) from as far north as Shark Bay, north-western Australia, and throughout south-western Australia, South Australia, Victoria, Tasmania and New South Wales. Common in beach shell sand, locally common living intertidally, dead specimens locally common to 101 m (off Cape Borda—SAM) and less frequently to 549 m (off Beachport—SAM).

Remarks. *T. granifera* is by far the most common shallow water triphorid in southern Australia. It is rendered distinctive by the combination of small, lightly built, translucent, variably-coloured shell, ovate contour, immediate appearance of teleoconch spiral 2, and unicarinate protoconch with reticulate first whorl. The depressed summit of the protoconch is particularly characteristic.

T. albina and *N. pocula* are based on rare colour forms that are probably partial albinos. The holotypes of *N. topazica* and *N. jacksonensis* are exceptionally large specimens that differ significantly from each other in colour only. Such forms occur throughout the range of the species, perfectly intergrading with smaller, variably-coloured specimens.

Specimens from Western Australia, South Australia and Victoria differ from New South Wales specimens in being more brightly coloured and more boldly patterned, and in having slightly but constantly smaller first protoconch whorls (diameter 130 μm vs. 140–150 μm). Tasmanian specimens are somewhat intermediate in being brightly coloured and in having first whorls about 140 μm in diameter. This suggests that there is little exchange of pelagic larvae through Bass Strait, and that Tasmania receives larvae from both New South Wales and west of Bass Strait. Divergence of eastern and western populations may have commenced during the Pleistocene when they were isolated by the Bass Strait Landbridge (see remarks on zoogeography). Unfortunately there is inadequate material from the zone of overlap (north-eastern Victoria - southern New South Wales) so it is yet impossible to ascertain whether we are dealing with clinally intergrading conspecific forms, geographic subspecies, or distinct species. Should they prove to be separable taxonomically, *T. adela* Thiele is available for the western form.

Tetraphora mcgilpi (Cotton, 1952)
Fig. 15A–C

Teretriphora mcgilpi Cotton, 1952: 25, pl.3, fig. 6.

Description. Shell 2.90–3.10 mm x 1.00 mm, of 10–10¼ whorls, thin, narrowly cyrtoconoid, spire up to 3 x higher than aperture plus canal.

Colour of protoconch light yellowish brown. Teleoconch uniform reddish brown, or pale yellowish brown and irregularly maculate with a darker shade, base yellowish brown.

Protoconch of planktotrophic larval type, of 3½–3¾ convex whorls, diameter 330 μm, diameter of first whorl 130 μm. First whorl with markedly depressed summit, reticulately sculptured with fine crisp spiral threads and axial riblets. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 1 fine crisp submedian spiral thread.

Teleoconch whorls shallowly convex, sculptured with prominent spiral cords, axial costae obsolete, suture well defined, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–3 commencing immediately, about as high as broad on spire, spiral 1 weakest and spirals 2 and 3 similar throughout; spirals 1–4 depressed and markedly broader than high on body whorl; spirals 5 and 6 low and poorly defined, abapical margin of spiral 4 not defined. Axial costae obsolete, conspicuous as a few weak nodules on spirals 1 and 2 on penultimate and body whorls. Base evenly contracted. Columella narrow. Aperture ovate. Outer lip flared basally, inner extremity very shallowly infolded and distant from base of inner lip, profile gently prosocyrt-opisthocline below a broad shallow posterior siphonal notch. Inner lip thin (immature?). Parietal glaze thin. Anterior siphonal canal slightly oblique, very short.

Animal unavailable.

Type locality. Henley Beach, South Australia.

Holotype. SAM D.14464 (2.90 x 1.00 mm; 10.25 whorls).

Other material examined (1 specimen). Glenelg Beach, South Australia, 9 Apr. 1973, J. Kerslake (AMS).

Remarks. Apart from the virtual absence of axial costae and the simpler apertural features, *T. mcgilpi* is extremely similar to *T. granifera* (Brazier). Indeed I strongly suspect that *I. mcgilpi* is merely an abnormal form of that species.

Tetraphora iniqua (Jousseaume, 1898)
Figs 6F, 15D–F, Table 10

Mastonia iniqua Jousseaume, 1898: 75.
Mesophora sardonyx Laseron, 1958: 598, figs 74, 75.
Notosinister kawamarui Kosuge, 1962b: 81, pl.10, fig. 3, text figs 5, 6.
Triphora sardonyx.—Kosuge, 1965: 212.
Triphora iniqua.—Habe & Kosuge, 1966: 104, pl.41, fig.1.
Triphora fuscolineae Kosuge, 1974: 1, pl.1, fig.1. New synonym.

Description. Shell 2.60–7.80 mm x 0.85–1.90 mm, of 11–19 whorls, rather thin, narrowly cyrtoconoid, spire up to 5 × higher than aperture plus canal.

Table 10. *Tetraphora iniqua.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	15	4.22	2.60–7.80	1.66
Diameter	15	1.22	0.85–1.95	0.35
Height/diameter	15	3.37	2.88–4.10	0.35
Diameter 1st whorl	15	0.17	0.15–0.17	0.01
No. whorls	15	13.97	11.00–19.00	2.24
No. axials	15	20	17–24	—

Colour of protoconch buff white. Teleoconch white or buff white, yellowish to deep reddish brown on spirals 4 and 5, below spiral 6, and either in an adapical zone extending from suture to abapical side of spiral 1 (*iniqua* form) or on abapical side of spiral 1 (*kawamarui* form). Spirals 2 and 3 yellowish or reddish brown immediately behind outer lip.

Protoconch of planktotrophic larval type, of 4½–5 convex whorls, diameter 350–400 μm, diameter of first whorl 150–170 μm. First whorl reticulately sculptured with fine crisp spiral threads and axial riblets. Subsequent whorls entirely traversed by fine crisp axial riblets and encircled by 1 fine crisp submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided throughout (*iniqua* form) or becoming markedly convex (*kawamarui* form), reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular; very fine, crisp, granulate spiral lirae below spiral 6. After attaining otherwise normal adult facies, some specimens of the *kawamarui* form suddenly increase in diameter, from which point whorls become more strongly convex and spiral 2 broadens before dividing into 2 similar spirals. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch spiral; spiral 2 appearing as a thread on 8th–10th shell whorl, gradually enlarging to resemble spiral 3. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 strongly or weakly nodular; spirals 5 and 6 weakest, similar, smooth. Axial costae straight, orthocline or slightly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17–24 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded and distant from base of inner lip; profile prosocyrt-opisthocline below broad, shallow posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, open, short.

Operculum (as in Fig. 1I) horny, translucent pale yellowish brown, rather thin, flat, subcircular, nucleus subcentral, of about 3 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle

attachment scar minutely pitted, with a low swelling immediately behind nucleus.

Radula (Fig. 6F) with the formula 2+1+1+1+2. Central tooth 6.3 μm wide, with 4 similar cusps; lateral teeth each 5.0 μm wide, with 4 similar cusps; marginal teeth 3.0–4.0 μm wide, each with 3 similar cusps.

Type localities. *M. iniqua*: Djibouti, Red Sea; *M. sardonyx*: Bowen, Queensland; *N. kawamarui*: Ankyaba, Setouchi-machi, Amami Islands, Japan; *T. fuscolineae*: off northern Burias, Ragay Gulf, Luzon, Philippine Islands.

Types. *M. iniqua*: LECTOTYPE (here selected from 2 syntypes) MNHN. *M. sardonyx*: HOLOTYPE AMS C.103056. *N. kawamarui*: HOLOTYPE NSMT Mo.13035. *T. fuscolineae*: HOLOTYPE USNM 310791.

Other material examined. *New Caledonia* (75 specimens): living intertidally at various localities, 1978-79, P. Bouchet (8 lots MNHN); Maitre I. Channel off Noumea, 24 m, 19 Sept. 1978, P. Bouchet (MNHN). *New South Wales* (3 specimens): Angourie, algae washings, 27 Sept. 1975, F. Rost (AMS); Shelley Beach, S of Angourie, shell sand, 1976, D. Tarrant (MPM); Long Reef, Collaroy, Sydney, rock washings, 1950-60, J. Voorwinde (AMS).

Remarks. By direct comparison I could detect no taxonomically significant differences between the holotypes of *M. sardonyx* and *T. fuscolineae* and the lectotype of *M. iniqua*. *N. kawamarui* is based on a distinctive form that was later synonymized with *M. sardonyx* by its author (Kosuge, 1965, p.212). The *kawamarui* form is identical to typical *T. iniqua* on the early spire whorls, but the later whorls become more convex in approximate conjunction with a change in the colour and colour pattern of spiral 1 (see description). In a large collection of living specimens made in New Caledonia by Philippe Bouchet (MNHN), all specimens collected intertidally are typical *T. iniqua,* while in a large sample from 24 m in the Maitre Island Channel, the *kawamarui* and typical forms occur in a ratio of 8:1.

Genus *Teretriphora* Finlay

Teretriphora Finlay, 1927: 384. Type species (original designation): *Triphora huttoni* Suter, 1908; Recent, New Zealand.

Distophora Laseron, 1958: 613. Type species (original designation): *Distophora distorta* Laseron, 1958; Recent, Queensland.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, and 2 spiral threads and a broad smooth zone on subsequent whorls of planktotrophic larval protoconch. Teleoconch whorls convex, spirals 1–3 commencing simultaneously. Sculpture either evenly reticulate with nodular intersections, or with axials and nodules almost obsolete.

Remarks. While undoubtedly distinct species, the type species of *Teretriphora* (Fig. 15H) and *Distophora* (Fig. 15J–L) appear to exhibit no characters of generic significance, any potentially significant shell characters being rendered totally inapplicable by the interspecific variation of their apparent congeners. Since I am unable to justify their continued separation, *Distophora* is placed as a synonym of the prior *Teretriphora*. Unfortunately radulae are not available for comparison.

As here limited, *Teretriphora* species are characterized by the combination of simultaneous appearance of teleoconch spirals 1–3, very short anterior siphonal canal, and the very shallowly infolded inner extremity of the outer lip. The marked convexity of the teleoconch whorls in *T. huttoni, T. gemmegens* (Verco), *T. distorta* and *T. ponderorum* n.sp. is a particularly distinctive character, but otherwise similar species have flat-sided whorls. Some species (*T. huttoni, T. gemmegens* and *T. ponderorum*) exhibit a distinct tendency toward obsolescence of the axial costae.

Insight into the possible phylogenetic relationships of *Teretriphora* is afforded by the planktotrophic larval protoconch of *T. spica* (Verco) (Fig. 16C), which more closely resembles *D. distorta* in teleoconch facies than the type species of any other genus group. Its protoconch has a smooth spiral zone as in species of *Inella* (s.l.) and *Hedleytriphora* n.gen., resembling an *Inella* in having two spiral threads, but more closely resembling *Hedleytriphora* in having hemispherical instead of T-shaped granules on the first whorl, and a much broader smooth zone than any known Recent *Inella*.

Certain phenotypic variants of *T. huttoni* are strikingly similar to the type species of *Sychar* Hinds, 1843, the peculiar *S. vitreus* (Hinds, 1843) from the Straits of Malacca. The holotype of *S. vitreus* (10.0 x 2.10 mm) (Fig. 15G) has a blunt-tipped uniangulate lecithotrophic larval protoconch, and the teleoconch whorls are markedly convex, entirely devoid of axial ornamentation, and smooth apart from two narrow spiral grooves that would be equivalent to the interspaces of spirals 2–4 were it to have normal spiral sculpture. I have little doubt that *Sychar* and *Teretriphora* are closely related, but prefer to retain *Teretriphora* as a distinct genus until radulae can be compared. *Teretriphora* species are rather similar to the type species of *Cautor* Finlay, 1927 (*T. lutea* Suter, 1908; Recent, New Zealand), *Cautotriphora* Laws, 1940 (*C. simulans* Laws, 1940; Pleistocene New Zealand), and *Cinctriphora* Olsson & Harbison, 1953 (*T. bartschi* Olsson, 1916; Miocene, North America), but since *Teretriphora* has priority they need not concern us here.

Teretriphora gemmegens (Verco, 1909)

Fig. 15I

Triphora gemmegens Verco, 1909: 290, pl.23, figs 7, 8.
Teretriphora gemmigens [sic.].—Finlay, 1927: 384.
Teretriphora gemmegens.—Cotton & Godfrey, 1931.

Description. Shell (holotype) 7.20 x 2.00 mm, of 12 whorls, rather thick, narrowly conical, spire 4.5 x higher than aperture plus canal.

Colour of spire uniform dull pale yellowish brown, base yellowish brown on and below spiral 5.

Protoconch of lecithotrophic larval type, of 3 convex whorls, diameter 550 μm, diameter of first whorl 350 μm. Sculptured over abapical two-thirds with 3 strong, smooth, rounded spiral cords, sutural ramp concave and smooth.

Teleoconch whorls strongly convex, sculptured with strong spiral cords and very weak axial costae, intersections weakly nodular, becoming very weakly nodular on later whorls; suture well-defined, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 almost entirely exposed at suture on spire. Spirals 1–4 commencing immediately, spirals 2–4 continuing from protoconch spirals. Spirals 1–4 similar, strong, sharply defined; spiral 5 very low and indistinct, abapical margin not defined. Axial costae weak on early whorls, very weak and ill-defined on later whorls, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering about 30 on penultimate whorl. Base evenly contracted. Outer lip and tip of anterior canal broken. Inner lip thick. Parietal glaze thin.

Animal unavailable.

Type locality. Off Beachport, South Australia, 73 m.

Types. HOLOTYPE SAM D.13451 (7.20 x 2.00 mm; 12 whorls). PARATYPE (from type locality) AMS C.31106.

Remarks. *T. gemmegens* is rendered highly distinctive by its three smooth protoconch spirals, strongly convex teleoconch whorls and very weak axial costae. Not having seen the specimen I cannot confirm May's (1921, p.108; 1923, pl.27, fig. 17) Tasmanian record.

Teretriphora spica (Verco, 1909)

Fig. 16A–C

Triphora spica Verco, 1909: 281, pl.23, fig. 1.
Teretriphora spica.—Cotton & Godfrey, 1931: 56.

Description. Shell 5.35–7.60 mm x 1.15–1.50 mm, of 17–20 whorls, rather stout, narrowly cyrtoconoid, spire up to 6.6 x higher than aperture plus canal.

Colour of protoconch yellowish brown. First 3 or 4 teleoconch whorls white or buff white; subsequent whorls buff white or pale yellowish brown, irregularly axially maculate with yellowish brown. Base, columella and inner lip yellowish brown.

Protoconch of planktotrophic larval type, narrowly conical, of 4¾–5 convex whorls, diameter 370–400 μm, diameter of first whorl 170 μm. First whorl sculptured throughout with minute hemispherical granules. Subsequent whorls encircled by 2 similar crisp median threads, and a suprasutural thread; and traversed by fine crisp axial riblets that are interrupted by a broad smooth adapical spiral zone.

Teleoconch whorls more or less flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture very shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed at suture on spire. Spirals 1–3 commencing immediately, spirals 2 and 3 continuing from median protoconch spirals. Spiral 1 commencing weaker than spirals 2 and 3, gradually enlarging until broader than spirals 2 and 3, which are similar throughout. Spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 smooth. Edges of nodules on spirals 1–4 sharp, slightly overhanging sides of spirals. Interspaces of spirals 2–5 about as wide as each spiral, spirals 1 and 2 closer. Axial costae straight, slightly opisthocline, entirely traversing whorls, evanescent below spiral 4, numbering 17–19 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip slightly flared basally, inner extremity shallowly infolded, profile prosocyrt-opisthocline below simple posterior siphonal notch. Inner lip very thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, very short.

Animal unavailable.

Type locality. Off Beachport, South Australia, 73 m.

Holotype. SAM D.13453.

Other material examined (68 specimens). *Tasmania*: E of Grassy, King I., 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS). *South Australia*: off Beachport, 73 m, Verco Coll. (PARATYPES SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); off Cape Borda, 101 m & 113 m, Verco Coll. (2 lots SAM); off Neptune I., 190 m, Verco Coll. (SAM). *Western Australia*: SW of Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); E of Rocky Point (33°43′S, 125°04′E), 77–80 m, 7 July 1962, HMAS *Gascoyne* stn G2/104/62 (AMS); Margaret River, shell sand, Nov. 1975 (MPM).

Remarks. *T. spica* is rendered highly distinctive by the combination of the smooth zone on the protoconch, immediate appearance of teleoconch spiral 2, sharp-edged nodules, narrow contour, and colour pattern.

Teretriphora ponderorum n.sp.

Fig. 16D–F

Description. Shell 4.70–7.5(est) mm x 1.10–1.50 mm, of 13–18 (est.) whorls, narrowly conical, rather lightly built, spire up to 6 x higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white; subsequent whorls buff white, irregularly maculate with yellowish brown, most deeply pigmented at edges of summits of spirals 1–3; base buff white, spiral 5 yellowish brown.

Protoconch of lecithotrophic larval type, merging rather insensibly into teleoconch but of about 3 convex whorls, diameter 330 μm, first whorl rather bulbous, diameter 250 μm. Sculpture poorly developed, first whorl with fine, broken spiral lirae, subsequent whorls covered with minute spirally aligned granules; last whorl with the addition of a narrow subsutural zone of weak nodules; 2 low, narrow, median spiral cords; and a suprasutural spiral.

Teleoconch whorls at first shallowly convex then almost flat-sided, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 slightly exposed at suture on spire. Spirals 1–4 commencing immediately, spirals 2–4 continuing from protoconch spirals. Spirals 1–3 smooth and spiral 1 weaker than spirals 2 and 3 on early whorls, spirals 1–4 nodular and similar on subsequent whorls, spiral 5 smooth. Nodules with depressed summits, adapical edges shelved and slightly overhanging sides of spirals, especially on spirals 1 and 2. Spiral interspaces about as wide as each spiral. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 28–30 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity shallowly infolded, distant from base of inner lip; profile prosocyrt-opisthocline below open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, open, short.

Animal unavailable.

Type locality. Off Peppermint Grove Beach, between Bunbury and Busselton, Western Australia, 4.6–7.6 m, 28 Dec. 1971, W.F. & J.M. Ponder and R. Hancey.

Types. HOLOTYPE AMS C.130023 (4.70 x 1.10 mm; 13 whorls). PARATYPES AMS.

Remarks. *T. ponderorum* is closest to *T. distorta*, differing principally in having almost obsolete protoconch sculpture, much weaker teleoconch nodules, and larger maculations that are more deeply pigmented at the summits of the spiral cords. The holotype is the only intact specimen known. A fragmentary paratype is 1.60 mm in diameter, and was probably about 7.5 mm high with 18 whorls.

Teretriphora novapostrema (Verco, 1910)

Fig. 16G–I, Table 11

Triphora novapostrema Verco, 1910: 126, pl.30, figs 1, 2.
Cautor novapostrema.—Cotton & Godfrey, 1931: 55.

Description. Shell 3.15–6.10 mm x 1.10–1.70 mm, of 7¾–12 whorls, lightly built, narrowly cyrtoconoid, spire up to 4.35 x higher than aperture plus canal.

Uniform translucent white, old dead specimens opaque white.

Protoconch of lecithotrophic larval type, demarcated by appearance of teleoconch nodules, of 2–2¾ whorls, diameter 380–550 μm, diameter of first whorl 280–420 μm. First whorl sculptured with rounded axial riblets, occasionally almost smooth. Subsequent whorls encircled by 2 similar, strongly angulating, median spiral threads, and traversed by variably flexuous, crisp axial riblets that are interrupted above the adapical spiral by a narrow smooth zone. A suprasutural spiral is exposed on last whorl.

Teleoconch whorls convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture well-defined, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, spirals 1–4 commencing immediately, spirals 2–4 continuing from protoconch spirals. Spirals 1–4 strong, spirals 2 and 3 strongest and similar, spirals 1–3 strongly nodular, spiral 4 weakly nodular; spirals 5 and 6 weakest, smooth. Axial costae straight or shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 14–18 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip broken in all specimens. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Animal unavailable.

Table 11. *Teretriphora novapostrema.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	12	4.41	3.15–6.10	0.90
Diameter	12	1.38	1.10–1.70	0.20
Height/diameter	12	3.18	2.62–3.73	0.30
Diameter 1st whorl	12	0.34	0.30–0.42	0.04
No. whorls	12	10.04	8.50–12.00	1.34
No. axials	12	15	14–18	1.38

Type locality. Off Cape Borda, South Australia, 101 m.

Holotype. SAM D.13450.

Other material examined (26 specimens). *South Australia*: Gulf St. Vincent "depth?", Verco Coll. (SAM); Off Cape Jaffa, 165 m, Verco Co. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off Neptune I., 190 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, Fisheries Bureau (AMS); S of Cape Carnot (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62.

Remarks. *T. novapostrema* is characterized by its peculiar protoconch facies, convex teleoconch whorls, white shell and the immediate appearance of teleoconch spiral 2. In the absence of the radula *T. novapostrema* is referred to *Teretriphora* because of its rather close similarity to *T. huttoni* (Suter) in teleoconch facies.

Genus *Hedleytriphora* n.gen.

Type species (here designated): *Triphoris fasciata* T. Woods, 1879; Recent, southern Australia.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, 1 spiral thread, and a broad smooth spiral zone on subsequent whorls of the planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Radula with the formula 5–6 + 1 + 1 + 1 + 6–5. Central tooth with 3 cusps, laterals with 4 cusps, most marginals with 4 cusps.

Description. Shell 3.00–9.60 mm high, narrowly conical, weakly cyrtoconoid, spire several times higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with minute hemispherical granules on first whorl. All subsequent whorls or last 1 or 2 whorls encircled by 1 submedian angulating spiral thread; a suprasutural thread is exposed on last whorl. Axial riblets occupying supra- and subsutural zones separated by a broad smooth zone; subsutural zone narrow, suprasutural zone narrow or occupying abapical third or half of each whorl.

Teleoconch of up to 14 flat-sided or angulate whorls, sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch spiral; spiral 2 commencing later, enlarging but never as large as adjacent spirals. Spirals 1 and 3 similar or spiral 3 markedly larger. Spirals 1–3 nodular, spiral 4 weakly nodular or smooth, spiral 5 smooth. Axial costae strong, straight, weakly or rather strongly opisthocline, evenly traversing whorls, evanescent against or below spiral 4. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity rather deeply infolded to more or less contact base of inner lip; posterior siphonal notch U-shaped, simple and open. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) horny, thin, ovate, or subcircular, nucleus subcentral, of about 3 whorls. Periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (Figs 6G, 7A,B) with the formula 5-6 + 1 + 1 + 1 +6-5. Central tooth 4.8–5.8 μm wide, with 3 similar cusps. Lateral teeth each 4.8–5.8 μm wide, with 4 subequal cusps. Marginal teeth each 2.0–2.4 μm wide, marginal 1 with 3 or 4 subequal cusps; outer marginals each with 3 cusps, each median cusp longer and narrower than adjacent cusps.

Remarks. Species of the *Inella* group have a similar smooth zone on the protoconch, but differ in having T-shaped granules on the first whorl, two median protoconch spirals, simultaneously-developing teleoconch spirals 1–3, and different radular morphology. The *Hedleytriphora* protoconch is rather similar to that of *Teretriphora spica* (Verco), suggesting that *Hedleytriphora* and *Teretriphora* are closely allied. However, *Teretriphora* species differ primarily in having two median protoconch spirals and simultaneously-developing teleoconch spirals 1–3.

If my interpretation of progressive development of protoconch sculpture is correct (Fig. 2), the extreme width of the smooth protoconch zone in *Hedleytriphora* would suggest that the genus is of very early origin.

The genus is named as an appreciation of the thorough and brilliantly intuitive work of the late Charles Hedley.

Hedleytriphora fasciata (T. Woods, 1879)
Figs 6G, 17A–C, Table 12

Triforis tasmanica var. T. Woods, 1877:151.
Triforis tasmanica var. a T. Woods, 1878: 36.—May, 1903: 111.
Triphoris fasciata T. Woods, 1879: 34.
Triphora fasciata.—Hedley, 1903: 615, pl.33, figs 40, 41 (in part—excluding protoconch).
Triphora pfeifferi.—Verco, 1909: 287 (in part).
Notosinister fasciata.—Laseron, 1954: 152, figs 18, 18a.
Not *Triforis fasciata.*—Tate & May, 1901: 457, pl.23, figs 10, 11 (= *T. granifera* Brazier).

Description. Shell 3.00–7.30 mm x 0.90–1.90 mm, of 11–16¾ whorls, narrowly conical, lightly-built, body whorl weakly contracted at maturity, spire up to 3.7 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown, first whorl darker. Teleoconch pale yellowish brown, base frequently a darker shade on and below spiral 5, especially in pale specimens; spiral 3 translucent white with opaque white nodules; spiral 4 white or buff white, with irregular yellowish brown blotches.

Protoconch of planktotrophic larval type, narrowly conical, of 4–5½ convex whorls, diameter 370–480 μm, diameter of first whorl 140–170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls traversed by fine crisp axial riblets that occupy narrow suprasutural and very narrow subsutural zone; intermediate space smooth apart from a fine submedian groove that appears near end of third whorl and develops into an increasingly prominent submedian angulation.

Teleoconch whorls weakly angulate at spiral 3, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, much of spiral 4 exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch angulation; spiral 2 appearing as a thread on 9th–12th shell whorl, gradually enlarging but always weaker than adjacent spirals. Spirals 1 and 3 strongly nodular and spiral 3 highest before body whorl, more weakly nodular and of similar height on body whorl. Spiral 2 weak and undulate throughout. Margins of spirals 1–3 crisply defined, interspaces of spirals 1–4 narrow grooves on body whorl. Spirals 4 and 5 smooth,

Table 12. *Hedleytriphora fasciata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	20	4.95	3.00–7.30	1.16
Diameter	20	1.50	0.90–1.90	0.27
Height/diameter	20	3.35	2.78–4.05	0.32
Diameter 1st whorl	20	0.15	0.14–0.17	0.01
No. whorls	20	13.88	11.00–16.75	1.54
No. axials	20	16	13–18	1.54

adapical margins crisply defined, abapical margins ill-defined.

Axial costae subdued, straight, rather strongly opisthocline, evenly traversing whorls, evanescent below spiral 3, numbering 13–18 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity infolded to contact base of inner lip, impressed below insertion, profile prosocyrt-opisthocline, posterior siphonal notch simple. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) thin, subcircular, pale yellow, nucleus almost central, of about 3 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar simple.

Radula (Fig. 6G) with the formula 6+1+1+1+6. Central tooth 4.8 μm wide, with 3 short cusps. Lateral teeth each 4.8 μm wide, with 4 short cusps. Marginal teeth each 4.8–2.0 μm wide, marginals 1 and 2 each with 4 short cusps; outer marginals each with 3 cusps, the median cusp long and narrow, the outer cusps short.

Type locality. Blackman's Bay, Tasmania—the locality given by T. Woods (1877, p.151) for *T. tasmanica* var.

Holotype. TMAG E531.

Other material examined (172 specimens). *New South Wales*: Disaster Bay, 33 m, T. Iredale (AMS); 15 miles off Twofold Bay (37°22′S, 150°02′E), 75 m, 19 June 1962, HMAS *Gascoyne* stn G2/58/62 (AMS); Twofold Bay, 18 m, T.A. Garrard (AMS); Twofold Bay, beach, 1950–60, J. Voorwinde (AMS); Cronulla Beach, T.A. Garrard (AMS); off Sow and Pigs Reef, Port Jackson, 11–16 m (AMS); Sydney Harbour, H.L. Kesteven (AMS). *Tasmania*: Deal I., algae washings, 6 m, 6 May 1974, S.A. Shepherd (AMS); E. of Grassy, King I., c. 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); E of King I. (40°00′S, 144°38.5′E), 46 m, 30 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2163 (AMS); SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2111 (AMS); W of West Point (41°01.2′S, 144°21.5′E), 80 m, 14 Apr. 1973 MT *Sprightly*, B.M.R. stn S73-2117 (AMS); S of West Point (41°09.2′S, 144°24.2′E), 88 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2121 (AMS); NW of Sandy Cape (41°09.4′S, 144°10.6′E), 132 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2120 (AMS); S of St. Helens Point (41°30′S, 148°17.5′E), 31 m, 24 Mar. 1973, MT *Sprightly*, B.M.R. stn S73-2033 (AMS); S of Cape Ladi (42°00′S, 148°18′E), 28 m, 19 Mar. 1973, MT *Sprightly*, B.M.R. stn S73-2015 (AMS); off Cape Frederick Hendrick (42°50′S, 147°59.8′E), 58 m, 13 Mar. 1973, MT *Sprightly*, B.M.R. stn S73-1993 (AMS); off Low Rocky Point (42°58.2′S, 145°26.6′E), 84 m, 10 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2095 (AMS); E of Tasman I., (43°15′S, 148°03.3′E), 183 m, 24 Mar. 1970, FRV *Penghana* (AMS); W of Port Davey 43°22.5′S, 145°44.5′E), 144 m, 9 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2086 (AMS); SW of Cape Raoul (43°25′S, 147°45′E), 117 m, 24 Mar. 1970, FRV *Penghana* (AMS); S. of Tasman Head (43°33.45′S, 147°19.21′E), 73 m, 24 Mar. 1970, FRV *Penghana* (AMS); off Fluted Cape, Bruny I., algae washings, 7–10 m, Jan. 1972, S.A. Shepherd (AMS). *Victoria*: off SSE side of Gabo I., red algae, 22 m & 28 m, S.A. Shepherd, Feb. 1973 (2 lots AMS); off Lakes Entrance, 37–46 m, Laseron Coll. (AMS). *South Australia*: off Middle Point, near Cape Northumberland, algae, 13 m, 19 Mar. 1974, S.A. Shepherd (AMS); off Beachport, 73 m & 201 m, Verco Coll. (2 lots SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); off West I., Victor Harbour, brown algae, 25 m, 12 May 1973, S.A. Shepherd (AMS); Gulf St. Vincent, "depth?", Verco Coll. (SAM); SE of Kangaroo I. (37°00′S, 138°33′E), 77 m, 26 June 1962, HMAS *Gascoyne* stn G2/76/62; off Cape Borda, 101 m, Verco Coll. (SAM); Arno Bay, Iredale Coll. (AMS); St. Francis I., beach, Verco Coll. (SAM); off St. Francis I., 11–27 m & 27–37 m, Verco Coll. (2 lots SAM). *Western Australia*: off Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS).

Remarks. *H. fasciata* is rendered extremely distinctive by its superficially smooth protoconch, weak teleoconch spiral 2 and closely-spaced body whorl spirals, and the spotting on spiral 4. Compared with the superficially similar *H. scitula* (A. Adams), it is more broadly conical, spiral 3 is lower, and the suprasutural axial riblet zone on the protoconch is broader. *H. fasciata* and *H. scitula* are sympatric in South Australia.

In the Tasmanian Art Gallery and Museum there is a single fragmentary specimen gummed to a card labelled "*T. tasmanica* var. a" in letterpress type, with pencilled notations " = *T. pfeifferi* Crosse & Fisch." and "type": There are no locality data. The pencilled notations are not in Woods's handwriting (A. Green, pers. comm.), and were evidently added by the committee formed to segregate the types of Woods's species (May, 1903, p.111). In the original description Woods (1879, p.34) compared *T. fasciata* with *T. tasmanica* Woods alone, even though they are quite dissimilar. Therefore it seems clear that *T. fasciata* was intended as a formal name for the specimen originally recorded as "a variety" of *T. tasmanica* and subsequently listed as "*T. tasmanica* var. a", (T. Woods, 1877, p.151 and 1878, p.36 respectively). In the absence of additional type material of *T. fasciata* or *T. tasmanica* var. so-labelled, the present specimen is considered to be the holotype of *T. fasciata*. This specimen was evidently the one examined by Hedley (1904, p.616), which formed the basis for his concept of *T. fasciata*, an interpretation followed by Laseron (1954, p.152). Despite its fragmentary condition, enough remains of the holotype to show that the present material is undoubtedly conspecific, and that it is not conspecific with the closely related *H. scitula* (A. Adams) (= *T. pfeifferi* Crosse & Fischer). No Australian species are known that combine the teleoconch and protoconch facies illustrated for *H. fasciata* by Hedley (1903, figs 40, 41). The specimen used to illustrate the penultimate and body whorl (fig. 41) is clearly *H. fasciata*. This specimen lacked the protoconch (fig.40) so the illustration of the protoconch (fig.41) is clearly from another specimen, perhaps an immature *H. innotabilis* (Hedley).

Hedleytriphora scitula (A. Adams, 1851)

Fig. 17D–F, Table 13

Triphoris scitulus A. Adams, 1851: 278.—Hedley 1903: 616.
Triphoris pfeifferi Crosse & Fischer, 1865: 47, pl.1, figs 14, 15. New synonym.

Triphora pfeifferi.—Verco, 1909: 287 (in part).
Notosinister pfeifferi.—Cotton & Godfrey, 1931: 54, pl.1, fig. 14.

Description. Shell 3.80–9.60 mm x 1.00–1.95 mm, of 13½–21 whorls, lightly-built, translucent, very narrowly conical, body whorl weakly contracted, spire up to 4.80 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown, suture darker. Teleoconch pale yellowish brown, nodules paler or white, spiral 4 irregularly spotted between axials with darker yellowish brown; base yellowish brown on and below spiral 5.

Protoconch of planktotrophic larval type, narrowly conical, of 4–5 convex whorls, diameter 330–380 μm, diameter of first whorl 140–180 μm. First whorl sculptured with minute, spirally aligned, hemispherical granules. Subsequent whorls smooth apart from narrow supra- and subsutural zones of fine, crisp, axially elongate nodules; last whorl with the addition of an increasingly prominent, sharp-crested, median angulation.

Teleoconch whorl strongly angulate at spiral 3, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, much of spiral 4 exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch angulation; spiral 2 appearing as a thread on 11th–14th shell whorl, gradually enlarging but never as large as spirals 1 and 3. Spiral 1 strong, strongly nodular; spiral 2 narrowest, weakly nodular; spiral 3 highest and broadest, very strongly nodular, abapical margin poorly defined; spiral 4 undulate rather than nodular, abapical margin not defined; spiral 5 smooth, abapical margin not defined. Axial costae subdued, straight, rather strongly opisthocline, evenly traversing whorls, evanescent below spiral 3, numbering 11–14 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip flared and produced basally, inner extremity infolded to contact or overhang base of inner lip, indented below insertion, profile prosocyrt-opisthocline below simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unknown.

Table 13. *Hedleytriphora scitula.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	10	5.54	3.80–9.60	1.77
Diameter	10	1.36	1.00–1.95	0.30
Height/diameter	10	4.04	2.77–4.92	0.58
Diameter 1st whorl	10	0.16	0.14–0.18	0.01
No. whorls	10	16.03	13.50–21.00	2.23
No. axials	10	12	11–14	0.97

Type localities. *T. scitula*: Port Lincoln, South Australia. *T. pfeifferi*: Gulf St. Vincent, South Australia.

Types. *T. scitula*: LECTOTYPE (here selected from 3 syntypes) BMNH 196561. *T. pfeifferi*: repository unknown—not MNHN (P. Bouchet, pers. comm.).

Other material examined (c. 1000 specimens). *South Australia*: Largs Bay, 9 Mar. 1957, J. Kerslake (AMS); Largs Bay, Verco Coll. (SAM); Glenelg, E.A. Lower (AMS); Glenelg, Cox Coll. (AMS); Gulf St. Vincent, beach (AMS); Gulf St. Vincent, "depth?"and beach, Verco Coll. (SAM); Red Bank, Nepean Bay, Kangaroo I., alive among large brown algae on sheltered rock platform, low tide, 9 Mar. 1978, E.K. Yoo (AMS); Knobs Bluff, Kangaroo I., alive among algae on rocks, 18 m, 5 Mar. 1978, I. Loch (AMS); Arno Bay, 1950–60, J. Voorwinde (AMS).

Additional record. Elephant Shoal Reef, King I., Bass Strait, 13 m (Gabriel, 1956, p.11).

Remarks. *H. scitula* is rendered extremely distinctive by its almost entirely smooth planktotrophic larval protoconch, and very uneven-sized teleoconch spirals. It closely resembles *H. fasciata* (T. Woods) (see above), with which it is sympatric in South Australia.

The specimen chosen as lectotype is a well preserved adult with intact protoconch. The type material of *T. pfeifferi* could not be located despite extensive enquiries. However, I have no doubt that *T. pfeifferi* is a synonym of the prior *H. scitula* because the original illustration and description of the shell and the description of the colour of the basal spiral (i.e. spiral 4)—"*fusco et albo brunnea*"—are perfectly accordant and cannot be applied to any other known species. *H. scitula* is abundant on beaches at Gulf St. Vincent, the type locality for *T. pfeifferi*.

A specimen of *H. scitula* in the MNHN is labelled "*T. angustissimus* Deshayes, Bourbon—Dr F. Jousseaume 1921" but is almost certainly wrongly localized because *H. scitula* is restricted to south-eastern Australia. Unfortunately type specimens of *T. angustissimus*—described from Reunion—are not among the other material described by Deshayes (1863) (MNHN—P. Bouchet, pers. comm.), and the original description and illustration (Deshayes, 1863, p.104, pl.7, figs 1, 2) are not adequate for subsequent recognition.

Hedleytriphora innotabilis (Hedley, 1903)
Figs 7A, 17G–I, Table 14

Triphora innotabilis Hedley, 1903: 608, pl.32, figs 23, 24 (**not** fig. 25 = *Bouchetriphora marrowi* n.sp.).
Notosinister innotabilis.—Laseron, 1954: 152, figs 16, 16a.

Description. Shell 3.55–4.70 mm x 1.05–1.30 mm, of 13–15 whorls, narrowly conical or weakly cyrtoconoid, rather lightly built, spire up to 4.6 x higher than aperture plus canal.

Colour of protoconch reddish brown. Teleoconch dull reddish or deep dull yellowish brown, nodules paler.

Protoconch of planktotrophic larval type, narrowly conical, of 4½–5½ convex whorls, diameter 330–400 μm, diameter of first whorl 140–160 μm. First 1¼

Table 14. *Hedleytriphora innotabilis.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	6	4.00	3.55–4.70	0.48
Diameter	6	1.17	1.05–1.30	0.09
Height/diameter	6	3.42	3.08–3.61	0.19
Diameter 1st whorl	6	0.15	0.14–0.16	0.01
No. whorls	6	13.83	13–15	0.82
No. axials	6	18	17–20	1.17

whorls sculptured with minute, roughly spirally aligned, hemispherical granules, with the addition of a narrow subsutural zone of axial riblets on first quarter of second whorl. Subsequent whorls encircled by a fine crisp submedian spiral thread that surmounts an increasingly prominent angulation; and traversed by fine crisp axial riblets that occupy supra- and subsutural zones separated by a broad smooth zone. Subsutural riblet zone narrow, suprasutural riblet zone broad, extending slightly beyond adapical side of median spiral thread. A suprasutural thread is more or less exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, margins crisply defined, spiral 4 partly exposed at suture on spire. Spirals 1, 3 and 4 commencing immediately, spiral 3 continuing from median protoconch spiral, spiral 4 continuing from suprasutural protoconch spiral; spiral 2 appearing as a thread on 9th–10th shell whorl, gradually enlarging but never as large as adjacent spirals. Spirals 1–3 strongly nodular, of similar height, spirals 1 and 3 of similar size, spiral 4 weakly nodular, spiral 5 smooth. Axial costae straight, weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17–20 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded to more or less contact base of inner lip, indented below insertion, profile prosocyrt-opisthocline below a deep open U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) pale brownish yellow, thin, ovate, nucleus subcentral, of about 3 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (Fig. 7A) with the formula 5 + 1 + 1 + 1 + 5. Central tooth 5.8 μm wide, with 3 similar conical cusps. Lateral teeth each 5.8 μm wide, with 4 subequal cusps. Marginal teeth 4.8–2.4 μm wide, each with 3 cusps, outer 2 cusps longer than innermost cusp. Outermost 2 cusps of marginal 1 similar, median cusp of marginals 2–5 narrower than adjacent cusps.

Type locality. Sydney Harbour, New South Wales.

Holotype. AMS C.13508.

Other material examined (20 specimens). *New South Wales*: Clarence River, Yamba, A.A. Cameron (AMS); off Groper I., Coffs Harbour, algae washings, 15 m, alive, 18 Aug. 1977, C. Short (AMS); Long Reef, Collaroy, 1950-60, J. Voorwinde (AMS); Long Reef, shell sand, 27 June 1973, F.M. Climo (NMNZ); Long Reef, N side of platform near Fisherman's Beach, intertidal, alive, 10 Jan. 1978, B. Jenkins (AMS); off Long Reef, 26 m, T.A. Garrard (AMS); Sydney Harbour, C. Hedley (AMS); off North Head, Sydney, alive on sponge, 46 m, 5 Feb. 1973, Shelf Benthic Survey (AMS); off Dolls Point, Georges River, Sydney, 15 m (AMS); Little Coogee Bay, Sydney, Apr. 1895 & 19 July 1895, J. Brazier (AMS); NE side of SW arm, Port Hacking, stone washings, alive, 9 Oct. 1975, W.F. Ponder (AMS); Ocean Beach, Kurnell, 1950-60, J. Voorwinde (AMS); 5 km E of Long Point, rocks, 39.2 m, alive, 14 Apr. 1972, Shelf Benthic Survey (AMS).

Remarks. *H. innotabilis* differs from *H. fasciata* (T. Woods) in details of radular morphology, and from *H. fasciata* and *H. scitula* (A. Adams) in its uniform dark coloration and broader suprasutural protoconch riblet zone, and in having spirals 1 and 3 of similar height throughout. A very closely related species is described below. *H. innotabilis* is apparently endemic to New South Wales where it occurs sympatrically with *H. fasciata* (T. Woods).

Hedleytriphora basimacula n.sp.

Figs 7B, 18A–C, Table 15

Triphora pfeifferi.—Verco, 1909: 287 (in part not Crosse & Fischer).

Notosinister innotabilis.—Cotton & Godfrey, 1931: 53, pl.1, fig. 15 (**not** Hedley, 1903).

Description. Shell 2.95–8.50 mm x 0.90–2.00 mm, of 11½–19½ whorls, rather lightly built, narrowly conical or weakly cyrtoconoid, spire up to 5.7 x higher than aperture plus canal.

Colour of protoconch yellowish to reddish brown, first and last whorl frequently darker. Subsequent whorls pale yellowish to reddish brown, pale specimens frequently sparsely and irregularly maculate in darker shades, occasionally all of spiral 1 and nodular interspaces of spirals 2–4 a darker shade. Mature body whorl a darker shade on and below spiral 4 and on and between spirals 1 and 2; spiral 3 and interspace of spirals 3 and 4 white.

Protoconch of planktotrophic larval type, narrowly conical, of 4–5¾ convex whorls, diameter 330–470 μm, diameter of first whorl 130–150 μm. First 1¼ whorls sculptured with minute, roughly spirally aligned, hemispherical granules. Subsequent whorls encircled by a fine crisp submedian spiral thread that surmounts an increasingly prominent angulation; and traversed by fine crisp axial riblets that occupy a narrow subsutural zone and a broad suprasutural zone, interspace smooth. Suprasutural riblet zone extending slightly beyond submedian spiral. A suprasutural spiral thread is more or less exposed on last whorl.

Table 15. *Hedleytriphora basimacula.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	21	4.79	2.95–8.50	1.44
Diameter	21	1.34	0.90–2.00	0.28
Height/diameter	21	3.52	2.95–4.25	0.36
Diameter 1st whorl	21	0.13	0.13–0.15	0.01
No. whorls	21	14.65	12.00–19.50	2.14
No. axials	21	16	13–20	1.40

Teleoconch whorls flat-sided or weakly angulate abapically, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow but position clear, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 almost entirely exposed at suture on spire. Spirals 1, 3 and 4 commencing immediately, spiral 3 continuing from submedian protoconch spiral, spiral 4 continuing from suprasutural protoconch spiral; spiral 2 appearing as a thread on 8th–11th shell whorl, gradually enlarging but never as large as adjacent spirals. Spirals 1 and 3 strongly nodular, spirals 2 and 4 weakly nodular, spiral 5 smooth. Spiral 3 usually higher and broader than spiral 1, occasionally similar to spiral 1. Margins of spirals 1–3 and adapical margin of spiral 4 sharply defined, adapical margin of spiral 5 sharply or poorly defined, abapical margins of spirals 4 and 5 poorly defined. Axial costae straight or shallowly prosocyrt, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 13–20 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded to more or less contact base of inner lip, indented below insertion; profile prosocyrt-opisthocline below a deep open U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I), pale brownish yellow, thin, ovate, nucleus subcentral, of about 3 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (Fig. 7B) with the formula 5 + 1 + 1 + 1 + 5. Central tooth 4.8 μm wide, with 3 similar, conical cusps. Lateral teeth each 4.8 μm wide, with 4 subequal conical cusps. Marginal teeth 3.9–2.4 μm wide, each with 3 cusps. Outermost cusp of marginal 1 markedly longer than inner cusps. Outer 2 cusps of marginals 2–5 longer than innermost cusp, median cusp narrower than adjacent cusps.

Type locality. Dunsborough, southern Western Australia, on algae, 0–2 m, 25–27 Dec. 1971, W.F. & J.M. Ponder & B.R. Wilson.

Holotype. AMS C.130017.

Other material examined (many PARATYPES). *Tasmania*: SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2111 (AMS). *Victoria*: Bear's Gully, Waratah Bay, 30 July 1977 (MPM). *South Australia*: off Beachport, 73 m & 90 m, Verco Coll. (2 lots SAM); West I., off Victor Harbour, among brown algae, 25 m, 12 May 1973, S.A. Shepherd (AMS); Gulf St. Vincent, "depth?" & beach, Verco Coll. (2 lots SAM); Port Willunga, Verco Coll. (SAM); Knobs Bluff, Kangaroo I., alive among algae, 18 m, 5 Mar. 1978, I. Loch (AMS); off Cape Borda, 101 m & 113 m, Verco Coll. (2 lots SAM); Investigator Strait, 40 m, Verco Coll. (SAM); Arno Bay, Iredale Coll. (AMS); Arno Bay 1950-60, J. Voorwinde (AMS); 40 miles S of Cape Wiles, 183 m, Fisheries Bureau (AMS); off Pearson I., algae, 18 m, Jan. 1973, V. Taylor (AMS); Venus Bay, Verco Coll. (SAM); Streaky Bay, on rock platform, 6 Dec. 1971, W.F. & J.M. Ponder (AMS); off Point Brown, 6 m, Sept. 1972 (MPM); Petrel Bay, St. Francis I., 20–30 m, Dec. 1973, D. Howlett (AMS); St. Francis I., beach, Verco Coll. (SAM); off St. Francis I., 11 m, 27–37 m & 64 m, Verco Coll. (3 lots SAM). *Western Australia*: Off Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); E of Salisbury I. (34°13′S, 125°04′E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS); King George Sound, Verco Coll. (SAM); off Dunsborough, shell sand near limestone and coral reef, 16.5 m, 27 Dec. 1971, W.F. Ponder, N. Coleman & B.R. Wilson (AMS); off Dunsborough, *Cymodocea* washings, 1–2 m, 24 Dec. 1971, W.F. & J.M. Ponder (AMS); off Dunsborough Beach, 0–2 m, Dec. 1971, W.F. & J.M. Ponder & B.R. Wilson (AMS); Margaret River, shell sand, Nov. 1975 (MPM); Ellenbrook, near Cowaramup, Verco Coll. (SAM); Yallingup, Verco Coll. (SAM); Yallingup, algae washings on limestone platform, 2 Jan. 1972, W.F. Ponder & B.R. Wilson (AMS).

Remarks. *H. basimacula* closely resembles *H. innotabilis* (Hedley) in radular morphology, differing principally in colour and colour pattern (see description), in having a smaller first protoconch whorl (diameter 130–150 μm vs 140–160 μm), and in having teleoconch spiral 3 usually somewhat higher than spiral 1. From *H. scitula* (A. Adams) and *H. fasciata* it differs markedly in protoconch sculpture and colour pattern. *H. basimacula* is frequently misidentified as *T. granifera* Brazier in collections, from which it is most easily distinguished by the later appearance of teleoconch spiral 2 and the smooth zone on the protoconch.

H. basimacula, H. scitula and *H. fasciata* are sympatric in South Australia. *H. basimacula* and *H. innotabilis* will probably be found to occur sympatrically in southern New South Wales or in north-eastern Victoria when adequate collections are available.

Hedleytriphora elata (Thiele, 1930)

Fig. 18D–F, Table 16

Triphora elata Thiele, 1930: 577, pl.4, fig. 37.

Description. Shell 3.55–6.15 mm x 1.00–1.50 mm, of 13–18 whorls, rather lightly built, narrowly conical or cyrtoconoid, spire up to 5.7 x higher than aperture plus canal.

Colour yellowish to reddish brown, darker between nodules on spirals 1 and 3, nodules paler.

Protoconch of planktotrophic larval type, narrowly conical, of 4–5¼ convex whorls, diameter 330–450 μm, diameter of 1st whorl 130–150 μm. First 1¼ whorls

Table 16. *Hedleytriphora elata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	10	4.66	3.55–6.15	0.96
Diameter	10	1.21	1.00–1.50	0.20
Height/diameter	10	3.84	3.43–4.39	0.29
Diameter 1st whorl	10	0.14	0.13–0.15	0.01
No. whorls	10	15.18	13.00–18.00	1.73
No. axials	10	19	17–22	1.40

sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by a fine crisp submedian spiral thread that surmounts an increasingly prominent angulation; a suprasutural spiral is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1, 3 and 4 commencing immediately, spiral 3 continuing from median protoconch spiral, spiral 4 continuing from suprasutural protoconch spiral; spiral 2 appearing as a thread on 10th or 11th shell whorl, gradually enlarging until as large as spiral 3 on body whorl only. Spirals 1–4 of similar height, spirals 1–3 strongly nodular, spirals 1 and 3 similar, strongest; spiral 4 weakly nodular, spirals 5 and 6 smooth, spiral 6 usually very weak. Axial costae straight, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17–22 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity moderately infolded to more or less contact base of inner lip, indented below insertion; profile prosocyrt-opisthocline below a simple, open, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Animal unavailable.

Type locality. Surf Point, Outer Bar, at entrance to South Passage, Shark Bay, north Western Australia.

Holotype. ZMHU 67492.

Other material examined (29 specimens). *New South Wales*: N of Coffs Harbour (30°00′S, 153°23′E), 61 m, 22 Feb. 1972, MV *San Pedro Strait*, B.M.R. stn 1577 (AMS); Middle Harbour, Sydney, C. Hedley (AMS); Sydney Harbour dredge *Triton*, Capt. Comtesse (AMS). *South Australia*: Brighton Beach, Adelaide, T.A. Garrard (AMS); Gulf St. Vincent, Verco Coll. (SAM); off Cape Borda, 113 m, Verco Coll. (SAM); Investigator Strait, 40 m, Verco Coll. (SAM); Arno Bay, T.A. Garrard (AMS); Arno Bay, 1950-60, J. Voorwinde (AMS); Port Lincoln, stone washings, 10 Apr. 1975, F.H. Plant (AMS). *Western Australia*: 80 miles W of Eucla, 148 m, Verco Coll. (SAM); off Dunsborough, 16.5 m, 27 Dec. 1971. W.F. Ponder, N. Coleman & B.R. Wilson (AMS); Quobba Point, shell sand, W.J. Paul Coll. (NMNZ).

Remarks. Originally illustrated as an intact specimen (Thiele, 1930, fig. 37), the holotype now lacks the rim of the outer lip and all but the last three protoconch whorls. The material recorded here is indistinguishable from the holotype, and no other strictly similar species are known from Western Australia near the type locality. New South Wales specimens differ from Western Australian and South Australian specimens in having an extra protoconch whorl and a later-developing teleoconch spiral 2. Unfortunately all available New South Wales specimens are in poor condition and animals are not available, so it is yet impossible to ascertain whether they represent a distinct species or extralimital populations of *H. elata.*

Despite its uninterrupted protoconch axials, *H. elata* is tentatively referred to *Hedleytriphora* because of its close resemblance to *H. innotabilis* (Hedley) and *H. basimacula* n.sp. in gross shell morphology. Confirmation of this placement must await comparison of radulae.

Latitriphora n. gen.

Type species (here designated): *Triphora latilirata* Verco, 1909; Recent, southern Australia.

Diagnosis. Triphorines with hemispherical granules on the 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spirals 1–3 commencing simultaneously. Nodules strongly flattened, with sharp edges that overhang sides of spirals.

Description. Shell 6.10–13.5 (est.) mm high, narrowly or rather broadly conical, sometimes weakly cyrtoconoid, spire several times higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with hemispherical granules on first whorl. Subsequent whorls encircled by 2 median spiral threads, and entirely traversed by axial riblets. Lecithotrophic larval protoconch unknown.

Teleoconch of up to 18 whorls that are shallowly convex at first then flat-sided, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture very shallow, with or without spiral lirae on base. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 partly exposed at suture on spire. Spirals 1–3 commencing immediately, spirals 2 and 3 continuing from median protoconch spirals. Spiral 1 weak at first, spirals 1–3 similar or spiral 1 broadest on subsequent whorls. Spirals 1–4 nodular, almost flat-topped, nodules strongly depressed so that summits of spirals are gently undulate; edges of nodules thin and sharp, overhanging sides of spirals and projecting into spiral interspaces. Axial costae weak, straight or shallowly opisthocyrt, weakly opisthocline, evenly traversing whorls, evanescent below spiral 4 or 5. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity deeply infolded, profile prosocyrt-opisthocline below open posterior siphonal notch. Inner

lip thick. Parietal glaze thin. Anterior siphonal canal oblique, tubular and rather long or subtubular and short.

Animal unavailable.

Remarks. In the absence of knowledge of the radula, phylogenetic relationships are uncertain. However, I suspect that *Latitriphora* is related to *Teretriphora* Finlay, some species of which (e.g. *T. distorta* and *T. spica*) also tend to have sharp-edged nodules, though considerably less strongly developed. *Teretriphora* species differ otherwise in having interrupted protoconch axials (*T. spica*) and less well-developed basal features.

Besides the species described below, the genus contains *T. maxillaris* Hinds, 1843 and *Inella granicostata* Kosuge, 1962, together with several as yet undescribed tropical and subtropical Indo-Pacific species.

Latitriphora latilirata (Verco, 1909)
Fig. 18G–J, Table 17

Triphora latilirata Verco, 1909: 283, pl.26, fig. 1.
Notosinister latilirata.—Cotton & Godfrey, 1931: 53.

Description. Shell 6.10–13.5 (est.) mm x 1.55–3.20 mm, of 17–23 (est.) whorls, rather stoutly built, narrowly conical, weakly cyrtoconoid, spire up to 5.75 x higher than aperture plus canal.

Protoconch yellowish brown. First few teleoconch whorls white; subsequent whorls white or buff white, irregularly and sparsely maculate with pale yellowish brown; base white or buff white.

Protoconch of planktotrophic larval type, narrowly conical, of 4¾–5¼ convex whorls, diameter 330–380 μm, diameter of first whorl 140–170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by 2 similar fine crisp median spiral threads; a suprasutural thread is exposed on last whorl.

Teleoconch whorls more or less flat-sided, reticulately sculptured with strong, well-defined spiral cords and much weaker axial costae, suture indistinct, no microsculpture. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 very slightly exposed at suture on spire. Spirals 1–3 commencing immediately, spirals 2 and 3 continuing from median protoconch spirals. Spiral 1 weaker than spirals 2 and 3 on earliest whorls, enlarging until broader than spirals 2 and 3, which are similar throughout; spiral 4 slightly weaker than spiral 3; spiral 5 still weaker, smooth. Spirals 1–4 almost flat-topped, nodular, summits of nodules depressed so that summits of spirals are gently undulate; edges of summits of nodules thin and sharp, strongly overhanging sides and produced over spiral interspaces; adapical edge of nodules of spiral 1 overhanging suture. Spiral interspaces ¼–⅓ as wide as each spiral on later whorls. Axial costae weak, straight or shallowly opisthocyrt, weakly opisthocline, evenly traversing whorls, evanescent below spiral 5, numbering 27–32 on penultimate whorl. Base evenly contracted. Aperture ovate to subquadrate. Outer lip produced and flared basally, inner extremity deeply infolded, overhanging and more or less in contact with base of inner lip; profile opisthocline below open U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, of moderate length, tubular.

Animal unavailable.

Table 17. *Latitriphora latilirata.* Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls
13.5 (est.)	3.00	4.50 (est.)	—	23 (est.)
8.90	2.20	4.04	0.14	19
8.20	2.30	3.56	0.15	17
6.10	1.55	3.93	0.17	17

Type locality. Gulf St. Vincent, South Australia, depth not recorded.

Holotype. SAM D.13447.

Other material examined (30 specimens). *South Australia*: Gulf St. Vincent, 18 m, Verco. Coll. (PARATYPES SAM); Gulf St. Vincent, Verco Coll. (PARATYPES SAM & AMS); off St. Francis I., 27–37 m, Verco Coll. (SAM). *Western Australia*: W of Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); 40 miles W of Eucla, 132 m, Verco Coll. (SAM); 80 miles W of Eucla, 148 m, Verco Coll. (SAM); off Hopetoun, 64 m, Verco Coll. (SAM); King George Sound, 51 m, Verco Coll. (SAM); Ellenbrook near Cowaramup, shell sand, Jan. 1972, W. Anson (AMS); Ellenbrook, Verco Coll. (SAM).

Remarks. This species is rendered highly distinctive by its flat-topped, sharp-edged nodules and very narrow spiral interspaces. *L. conferta* (Laseron) has very similar sculpture but differs in colour (see below).

Latitriphora conferta (Laseron, 1958)
Fig. 19A, B

Aclophora conferta Laseron, 1958: 629, fig. 182.

Description. Protoconch unknown. Teleoconch shape and sculpture as in *L. latilirata* (Verco). Colour yellowish brown with subordinate white or buff white maculations.

Animal unavailable.

Type locality. Angourie, northern New South Wales.

Holotype. AMS C.103108 (9.70 [est.] x 2.50 mm; 13+ teleoconch whorls).

Other material examined (2 specimens). Shelley Bay, S of Angourie, northern New South Wales, D. Tarrant (MPM).

Remarks. The holotype, which lacks the protoconch and the first teleoconch whorl, is extremely similar to *L. latilirata* in shell shape and sculpture, differing in being yellowish brown with white maculations instead of white with sparse, yellowish brown

maculations. Judging from its rarity in northern New South Wales, and the absence of *L. latilirata* from east of Bass Strait, it seems likely that *L. conferta* is a distinct species that has its centre of distribution in warmer waters to north of New South Wales. Congeners are as yet unknown from Queensland, but very similar species occur off Lord Howe Island (AMS), Norfolk Island (NMNZ, MF.24538, 25176), Japan (*Inella granicostata* Kosuge 1962), and in the Mozambique Channel (MNHN).

Latitriphora kesteveni (Hedley, 1903)
Fig. 19C, D

Triphora kesteveni Hedley, 1903: 618, pl.33, fig. 45.
? *Teretriphora kesteveni.*—Laseron, 1954: 156, fig. 26.

Description. Shell up to 8.00 mm (est.) high, narrowly conical, spire up to 5.7 x (est.) higher than aperture plus canal.

Colour of protoconch unknown. Teleoconch pale pink (holotype) or yellowish brown.

Protoconch unknown.

Teleoconch of up to at least 13 flat-sided whorls, reticulately sculptured with spiral cords and axial costae, suture indistinct, fine spiral lirae on base below spiral 4. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 very slightly exposed at suture on spire. Spirals 1–3 evidently commencing immediately (first whorl unknown). Spirals 2 and 3 similar throughout, spiral 1 weaker on earliest whorls, the strongest spiral on subsequent whorls; spiral 4 slightly weaker than spirals 2 and 3; spirals 5 and 6 weakest, smooth, similar. Spirals 1–4 nodular, almost flat-topped, nodules strongly depressed so that summits of spirals are gently undulate; edges of nodules sharp and overhanging sides. Interspaces of spirals 2–4 about as wide as each spiral, interspace of spirals 1 and 2 about as wide as spiral 2. Axial costae considerably weaker than spirals 1–4, straight, narrow, opisthocline, evenly traversing whorls, evanescent below spiral 5, numbering 32–40 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip damaged in all available specimens. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, short, probably subtubular.

Animal unavailable.

Type locality. Lady Bay, South Head, Sydney Harbour, New South Wales.

Holotype. AMS C.13505 (6.60 x 1.60 mm; lacks protoconch and first 1 or 2 teleoconch whorls).

Other material examined (5 specimens). *New South Wales*: Middle Harbour, Sydney, C. Hedley (AMS); Cronulla, Sydney, E.H. Biden (AMS); Little Coogee Bay, Sydney, July 1895, J. Brazier (AMS).

Remarks. This species resembles *L. latilirata* (Verco) and *L. conferta* (Laseron) in having flat-topped, sharp-edged nodules, but differs mainly in having a narrower spire, smaller nodules, and narrower spire spirals with broader interspaces. The well-preserved Port Stephens specimen illustrated by Laseron (1954, fig. 26) is slightly broader than the specimens recorded above and differs further in having broader spire spirals with narrower interspaces. While it may well be another species, the sculptural differences could be an artifact, because in all other material, including the holotype, the shell surface is rather worn or etched, and wear to the edges of the nodules would effectively narrow the spirals and broaden the interspaces.

Genus *Mesophora* Laseron

Mesophora Laseron, 1958: 592. Type species (original designation): *Mesophora bowenensis* Laseron, 1958 (= *Triforis fusca* Dunker, 1860); Recent, Western Pacific.
Coriophora Laseron, 1958: 602. Type species (original designation): *Coriophora negrita* Laseron, 1958: Recent, Western Pacific. New synonym.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, and 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Axial costae nodular at intersections with spirals, laterally dislocate against spiral 2 before body whorl. Radula with the formula 24 + 1 + 1 + 1 + 24. Central tooth with 3 cusps, laterals with 4 or 5 cusps, marginals with 3 cusps.

Remarks. The type species of *Mesophora* and *Coriophora* belong to a large group of species that exhibit a tendency toward very late development of teleoconch spiral 2, and spiral dislocation of the axial costae against spiral 2 before the body whorl. These characters are shared with the type species of *Mastonia* Hinds, 1843 (*T. rubra* Hinds, 1843), *Iniforis* Jousseaume, 1884), *Epiforis* Laseron, 1958 (*E. australis* Laseron, 1958), and *Contraforis* Laseron, 1958 (*C. insulana* Laseron, 1958 = *C. bellula* Kosuge, 1961). Kosuge (1965, p.216) placed *Mesophora* as a synonym of *Mastonia* because of anatomical similarities and because of the difficulty of clearly distinguishing them on shell characters. Laseron (1958) considered that *Mesophora* and *Mastonia* were closely related, placed in *Mesophora* those species with less well-developed apertures with narrower spires, and in which teleoconch spiral 2 appears earlier. Species referable to *Mesophora* on these criteria differ further in having much weaker or (usually) no microsculpture on the spire, and in having two similar basal spirals (5 and 6). By contrast, typical *Mastonia* species have an extensive microsculpture of granulate spiral threads and only one basal spiral, which is equivalent to spiral 5 in *Mesophora*. Most species referable to *Mesophora* have one spiral thread on the protoconch, but typical *Mastonia* species have two spirals, at least on the first half of the second whorl (in several species the adapical spiral vanishes on subsequent whorls).

The type species of *Iniforis* (Fig. 20A) resembles *M. rubra* in teleoconch facies but differs markedly in having a short tubular instead of notched posterior canal, a weak teleoconch spiral 5, and a strong spiral 6. Unfortunately *I. malvaceous* has lecithotrophic larval

development but the protoconch of the two (congeneric) species normally identified as *I. violacea* (Quoy & Gaimard, 1833) (? = *I. fusiformis* Kosuge, 1961) (Fig. 20G, H)—which are essentially similar to *I. malvaceous* in shell and radular morphology—is like that of typical *Mastonia* species.

The radulae of *M. fusca* (Fig. 4I), *M. rubra* (Fig. 4J) and *I. malvaceous* (Fig. 4G) are basically rather similar, having numerous very small teeth, with three cusps on each marginal tooth. They differ in the following respects: *M. fusca* (and *C. negrita*—Fig. 4K) has three cusps on the central tooth, four cusps on each lateral tooth, and short, similar marginal cusps; *M. rubra* has five cusps on the central and each lateral tooth, and marginal teeth in two series, the inner teeth with three short cusps, the outer teeth with greatly elongate median cusps and short bordering cusps; *I. malvaceous* (and *I. violacea*—Fig. 4H) has three short similar cusps on all teeth. Although differences in radular morphology are associated with distinctive shell facies, it will be essential to compare radulae of many more species to ascertain the extent of variation within the groups. Pending a more exhaustive study, I prefer to retain *Mastonia, Mesophora* and *Iniforis* as distinct, closely related genera. *Coriophora* is placed as a synonym of the prior *Mesophora* because the differences between their type species are considered to be slight and specific, the differences in their protoconchs merely reflecting different types of larval development. Subfamily Mastoniinae Kosuge, 1966 is synonymized with Iniforinae Kosuge, 1966 because their type genera are undoubtedly very closely related.

Jousseaume (1884, p.236) proposed *Mastoniaeforis* for *M. chaperi* Jousseaume, 1884, which he described as being *Mastonia*-like but with three apertures (i.e. having a tubular posterior canal). His description agrees well with the only known syntype (MNHN), but his illustration either is grossly inaccurate or represents an entirely different species because it shows three spiral cords instead of two on most spire whorls. The syntype lacks the protoconch and outer lip, but from the original description the species has four protoconch whorls and a tubular posterior canal. *T. ofuensis* Baker & Spicer (1935, p.38, pl.5, fig. 3) and some Queensland specimens (Fig. 20E,F) are indistinguishable from the syntype in teleoconch morphology, differing in having five protoconch whorls instead of four as stated by Jousseaume (which is well within the limits of normal infraspecific variation). *M. chaperi* (? = *ofuensis*) and the type species of *Epiforis* and *Contraforis* resemble *I. malvaceous* in gross shell facies, but differ in having much more strongly produced posterior and anterior canals, and in having either very weak teleoconch microsculpture or (usually) none at all. The protoconchs of *M. chaperi* and *C. insulana* differ from those of *M. rubra, I. violacea* and *M. fusca* in the earlier appearance of the axial riblets, and in having larger granules on the first whorl, which are coalescent in spiral lines instead of discrete and evenly distributed over the whorl. I regard *Epiforis* and *Contraforis* as synonyms of *Mastoniaeforis*: the differences between the protoconchs of *E. australis* and *M. chaperi* merely reflect the type of larval development, and there is a smooth transition between species with long and short canals. *Mastoniaeforis* contains at least 30 distinct species, including *T. albogranosa* Kosuge, 1962, which according to Kosuge (1966, p.309) has a radula like that of *T. concors* Hinds, 1843 (i.e. like *M. rubra*). *Mastoniaeforis* should be retained at generic level pending a more exhaustive study of the entire complex.

Risbecia Kosuge, 1966 (type species *T. montrouzieri* Hervier, 1897, = *T. loyaltyensis* Hervier, 1897, ? = *T. rosea* Hinds, 1843) evidently belongs to this group as well, but its more precise relationships are uncertain.

Incidentally, *T. vulpina* Hinds, 1843, incorrectly cited as type species of *Mastonia* by Kosuge (1966), is a species of *Viriola*.

Mesophora granosa (Pease, 1870)
Figs 1D,G, 19E-G, Table 18

Triphoris granosus Pease, 1870: 776.
Mastonia aegle Jousseaume, 1884: 256, pl.4, fig. 12.—Habe & Kosuge, 1966: 104, pl.41, fig.4. New synonym.
Triforis aegle.—Hedley, 1899: 439, fig. 27.
Mastonia queenslandica Laseron, 1958: 591, figs 42, 43, 46, 47. New synonym.
Notosinister aegle.—Kosuge, 1963: 241, pl.15, fig.12.

Description. Shell 3.20–6.05 mm x 0.95–1.75 mm, of 13–17½ whorls, rather thick, narrowly cyrtoconoid, spire up to 5.1 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown. Teleoconch bright translucent yellowish or orange brown, spirals deep yellowish brown betwen opaque white nodules.

Protoconch of planktotrophic larval type, narrowly conical, of 5–6¼ convex whorls, diameter 370–450 μm, diameter of first whorl 130–170 μm. First whorl sculptured with minute roughened hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by a submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with spiral cords and axial costae, intersections strongly nodular, suture shallow. Spiral interspaces obscurely

Table 18. *Mesophora granosa.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	11	4.56	3.20–6.05	1.15
Diameter	11	1.40	0.95–1.75	0.29
Height/diameter	11	3.22	2.92–3.45	0.22
Diameter 1st whorl	11	0.14	0.13–0.17	0.01
No. whorls	11	15.16	13.00–17.50	1.81
No. axials	11	17	16–18	0.79

spirally lirate; very fine crisp spiral lirae on base below spiral 6. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed on spire; a secondary spiral between spirals 2 and 3, and later, between spirals 3–5 on body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 appearing as a thread on 10th–13th shell whorl, near abapical margin of spiral 1, gradually descending and enlarging to resemble spiral 3 on body whorl only. Spirals 1 and 3 similar on spire, spirals 2–4 of similar size on body whorl following weakening of spiral 3, spirals 1–3 strongly nodular, spiral 4 weakly nodular; spirals 5 and 6 weakest, similar, smooth. Axial costae opisthocline, very weak and markedly spirally dislocate between spirals 1 and 3 on spire, straight and more evenly developed on body whorl, evanescent below spiral 4, numbering 16–18 on penultimate whorl. Base very evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip, profile opisthocline below a deep, broad, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thickened beside posterior siphonal notch. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (Fig. 1D, G) pale yellowish brown, rather thick, flat, ovate, nucleus subcentral, spiral, of about 4 whorls; periphery thinner, upturned, projecting from suture externally. Muscle attachment scar minutely pitted, with a small central, spirally twisted, conical peg.

Radula with the formula 24 + 1 + 1 + 1 + 24. Central tooth 2.4 μm wide, with 3 similar cusps; lateral teeth each 2.9 μm wide, with 4 similar cusps; marginal teeth similar, 2.4–1.4 μm wide, each with 3 cusps, median cusp longer and narrower than adjacent cusps.

Type localities. *T. granosus*: Tahiti; *M. aegle*: New Caledonia; *M. queenslandica*: Michaelmas Cay, Queensland.

Types. *T. granosus*: LECTOTYPE (here selected from 2 syntypes) MCZH 273207. *M. aegle*: SYNTYPES MNHN. *M. queenslandica*: HOLOTYPE AMS C.103115.

Other material examined (98 specimens). *Solomon Is* (4 specimens): Banika I., Russell Is, under coral blocks, 24 Oct. 1965, R. K. Dell (NMNZ); Marau Sound, Guadalcanal, 8 Oct. 1965, R.K. Dell (NMNZ); Plantation Reef, Marau Sound, stone washings, 24 Sept. 1965, R.K. Dell (NMNZ). *Tahiti* (10 specimens): Motoiti I., Papeeti, coral block washings, June-July 1919, W.R.B. Oliver (NMNZ). *New Caledonia* (53 specimens): Pott I., Belep Is, low tide, 27 Aug. 1978; Nouville, low tide, 11 May 1978; Nienane, low tide, 23 Aug. 1978; Mangalia Reef, low tide, 11 May, 1979; Tabou Reef, 5 m, 23 June, 1978; Mamié, low tide, 3 Sept. 1978 & 15 Feb. 1979; Ploum, low tide, 22 June 1978; Rocher à la Voile, Nouméa, low tide, 10 May 1978; Bonne Anse, Prony Bay, low tide, 5 June 1978; Ouest Bay, Ouen I., low tide, 17 Sept. 1978 (all coll. P. Bouchet, MNHN). *Queensland* (24 specimens): Wilson I., Capricorn Group, intertidal, 8–29 Sept. 1969, A.N. & B.A. Boorman (AMS); Euston Reef, off Cairns, below steep coral walls, 21 m, 30 Nov. 1972, P.H. Colman (AMS); 3 km NE of W side of Gillett Cay, Swains Reef, 64–73 m, 17–19 Oct. 1962 (AMS). *New South Wales* (7 specimens): Iluka Bluff, on coralline algae, 17 Aug. 1976, I. Loch (AMS); Little Coogee Bay, Sydney, 9 July 1895 & 20 July 1896, J. Brazier (2 lots AMS); Kurnell, Botany Bay, J. Kerslake (AMS); Ocean Beach, Kurnell, 1950–60, J. Voorwinde (AMS); Long Reef, Collaroy, on algae in pool, low tide, 7 Oct. 1976, W.F. Ponder, I. Loch, B. Duckworth (AMS).

Remarks. *M. granosa* is characterized by the combination of extremely distinctive colour pattern, late-developing teleoconch spiral 2, spirally dislocate axial costae, and the single protoconch spiral. The type specimens of *M. aegle* and *M. queenslandica* are indistinguishable from the lectotype and topotypes of *T. granosus* and accordingly they are placed as synonyms. The holotype and paratypes of *M. queenslandica* are yellowish brown with white nodules, so Laseron's (1958) statement that they are "uniform bright cream" is inaccurate.

Like *M. fusca* (Dunker), *M. granosa* is common on reefs throughout the tropical and subtropical Western Pacific, and the rare New South Wales specimens clearly originate as stray larvae transported in southward-moving water masses.

Mesophora fusca (Dunker, 1860)

Figs 4I, 19I–K, Table 19

Triforis fusca Dunker, 1860: 237; 1861, pl.2, fig. 22.
Mastonia limosa Jousseaume, 1884: 263, pl.4, fig. 16.—Habe & Kosuge, 1966: 106, pl.41, fig. 21; Kosuge, 1966: 301, figs 1–5, 9–20. New synonym.
Triphora nocturna Hedley, 1903: 613, pl.32, figs 30, 31. New synonym.
Triphora hungerfordi Sowerby, 1914: 477, pl.19, fig.10.—Yen, 1942: 208, pl.15, fig. 84. New synonym.
Notosinister nocturna.—Laseron, 1954: 153, figs 19, 19a.
Mesophora bowenensis Laseron, 1958: 593, figs 52–55. New synonym.
Notosinister limosa.—Kosuge, 1963: 241, pl.14, fig. 5.
Cautor hungerfordi.—Kosuge, 1963: 250, pl.17, fig. 32.
Mastonia bowenensis.—Kosuge, 1965: 210.

Description. Shell 5.55–12 (est.) mm x 1.80–3.05 mm of 14–18 (est.) whorls, narrowly cyrtoconoid, rather thick, spire up to 6 x higher than aperture plus canal.

Colour deep reddish brown, nodules often slightly paler.

Protoconch of planktotrophic larval type, narrowly conical, of 2¾–3¼ convex whorls, diameter 300–350 μm, diameter of first whorl 200–230 μm. First whorl sculptured with minute hemispherical granules, subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by a fine crisp submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural spiral is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with spiral cords and axial costae, intersections strongly nodular, suture shallow but well defined. No microsculpture on spire, base very finely spirally lirate below spiral 6. Spiral cords numbering 4 on body whorl and 2 on base, adapical margin of spiral 4 exposed at suture

Table 19. *Mesophora fusca.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	8	7.28	5.55–8.70	1.19
Diameter	8	2.28	1.80–2.65	0.30
Height/diameter	8	3.18	2.97–3.34	0.14
Diameter 1st whorl	8	0.21	0.20–0.23	0.01
No. whorls	8	15.56	14.00–17.00	1.08
No. axials	8	20	18–22	1.20

on spire; usually a single weakly nodular, well-developed secondary spiral in each interspace of spirals 1–5 on last half whorl, that between spirals 1 and 2 appearing first. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch angulation; spiral 2 appearing as a thread on 9th–13th shell whorl near abapical margin of spiral 1, gradually descending and enlarging to resemble spiral 3 on body whorl only. Spirals 1 and 3 strongly nodular, similar on spire, spiral 3 weaker on body whorl; spiral 2 strongly nodular on body whorl only, spiral 4 weakly nodular, spirals 5 and 6 smooth. Axial costae straight, weak and often spirally dislocate between spirals 1 and 3, markedly opisthocline on all whorls except mature body whorl where more nearly orthocline and evenly developed, evanescent at spiral 4, numbering 18–21 on penultimate whorl. Base evenly contracted. Aperture subcircular or subquadrate. Outer lip produced and flared basally, inner extremity rather deeply infolded to almost contact columellar edge of base of inner lip, indented below insertion, profile opisthocyrt below a deep open U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, well produced.

Operculum (as in Fig. 1G) pale translucent yellowish brown, rather thick, externally shallowly concave, ovate, nucleus subcentral, of about 4 whorls; periphery thin, upturned, slightly projecting from suture externally. Muscle attachment scar well defined, minutely pitted, no accessory peg.

Radula (Fig. 4I) with the formula 24 + 1 + 1 + 1 + 24. Central tooth with 3 similar cusps; lateral teeth each with 5 similar cusps; marginal teeth similar, each with 3 cusps, the median cusp longer and narrower than adjacent cusps.

Type localities. *T. fusca*: Japan; *M. limosa*; New Caledonia; *T. nocturna*: Pearl Bay, Middle Harbour, Sydney New South Wales; *T. hungerfordi*: Hong Kong; *M. bowenensis*: Bowen, Queensland.

Types. *T. fusca*: LECTOTYPE (here selected from 2 syntypes) MNHU 101922a. *M. limosa*: SYNTYPES MNHN *T. nocturna*: HOLOTYPE AMS C.13515. *T. hungerfordi*: HOLOTYPE BMNH 1919.12.31.17. *M. bownenensis*: HOLOTYPE AMS C. 103055.

Other material examined (91 specimens). *Solomon Is* (8 specimens): Lauvie I., Marau Sound, Guadalcanal, intertidal, 4 Oct. 1965, R.K. Dell (NMNZ); Plantation Reef, Marau Sound, stone washing, 24 Sept. 1965, R.K. Dell (NMNZ). *New Caledonia* (1 specimen): Prony Bay, low tide, 4 June 1978, P. Bouchet (MNHN). *Queensland* (67 specimens, AMS): Fitzroy I., off Cairns, 1871, J. Brazier; Airlie Beach, Proserpine, rock washings, low tide, Sept. 1972, F.G. Plant; Port Curtis, Gladstone; Hervey Bay, J. Laseron; Hervey Bay, off Bundaberg, J. Laseron; Cleveland, Moreton Bay, J. Kerslake. *New South Wales* (15 specimens AMS): Middle Harbour Sydney, 5 m, T.A. Garrard; Pearl Bay, Middle Harbour, Sydney C. Hedley (3 lots); Port Hacking, outer end of SW arm on W side, on algae, low tide, 9 Aug. 1975, W.F. Ponder; Port Hacking, NE side of SW arm, stone washings, 9 Oct. 1975, W.F. Ponder.

Remarks. Among known southern Australian triphorids, *M. fusca* is rendered distinctive by its deep reddish brown coloration, single protoconch spiral, late-developing spiral 2, strong basal spirals, strong nodules, and oblique axial costae before the body whorl. Apart from their larger maximum size, New South Wales specimens (*T. nocturna*) are indistinguishable from the type specimens of *T. fusca, M. limosa, T. hungerfordi* and *M. bowenensis*. Accordingly all are regarded as synonyms of *T. fusca*, which has priority and is evidently the earliest name for the species. Unfortunately this synonymy must be tentative because the type specimens of *T. fusca, M. limosa, T. nocturna* and *T. hungerfordi* lack all or most of the protoconchs. The best preserved syntype of *M. limosa* retains the last whorl of the protoconch and is indistinguishable from topotypes of *M. limosa* and *M. nocturna*, and type specimens of *M. bowenensis* with intact protoconchs. The protoconch of the holotype of *M. bowenensis* (now detached in its tube) is of three and three-quarter whorls, not five as stated by Laseron (1958). Furthermore, contrary to Laseron's (1958) statement, there are no significant differences between the protoconchs of the specimens he examined (AMS). The specimen chosen as lectotype of *T. fusca* agrees most closely with Dunker's (1861) illustration (7.60 x 2.55 mm).

M. fusca is locally very common intertidally in the tropical Western Pacific, occurring only sporadically in New South Wales. The exceptionally large size attained by New South Wales specimens is probably associated with some local environmental factor.

Genus *Viriola* Jousseaume

Viriola Jousseaume, 1884: 238. Type species (original designation): *Viriola bayani* Jousseaume, 1884; Recent, New Caledonia.

Sinistroseila Oliver, 1915: 523. Type species (original designation): *Triforis incisus* Pease, 1861 (Oliver's specimens are *T.* cf. *intergranosa* Hervier, 1897).

Solosinister Laseron, 1954: 157. Type species (original designation): *Solosinister pagoda* laseron, 1954: Recent, New South Wales (= *T.* cf. *corrugatus* Hinds, 1843). New synonym.

Orbitriphora Laseron, 1958: 582. Type species (original designation): *Orbitriphora iredalei* Laseron, 1958 (= *T. cancellatus* Hinds, 1843); Recent, Queensland.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Spiral cords smooth, axials much narrower and closer. Spiral interspaces without spiral lirae. Radula with the formula 16–30 + 1 + 1 + 1 + 30–16. Central tooth with 3 cusps, laterals with 4 cusps, marginals with 3 cusps.

Remarks. As here limited, *Viriola* is a compact, very well defined group of predominantly tropical and subtropical species. They are characterized by having hemispherical granules on the first protoconch whorl, weak teleoconch spiral 2, prominent, smooth, or gently undulate teleoconch spirals, and numerous subordinate interstitial axial costae. The *Viriola* radula (Fig. 4L) is extremely similar to that of *Mesophora* Laseron and very like that of *Mastonia* Hinds, so I follow Kosuge (1966) in regarding them as closely related genera. *Mesophora* and *Mastonia* species differ very markedly from *Viriola* in having fewer, stronger, spirally dislocate axial costae, which are strongly nodular at intersections with the spiral cords.

Sinistroseila Oliver is based on misidentified (NMNZ) specimens of *V.* cf. *intergranosa* (Hervier, 1897) from the Kermadec Islands, a species that differs from *V. incisa* (Pease, 1861) in having a more strongly undulate teleoconch spiral 2 and stronger microsculpture. *V. cancellata* (Hinds, 1843), the type species of *Orbitriphora* Iredale, differs from *V. corrugata* (Hinds, 1843) in being distinctly cyrtoconoid, and in having weaker axial costae, and well-developed teleoconch microsculpture. However, axial costae are entirely lacking in the *V. corrugata*-like *V. excelsior* (Melville & Standen, 1899), and teleoconch microsculpture is obsolete in the *V. cancellata*-like *V. incisa*. Therefore the only constant difference between *Orbitriphora, Sinistroseila* and *Viriola* seems to be spire shape, which is interspecifically variable in both groups and surely trivial. Since *V. corrugata* (Fig. 20 I-K) and *V. cancellata* (from SEM) have essentially similar radulae and protoconchs, I cannot justify separation of *Sinistroseila* and *Orbitriphora* from *Viriola. Solosinister* Laseron is based on an immature specimen of *V.* cf. *corrugata* and is therefore a subjective synonym of *Viriola.*

Cernohorsky (1977, p.130) incorrectly described the protoconch of *V. samoana* Cernohorsky, 1977 (= *abbotti* Baker & Spicer, 1935) as having 1¼ whorls: his illustration clearly shows a typical planktotrophic larval protoconch of 5½ whorls. The only *Viriola* known to have lecithotrophic larval development is described below.

Viriola cf. *corrugata* (Hinds, 1843)
Figs 4L, 20I–K

Solosinister pagoda Laseron, 1954: 157, figs 27, 27a. New synonym.

The holotype of *Solosinister pagoda* is a protoconch-less immature New South Wales specimen of the species usually identified as *V. corrugata* (Hinds, 1843). Despite long and careful examination of all available type material and 160 specimens from Singapore, Northern Territory, Queensland, the Solomon Islands and New Caledonia, I am unable to ascertain the limits of variation of *V. corrugata. T. interfilatus* Gould, 1861 appears to be a synonym.

All specimens examined from south and south-east of Cape York, Queensland, including the Solomon Islands and New Caledonia, differ constantly from syntypes and Singapore specimens of *V. corrugata* in having larger first protoconch whorls (diameter 170 μm vs 150 μm). Unfortunately available collections are insufficient to ascertain whether or not protoconch size varies clinally around Cape York.

Sublittoral Queensland specimens closely resemble syntypes of *V. corrugata* in teleoconch facies but differ in being yellowish brown with white maculations instead of yellowish brown with white spiral cords. Sublittoral specimens from Northern Territory and Torres Strait closely resemble syntypes of *V. corrugata* in shell morphology, yet resemble sublittoral Queensland specimens in colour pattern, thus suggesting that *V. corrugata* may have a variable colour pattern. Sublittoral Queensland specimens closely resemble the holotype (MNHN) and a New Caledonian topotype (MNHN) of *V. bayani* Jousseaume, 1884 in shell facies, but the latter are deep reddish brown with greyish white maculations.

Littoral Queensland specimens, which are more broadly conical and relatively slightly larger than type material of *V. corrugata* and *V. bayani*, occur in two clearly distinct colour forms, one deep reddish brown with paler spirals, the other yellowish brown with white maculations. I can detect no significant differences in shell morphology. The deeply pigmented form is very similar to New Caledonian syntypes of *Cerithium (Triphoris) connatum* Montrouzier, 1862 (MNHN) in shell facies, colour and colour pattern. It has the radular formula 30 + 1 + 1 + 1 + 30 and is thus evidently not conspecific with the similarly-coloured Japanese *V. tricincta* (Dunker, 1882) (= *T. cingulata* Dunker, 1860 not A. Adams, 1851 = *T. dunkeri* Jousseaume, 1884), which, according to Kosuge (1966, p.307), has the radular formula 16 + 1 + 1 + 1 + 16. The maculate form is very similar to syntypes of *T. cingulatus* A. Adams, 1851 (BMNH) and *V. morychus* Jousseaume, 1898 (MNHN), both described from the Red Sea.

Taxonomic evaluation of this very complex group must await a specialized study of much larger collections from throughout the Indo-Pacific and Red Sea, in conjunction with type material.

In passing, I note that the species illustrated as *V. excelsior* (Melville & Standen, 1899) by Laseron (1958, p.584, fig.20) should be identified as *V.* cf. *corrugata.* The holotype of *V. excelsior* (BMNH) lacks teleoconch axials, but these are well developed in Laseron's specimen. The species identified as *V. connata* by

Kosuge (1961b, 1966) is either *V. vulpina* (Hinds, 1843) or a closely related species. Judging from Johnson's (1964, pl.13, fig.4) illustration of the holotype, *T. intercalaris* Gould, 1861, is a *Viriola* but specifically indeterminate.

Viriola truncata n.sp.

Fig. 21A–C

Description. Shell 10.1–10.3 mm x 3.15–2.90 mm, of 15 whorls, narrowly conical, stout, spire up to 3.8 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch opaque white, rather regularly axially maculate with yellowish to reddish brown; pigmentation deep between spirals 1 and 3, especially between axial costae, pale on spiral 1 and on and between spirals 3 and 4. Inner lip and base yellowish brown on and below spiral 5.

Protoconch of lecithotrophic larval type, blunt-tipped, merging insensibly into teleoconch, but apparently demarcated by appearance of teleoconch spiral 2, of 3 whorls, diameter 660–680 μm, diameter of first whorl 370–430 μm. Sculptured throughout with 2 rows of axially elongate nodules, abapical row very prominent.

Teleoconch whorls flat-sided, sculptured with prominent spiral cords and weaker interstitial axial costae, intersections weakly undulate, obscure spiral lines in spiral interspaces, suture very shallow. Spiral cords numbering 4 on body whorl and 1 on base, spiral 4 slightly exposed at suture on spire, a single secondary spiral between spirals 2 and 3 on body whorl behind outer lip. Spirals 1–3 commencing immediately, spirals 1 and 3 continuing from protoconch nodule rows. Spirals 1–4 crisply defined, spiral 5 a low swelling; spirals 1 and 3 strongest and subtriangular in section, spiral 3 slightly higher than spiral 1, spiral 2 narrowest throughout, spiral 4 intermediate in size between spirals 2 and 3. Axial costae depressed, broader than high, interspaces narrower than each axial, straight, gently opisthocline, entirely traversing spire whorls, evanescent below spiral 4, numbering about 40 on penultimate whorl. Base suddenly contracted below spiral 4. Aperture subquadrate. Outer lip strongly produced and flared, inner extremity rather deeply infolded to overhang base of inner lip, profile prosocyrt-opisthocline below broad posterior siphonal notch. Inner lip very thick. Parietal glaze thick. Anterior siphonal canal oblique, subtubular, rather long.

Animal unavailable.

Type locality. Port Hedland, Western Australia.

Holotype (ex J. Kerslake Coll.). AMS C.130019 (10.3 × 2.90 mm; 15 whorls).

Other material examined (2 PARATYPES). *Western Australia*: Port Hedland, J. Kerslake (AMS); Port Hedland, alive under rocks, Mrs Seymour (AMS).

Remarks. *V. truncata* differs from syntypes of *V. corrugata* in protoconch facies, colour and colour pattern, and in being more broadly conical. It occurs sympatrically with *V.* cf. *corrugata* at the type locality. Although occurring outside the geographic limit imposed for this revision, it is described because it is the only known species of *Viriola* (s.s.) with lecithotrophic larval development.

Viriolopsis n.gen.

Type species (here designated): *Viriolopsis occidua* n.sp.; Recent, Western Australia.

Diagnosis. Triphorines with hemispherical granules on 1st whorl and 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Spiral cords smooth, axials much narower and closer. Spiral interspaces without spiral lirae. Radula with the formula 11+1+1+1+11. Central tooth with 3 cusps, laterals with 4 cusps, marginals with 3 cusps.

Description. Shell 2.35–5.15 mm high, narrowly cyrtoconoid, lightly-built, spire up to 3.6 x higher than aperture plus canal.

Protoconch. First whorl of planktotrophic larval protoconch sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by axial riblets, and encircled by 1 submedian spiral thread. Lecithotrophic protoconch unknown.

Teleoconch of up to 13½ flat-sided whorls, sculptured with prominent, well-defined spiral cords, and much weaker interstitial axial riblets, intersections very weakly undulate or smooth, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 or 3 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch spiral; spiral 2 commencing soon after, gradually enlarging to resemble spiral 3 on body whorl only. Spiral cords rounded, spirals 1–4 more or less similar in size, basal spirals more depressed. Axial riblets narrow, almost obsolete, margins ill-defined, shallowly prosocyrt, gently opisthocline. Base very evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity shallowly infolded to almost contact base of inner lip; posterior siphonal notch U-shaped, simple. Inner lip thick. Parietal glaze thickened beside posterior notch. Anterior siphonal canal oblique, subtubular, short.

Operculum (as in Fig. 4B) thin, pale translucent yellow, ovate, nucleus subcentral, of about 2 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (*V. occidua* Fig. 4M) with the formula 11+1+1+1+11. Central tooth 2.9 μm wide, with 3 narrowly conical cusps; lateral teeth each 3.9 μm wide, with 4 narrowly conical cusps; marginal teeth 2.9–1.9 μm wide, each with 3 narrowly conical cusps, median cusp narrower and longer, adjacent cusps similar.

Remarks. *Viriolopsis* and *Viriola* Jousseaume have essentially similar teleoconchs and radular teeth, and

are undoubtedly closely related. Compared with *Viriola, Viriolopsis* species have fewer marginal teeth, one instead of two median spiral threads on the protoconch, a much more shallowly infolded inner extremity on the outer lip and a shorter anterior siphonal canal, and attain much smaller maximum size.

Apart from *V. occidua* n.sp., the genus contains *T. alboguttata* (Tomlin, 1926) and *Viriola fallax* (Kay, 1979).

Viriolopsis occidua n.sp.

Figs 4M, 21D-F, Table 20

Description. Shell 3.40–4.25 mm x 1.30–1.50 mm, of 11½–13½ whorls, rather thin, narrowly cyrtoconoid, spire up to 3.6 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch white or buff white, spirals 1–4 alternately broadly maculate with yellowish to reddish brown and white, the white bands broader, most deeply pigmented on spiral 1 and on sides of other spirals, base yellowish to reddish brown.

Protoconch of planktotrophic larval type, of 4½–5¼ convex whorls, diameter 380–420 μm, diameter of first whorl 130 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by 1 fine, crisp, weakly angulating, submedian spiral thread that surmounts a prominent angulation on last half whorl only.

Teleoconch whorls flat-sided, sculptured with prominent spiral cords and much weaker interstitial axial riblets, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 3 on base, spiral 4 partly exposed at suture on spire, a secondary spiral in each interspace of spirals 1–4 on body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch spiral; spiral 2 appearing as a thread before end of first half of first teleoconch whorl, gradually enlarging to resemble spiral 3 on body whorl only. Spiral cords rounded, spirals 1–3 very weakly undulate where traversing axials on mature whorls. Spirals 1 and 3 of similar size or spiral 1 slightly broader, spiral 4 slightly weaker than spiral 3, spirals 5–7 low and closely-spaced. Axial riblets numerous, narrow, gently opisthocline, shallowly prosocyrt, confined to interspaces of spirals 1–4. Base evenly contracted. Aperture ovate. Outer lip flared and produced basally, inner extremity rather shallowly infolded to contact columellar edge of base of inner lip, indented below insertion, profile prosocyrt below a deep U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thick on spiral 4 beside notch. Anterior siphonal canal oblique, subtubular, short.

Operculum and radula (Fig. 4M) described under *Viriolopsis*.

Type locality. West side of Carnac I., off Fremantle, Western Australia, alive in mixed algae washings, 4–8 m, 18 Dec. 1971, W.F. & J.M. Ponder, B.R. Wilson & N. Coleman.

Holotype. AMS C.130018.

Other material examined (33 PARATYPES). *Western Australia*: E of Salisbury I. (34°13'S, 125°04'E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS); between Eucla and Esperance, 79–147 m, July 1962, HMAS *Gascoyne* stn G2/96-97/62 (AMS); Observatory Point, Esperance, shell sand, 7 Jan. 1975, N. Hewitt (AMS); King George Sound, beach, Verco Coll. (SAM); South Point, S side of Two Peoples Bay, near Albany, large sheltered pool on exposed coast, 22 Feb. 1972, W.F. Ponder (AMS); Margaret River, shell sand, Nov. 1975 & 20 Dec. 1979 (2 lots MPM); Kilcarnup, N side of Margaret River, shell sand, 1 Jan. 1972, W.F. Ponder (AMS); Ellenbrook, S of Cowaramup, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM); Triggs, near Perth, on algae, open coast, 0–2 m, 29 Jan. 1972 (AMS); Cottesloe, Perth, A. Henn (AMS); Horrock's Beach, N of Geraldton, on algae, limestone platform, 9 Jan. 1972, W.F. Ponder (AMS); Murchison River mouth, S side, on rocks, low tide, Oct. 1967, F. Plant (AMS); Warroora, S of North West Cape, on algae, limestone shore reef, low tide, 28 June 1972, N. Coleman (AMS); E side of Exmouth township, on algae, low tide, 17 Jan. 1972, W.F. & J.M. Ponder (AMS).

Remarks. *V. occidua* is very closely related to the South African *V. alboguttata* (Tomlin, 1926) and the Indo-Pacific *V. fallax* (Kay, 1979). Compared with the holotype of *V. alboguttata, V. occidua* has a smaller first protoconch whorl (diameter 130 μm vs 150 μm), a yellowish instead of reddish brown protoconch, and white teleoconch spirals with subordinate brown bands instead of vice versa. Teleoconch spiral 2 commences almost immediately in both species. *V. fallax* differs in being alternately maculate with yellowish brown and white, evenly pigmented on spirals 1–4, and in having more sharply angulate protoconch whorls and a later-developing teleoconch spiral 2 (end of teleoconch whorl 3). Based on comparison with Hawaiian type material, *V. fallax* can now be recorded from Moreton Bay, Queensland (C. 110839), the Solomon Islands (C. 110860) and from several localities in the Mozambique Channel (MNHN).

Table 20. *Viriolopsis occidua.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	7	4.04	3.40–4.60	0.38
Diameter	7	1.40	1.30–1.50	0.09
Height/diameter	7	2.88	2.61–3.17	0.17
Diameter 1st whorl	7	0.13	0.13	0.00
No. whorls	7	12.50	11.50–13.50	0.61

Genus *Euthymella* Thiele

Euthymia Jousseaume, 1884: 237. Type species (original designation): *Euthymia regalis* Jousseaume, 1884: Recent, New Caledonia. **Not** *Euthymia* Stal, 1876.

Euthymella Thiele, 1929: 219. Replacement name for *Euthymia* Jousseaume (preoccupied).

Torresophora Laseron, 1958: 585. Type species (original designation): *Torresophora elongata* Laseron, 1958: Recent, Torres Strait, Australia. New synonym.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Axial costae few and broader than spirals or absent, spirals 1 and 2 weakly nodular and spirals 3 and 4 strongly nodular, or all spirals smooth. Spiral interspaces spirally lirate. Radula with the formula 8 + 1 + 1 + 1 + 8. Central tooth with 3 cusps, laterals with 4 cusps, marginals with 3 cusps.

Remarks. The radula of a topotype of *E. regalis* (Coll. P. Bouchet) (Fig. 5A) has the formula 8 + 1 + 1 + 1 + 8 and is essentially similar to that of *Viriola* (Fig. 4L, M). *Euthymella* and *Viriola* species are somewhat similar in gross shell morphology but are separated by a marked morphological discontinuity. In *Euthymella*, teleoconch spiral 3 is much stronger and angulates the whorls and, with the exception of *E. pagoda* (Hinds, 1843), the teleoconch axials are fewer in number and stronger. Several species, especially the narrow-spired ones, are rendered particularly distinctive by the presence of small nodules on spiral 4 that are more numerous than the primary axial costae. The tropical Pacific *E. pagoda* (Kosuge, 1961, pl.22, fig. 2) is unusual in that it entirely lacks axial costae but is otherwise very similar to such species as *E. elongata* (Laseron, 1958) and *E. kosugei* n.sp. The type species of *Torresophora* is essentially similar to *E. regalis* in sculpture but is larger with less strongly angulate whorls, and has a much taller, narrower and straighter spire. However, there is a smooth morphological transition between these extremes through such species as *E. regalis* (Hinds, 1843), *E. flammulata* (Pease, 1861) and several undescribed species. Other members include *T. bilix* Hinds, 1843 and *T. crenulatus* Deshayes, 1863. *E. lutea* Kosuge, 1962 and *E. isaotakii* Kosuge, 1962 are definitely not referable to *Euthymella* but their true affinities are unknown. Extreme caution must be exercised when identifying *E. regalis* because there are several superficially very similar undescribed species.

Euthymella elegans (Hinds, 1843)
Fig. 21G–I

Triphoris elegans Hinds, 1843: 18.
Euthymia tibialis Jousseaume, 1884: 266, pl.4, fig. 19.
Triforis picturatus Sowerby, 1901: 210, pl.22, fig. 11. New synonym.
Triphora granti Baker & Spicer, 1935: 40, pl.5, fig. 5. New synonym.
Euthymella pannata Laseron, 1958: 588, fig. 31.
Viriola kanamarui "Oyama MS" Kosuge, 1961b: 414, pl.22, fig.10 (nomen nudum).
Viriola elegans.—Habe, 1964: 45, pl.13, fig.16; Habe & Kosuge, 1966: 108, pl.41, fig. 44; Cernohorsky, 1978: 172, pl.61, fig.4.
Viriola kanamarui Oyama & Habe *in* Habe, 1962: Appendix 42, pl.13, fig. 16.—Inaba & Oyama, 1977:57.
Viriola flammulata.—Kosuge, 1965: 213 (**not** Pease, 1861).

Description. Shell 7.00–8.95 x 2.30–2.60 mm, of 15–17 whorls, thick and heavy, narrowly cyrtoconoid, spire up to 4.2 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Subsequent whorls white, boldly irregularly maculate with reddish brown abapically from suture to spiral 3; spirals 3–5 reddish brown, nodules white. Yellowish brown below spiral 5.

Protoconch of planktotrophic larval type, narrowly conical, of 3¾–4½ convex whorls, diameter 370–420 μm, diameter of first whorl 180 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by fine crisp angulating spiral threads. First half of second whorl with 2 similar median spiral threads, adapical thread vanishing, reappearing before start of third whorl, similar to abapical thread on subsequent whorls, again vanishing on last whorl, where abapical spiral surmounts a prominent angulation and a suprasutural spiral is exposed.

Teleoconch whorls flat-sided, sculptured with prominent spiral cords and low rounded axial costae with ill-defined margins, suture very shallow. Fine crisp spiral threads in spiral interspaces and on base; crisp axial threads between spirals 4 and 5 and in channel below spiral 5, obscure elsewhere. Spiral cords numbering 4 on body whorl and 1 on base, summit of spiral 4 entirely exposed at suture on spire; a secondary spiral between spirals 2 and 3 on body whorl behind outer lip, sometimes others subsequently appearing between spirals 3–5. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 appearing as a thread on 8th or 9th shell whorl, gradually enlarging to resemble spiral 1. On spire whorls spirals 1, 2 and 4 of similar size, gently undulate where traversing axials, spiral 3 strongest and strongly undulate. On body whorl spirals 1, 2 and 5 of similar size, spirals 1 and 2 gently undulate, spiral 5 distinctly nodular; spirals 3 and 4 strongest, similar following weakening of spiral 3 and enlarging of spiral 4, strongly undulate, spiral 4 distinctly nodular. Axial costae in two orders of magnitude, low and ill-defined, conspicuous only at spiral intersections. Primary costae low and broad, straight, opisthocline, evanescent immediately below spiral 5, numbering 15 or 16 on penultimate whorl. Secondary costae narrower, one in each interspace of primary costae, conspicuous as strong undulations on spiral 4 and local weak undulations on spirals 1 and 2. Base evenly contracted, with a concave channel between spiral 5 and top of canal. Aperture subcircular. Outer lip strongly produced and flared basally; inner extremity very deeply infolded, profile prosocyrt-opisthocline; posterior siphonal notch U-shaped, simple. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather long.

Animal unknown.

Type localities. *T. elegans*: Straits of Malacca, 37 m; *E. tibialis*: Tahiti; *T. picturatus*: Philippine Is; *T. granti*: Ofu, Samoa; *E. pannata*: Heron I., Queensland, under coral block; *V. kanamarui*: Amami Is, Japan.

Types. *T. elegans*: HOLOTYPE BMNH 1879.2.26. 197. *E. tibialis*: HOLOTYPE MNHN. *T. picturatus*: SYNTYPES (2) BMNH 1901.10.3.89-90. *T. granti*: HOLOTYPE San Diego Society of Natural History 23764. *E. pannata*: HOLOTYPE AMS C. 103117. *V. kanamarui*: Repository unknown (T. Okutani, pers. comm.).

Other material examined (21 specimens). *Solomon Is*: Marau Sound, Guadalcanal, 23 Sept. 1965 & 8 Oct. 1965, R.K. Dell (2 lots NMNZ). *Papeeti, Tahiti*: Ahina, alive, under coral blocks, low tide, July 1977, H. & J. Trondle (NMNZ); Motoiti I., alive under coral blocks, low tide, June-July 1919, W.R.B. Oliver (NMNZ). *New Caledonia*: Yandé, low tide, 22 Sept. 1978, P. Bouchet (MNHN); Mangalia Reef, low tide, 11 May 1979, P. Bouchet (MNHN). *Western Australia*: Lighthouse Beach, North West Cape, 1972, L. Figgis (AMS). *Queensland*: One Tree Island, Capricorn Group, intertidal, Dec. 1971, A.G. Beu (NMNZ); Euston Reef, off Cairns, below steep coral walls, 21 m, 30 Nov. 1972, P.H. Colman (AMS); Heron I., intertidal, 25 Dec. 1976, W.F. Ponder (AMS). *New South Wales*: Angourie, Clarence River, Grafton, A.A. Cameron (AMS); South Solitary I., Coffs Harbour, algae washings, 23 m, 18 Aug. 1972, C. Short (AMS).

Remarks. *E. elegans* is superficially similar to a number of tropical and subtropical Indo-Pacific species (several undescribed), and is distinguishable by details of shell sculpture and the dark, strongly maculate colour pattern. It is very closely related to the Hawaiian *E. flammulata* (Pease, 1861), which differs principally in having a considerably larger teleoconch spiral 1 and almost obsolete microsculpture. The protoconch of *E. flammulata* (from SEM) differs in having more widely spaced axial riblets and a slightly broader first whorl (diameter 200 μm vs 180 μm). The type specimens of *E. tibialis, T. picturatus, T. granti* and *E. pannata* are indistinguishable from the lectotype of *T. elegans*, as are the published illustrations of the holotype of *V. kanamarui* (Inaba & Oyama, 1977, p.57).

The species identified as *V. flammulata* by Kosuge (1961b, pl.22, fig. 3) is probably *E. bilix* (Hinds, 1843).

Euthymella kosugei n.sp.

Fig. 22A–C

Description. Shell 16 mm x 3.85 mm, of 22½ whorls (holotype), narrowly conical, of moderate thickness, spire up to 4.7 x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch yellowish brown or light orange brown with subordinate irregular white maculations; deep reddish brown between primary and secondary nodules on spiral 4 throughout, and between nodules on spirals 1 and 2 on first 1 or 2 whorls, nodules on spirals 4 and 5 white. White between spirals 4 and 5. Yellowish or light orange brown between nodules on spiral 5 and on base.

Protoconch of planktotrophic larval type, narrowly conical, of 4½–5 convex whorls, diameter 470–500 μm, diameter of first whorl 170–200 μm. First whorl sculptured with minute hemispherical granules; subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by fine crisp angulating spiral threads. First half of second whorl with 2 similar median spiral threads; adapical spiral vanishing, reappearing on latter part of third whorl, similar to abapical spiral subsequent whorls. A suprasutural thread is exposed on last whorl.

Teleoconch whorls strongly angulate at spiral 3, sculptured with prominent spiral cords and almost obsolete axial costae, suture shallow. Spiral interspaces and exterior of canal sculptured with fine crisp spiral threads; crisp axial threads between spirals 4 and 5 and in channel below spiral 5, obscure elsewhere. Spiral cords numbering 4 on body whorl and 1 on base, summit of spiral 4 entirely exposed at suture on spire; a secondary spiral on body whorl, behind outer lip between spirals 2 and 3; others appearing later between secondary spiral and spiral 3, between spirals 4 and 5, and below spiral 5. Spirals 1, 3 and 4 commencing immediately, spiral 3 continuing from abapical median protoconch spiral, spiral 4 continuing from suprasutural protoconch spiral; spiral 2 appearing as a thread on 10th–13th shell whorl, very gradually enlarging but never as strong as adjacent spirals. Spirals 1–3 subtriangular in section, with narrow, shallowly rounded summits; spiral 4 subquadrate, spiral 5 rounded. On spire whorls spiral 1 and 4 of similar size, spiral 2 weakest, spirals 1 and 2 gently undulate where traversing axials; spiral 3 strongest, strongly undulate and angulating whorls; spiral 4 beaded. On body whorl spirals 3 and 4 similar following weakening of spiral 3 and enlargement of spiral 4, spiral 5 strongly undulate. Axial costae straight, opisthocline, low, broad and rounded, margins ill-defined, evanescent immediately below spiral 5, numbering 16 on penultimate whorl. Secondary axials more numerous than primary axials, conspicuous only as beads and undulations on spirals 4 and 5. Base sharply contracted below spiral 4, channelled between spiral 5 and swollen top of canal. Aperture ovate. Outer lip prominently flared and produced, inner extremity very deeply infolded and in contact with most of inner lip, indented below insertion, profile prosocyrt-opisthocline below a small, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, long.

Animal unavailable.

Type locality. Aoki Harbour reef, west coast of Malaita Island, Solomon Islands, 3–7.5 m, alive on brown algae, coral rubble bottom on slope of sheltered side of reef, 18 Aug. 1973, P.H. Colman.

Holotype. AMS C.110711.

Other material examined (9 PARATYPES). Leven Bank, Comoro Is, Mozambique Channel, (12°32'S, 47°40.2'E), 35-150 m, 18 Mar. 1977 (MNHN). Geyser Bank, Comoro Is (12°22.04'S, 46°26.9'E), 5–35 m, 10 Apr. 1977 (MNHN). Madang Harbour, Papua New Guinea, from living coral,

11 m, 29 May 1970, W.F. Ponder & P.H. Colman (AMS). Euston Reef, off Cairns, Queensland, slope below steep coral walls, 21 m, 30 Nov. 1972, P.H. Colman (AMS). 3 km NE of W side of Gillett Cay, Swains Reef, Queensland, 64–73 m, 17–19 Oct. 1962 (AMS). South Solitary I., Coffs Harbour, New South Wales, algae washings, 21 m, 18 Aug. 1977, C. Short (AMS).

Remarks. This magnificent species is closest to *E. elongata* (Laseron), from which it differs in being more broadly conical, more deeply pigmented, relatively larger, and in having a much stronger teleoconch spiral 3. The single New South Wales specimen is evidently an extralimital stray carried southward in the planktonic stage. *E. kosugei* is named in honour of Dr Sadao Kosuge, Tokyo, Japan, as an appreciation of his pioneering work on the Triphoridae.

Genus *Eutriphora* Cotton & Godfrey

Eutriphora Cotton & Godfrey, 1931: 51. Type species (original designation): *Triphora cana* Verco, 1909; Recent, southern Australia.

For remarks see *Isotriphora* Cotton & Godfrey.

Eutriphora cana (Verco, 1909)

Figs 5B, 8D, 22D–F, Table 21

Triphora cana Verco, 1909: 289, pl. 23, figs 2–4 (in part).
Eutriphora cana.—Cotton & Godfrey, 1931: 51, pl. 1, figs 1, 2 (in part).

Description. Shell 5.60–8.90 mm x 1.75–2.50 mm, of 11–13½ whorls, stout, narrowly conical or cyrtoconoid, spire up to 4.3 x higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white; subsequent whorls and base yellowish to reddish brown, spiral 1 frequently tinted grey.

Protoconch of lecithotrophic larval type, merging almost imperceptibly into teleoconch, of 2¼–2½ convex whorls, diameter 450–550 μm, diameter of first whorl 330–430 μm. First whorl rather evenly convex, subsequent whorls with a prominent median angulation. Sculptured throughout with rounded axial riblets that are usually spirally dislocate at adapical third. A suprasutural spiral thread is exposed on last whorl.

Teleoconch whorls flat-sided or shallowly convex, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, large specimens frequently with a secondary spiral in each interspace of spirals 2–4 behind outer lip on body whorl. Spirals 1, 3 and 4 commencing immediately, spirals 3 and 4 continuing from protoconch angulation and suprasutural protoconch spiral; spiral 2 appearing as a thread on 4th or early on 5th shell whorl, gradually enlarging to resemble spiral 3 from about 7th shell whorl. Spirals 1–4 strongly nodular, spiral 1 broadest; spirals 2–4 similar, rather more crisply defined than spiral 1, spirals 2 and 3 slightly higher than spirals 1 and 4; spiral 5 weakly nodular or smooth; spiral 6 a smooth, rounded swelling at top of canal. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–29 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded to almost contact base of inner lip, indented below insertion, profile prosocyrt-opisthocline below a shallow, open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) pale translucent brownish yellow, thick, flat, ovate, of about 3 whorls, nucleus almost central; periphery upturned, projecting from suture externally. Muscle attachment scar well defined, minutely pitted, with a low, bluntly conical callus on nucleus.

Radula (Figs 5B, 7D) with the formula 9 + 1 + 1 + 1 + 9. Central tooth 6.8 μm wide, with 3 similar strong cusps. Lateral teeth each 8.7 μm wide, with 4 strong cusps; marginal teeth 6.8–3.9 μm wide, each with 4 cusps, second to innermost cusp on marginals 1–8 and median 2 cusps of marginal 9 longer and narrower than adjacent cusps.

Type locality. Gulf St. Vincent, South Australia.

Holotype. SAM D.13439.

Other material examined (33 specimens). *South Australia*: off Beachport, 73 m and 201 m, Verco Coll. (2 lots SAM); Gulf St. Vincent, Verco Coll. (2 lots SAM); 50 miles SE of Kangaroo I. (37°00′S, 138°33′E), 77 m, 26 June 1962, HMAS *Gascoyne* stn 2/76/62 (AMS); off Cape Borda, 101 m, Verco Coll. (2 lots SAM); off St. Francis I., 64 m, Verco Coll. (SAM). *Western Australia*: Ellenbrook, Verco Coll. (SAM).

Remarks. *E. cana* is characterized by the combination of white protoconch, brown and white teleoconch, blunt, unicarinate, axially ribbed protoconch, and the early appearance and development of teleoconch spiral 2. *E. tricolor* (Laseron) and *E. pseudocana* n.sp. are superficially very similar (see below).

Table 21. *Eutriphora cana*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	8	7.68	5.60–8.90	1.02
Diameter	8	2.31	1.75–2.50	0.24
Height/diameter	8	3.31	3.06–3.70	0.21
Diameter 1st whorl	8	0.37	0.33–0.43	0.03
No. whorls	8	12.34	11.00–13.50	0.77

Eutriphora armillata (Verco, 1909)

Figs 5C, 22G–I, Table 22

Triphora armillata Verco, 1909: 283, pl.22, fig. 5.
Notosinister armillata.—Cotton & Godfrey, 1931: 53.

Description. Shell 6.60–12 (est.) mm x 2.10–3.10 mm, of 15–20 whorls, of moderate thickness, narrowly conical, spire up to 5 × higher than aperture plus canal.

Table 22. *Eutriphora armillata.* Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls
12.0 (est.)	2.95	4.06 (est.)	—	20 (est.)
12.0 (est.)	3.10	3.87 (est.)	—	20 (est.)
10.0	2.85	3.50	—	18.00
7.50	2.10	3.57	0.17	16.75
6.60	2.10	3.14	0.17	15.00

Colour of protoconch reddish brown. First 2½–3 teleoconch whorls white, next 2 or 3 whorls reddish brown or black, subsequent whorls and base white.

Protoconch of planktotrophic larval type, narrowly conical, of 4½–5 convex whorls, diameter 380–430 μm, diameter of first whorl 170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by 2 similar, fine, crisp, angulating, median spiral threads, adapical spiral vanishing on last half whorl and abapical spiral surmounting a prominent carina. A suprasutural spiral thread is exposed on last half whorl.

Teleoconch whorls flat-sided or very shallowly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, a secondary spiral in each interspace of spirals 2–5 on mature body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina, spiral 2 appearing as a thread on 9th shell whorl, gradually enlarging to resemble spiral 3 on last few whorls. Spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 smooth, spirals 1–4 of similar height, spiral 1 slightly broader than spirals 2 and 3. Axial costae straight, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 21–24 on penultimate whorl. Base evenly contracted. Aperture subcircular. Outer lip produced and flared basally, inner extremity moderately infolded to contact base of inner lip, indented below insertion, profile prosocyrt-opisthocline below open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (as in Fig. 1I) pale translucent brownish yellow, thick, flat, ovate, spiral, nucleus almost central, or about 3 whorls; periphery thin, upturned, slightly projecting from suture externally. Muscle attachment scar well defined, with a very low callus immediately behind nucleus.

Radula (Fig. 5C) with the formula 16 + 1 + 1 + 1 + 16. Central tooth 4.8 μm wide, with 3 cusps; lateral teeth each 6.8 μm wide, with 5 cusps; marginal teeth similar, 4.8–1.9 μm wide, marginals 1–13 each with 4 cusps, second to innermost cusp longer and narrower than adjacent cusps, marginals 14–16 each with 3 cusps.

Type locality. Gulf St. Vincent, South Australia, 37 m.

Holotype. SAM D.13448.

Other material examined (137 specimens). *Victoria*: Cape Liptrap, 26 Apr. 1975 (MPM); Flinders, Western Port Bay, 1956-7, J. Kerslake (AMS); Point Lonsdale, 14 Mar. 1977 (MPM); off Portsea, 18 m, F.C. Grant (AMS). *South Australia*: off Beachport, 73 m, Verco Coll. (SAM); Gulf St. Vincent, Verco Coll. (3 lots SAM); off Cape Borda, 101 m, Verco Coll. (SAM); Investigator Strait, 40 m, Verco Coll. (SAM); Hardwick Bay, H.L. Kesteven, (AMS); Arno Bay, T. Iredale (AMS), T.A. Garrard (AMS), J. Voorwinde (AMS); off Neptune I., 73 m, Verco Coll. (SAM); St. Francis I., beach, Verco Coll. (SAM); off St. Francis I., 27–37 m, Verco Coll. (SAM). *Western Australia*: 40 miles W of Eucla, 132 m, Verco Coll. (SAM); 80 miles W of Eucla, 148 m, Verco Coll. (SAM); King George Sound, beach and 64 m, Verco Coll. (2 lots SAM); Ellenbrook, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. The colour pattern of *E. armillata* is so distinctive that even worn fragments may be identified with confidence. *E. armillata* differs markedly from *E. cana* in having planktotrophic instead of lecithotrophic larval development, otherwise their teleoconchs and radulae are extremely similar.

Eutriphora tricolor (Laseron, 1954)
Fig 23A–C, Table 23

Triphora cana Verco, 1909: 289 (in part)
Eutriphora cana.—Cotton & Godfrey, 1931: 51 (in part)
Notosinister tricolor Laseron, 1954: 146, fig. 4.

Description. Shell 4.80–7.50 mm x 1.75–2.40 mm, of 9½–13 whorls, rather thick, narrowly conical, spire up to 4.3 x higher than aperture plus canal.

Colour of protoconch yellowish brown. First 3 teleoconch whorls white. Subsequent whorls yellowish or reddish brown, spirals 1, 4 and 5 frequently bluish grey or greyish white, nodules on spirals 2 and 3 usually pale in deeply pigmented specimens. Teleoconch of some specimens uniform pale yellowish brown or buff white.

Protoconch of lecithotrophic larval type, of 2½–3 whorls, diameter 470–650 μm, diameter of first whorl 330–450 μm. First whorls evenly convex or weakly medially angulate, sculptured with rounded opisthocline, opisthocyrt or V-shaped opisthocyrt axial

Table 23. *Eutriphora tricolor.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	11	6.21	4.80–7.50	0.88
Diameter	11	2.02	1.75–2.40	0.22
Height/diameter	11	3.07	2.74–3.36	0.19
Diameter 1st whorl	11	0.39	0.33–0.45	0.04
No. whorls	11	11.14	9.50–13.00	1.00

riblets. Last whorl with a prominent median angulation, rounded, sigmoidal axial riblets, and a suprasutural spiral thread.

Teleoconch whorls flat-sided or very shallowly convex, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, usually a secondary spiral between spirals 2 and 3 on body whorl behind outer lip of large specimens. Spirals 1, 3 and 4 commencing immediately, spirals 3 and 4 continuing from protoconch spirals; spiral 2 appearing as a thread shortly after spirals 1, 3 and 4, gradually enlarging to resemble spiral 3 on all but earliest whorls. Spirals 2–4 of similar size, spiral 1 slightly broader, less crisply defined, frequently slightly lower; spirals 1–4 strongly nodular, spiral 5 weakly nodular or smooth, spiral 6 a low smooth swelling. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 22–26 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity rather shallowly infolded to overhang base of inner lip, profile prosocyrt-opisthocline below a broad, shallow, open, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Crookhaven Heads, New South Wales.

Lectotype (here selected from 2 syntypes). AMS C. 103078.

Other material examined (54 specimens). *Tasmania*: East Cove, Deal I., Bass Strait, 6–15 m, 3–10 May 1974, S.A. Shepherd (AMS); Green Cape, Maria I., on algae, 5.5 m, 26 Mar. 1970, W.F. Ponder & D.C. Wolfe (AMS). *Victoria*: SSE side of Gabo I., on algae, 28 m, Feb. 1973, S.A. Shepherd (AMS); Point Lonsdale, 13 Mar. 1977 (MPM). *South Australia*: off Beachport, 73 m, Verco Coll. (SAM); Robe, Verco Coll. (SAM); Gulf St. Vincent, dredged, Verco Coll. (SAM); Port Willunga, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (2 lots SAM); NW of Cape Borda, 110 m, Verco Coll. (SAM); off Neptune I., 75 m, Verco Coll. (SAM); Port Lincoln, Verco Coll. (SAM). *Western Australia*: Ellenbrook, Verco Coll. (SAM).

Remarks. *E. tricolor* is very similar to *E. cana* (Verco) with which it occurs sympatrically. Intact specimens are easily separated by their yellowish brown instead of white protoconchs and the earlier appearance of teleoconch spiral 2, but specimens lacking the tip of the spire may be indistinguishable from *E. cana*. The lectotype is the specimen illustrated by Laseron (1954, fig. 4).

Eutriphora pseudocana n.sp.

Fig. 23D–G, Table 24

Triphora cana Verco, 1909: 289 (in part).

Description. Shell 3.10–5.60 mm x 1.15–1.80 mm, of 9–11¾ whorls, stout, narrowly conical or slightly cyrtoconoid, spire up to 4 x higher than aperture plus canal.

Table 24. *Eutriphora pseudocana.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	9	4.23	3.10–5.60	0.87
Diameter	9	1.47	1.15–1.80	0.24
Height/diameter	9	2.88	2.69–3.11	0.14
Diameter 1st whorl	9	0.33	0.31–0.33	0.01
No. whorls	9	10.03	9.00–11.75	1.04

Colour: Protoconch and first few teleoconch whorls white. Subsequent whorls and base white (bleached?) or yellowish to reddish brown.

Protoconch of lecithotrophic larval type, merging almost imperceptibly into teleoconch, of about 2¼–2½ convex whorls, diameter about 450–550 μm, diameter of first whorl 310–350 μm. First whorl flattened above submedian angulation. All whorls traversed by 2 spiral zones of rounded, axially elongate nodules, one subsutural, the other surmounting a prominent, rounded, submedian angulation; interspace broad and smooth. Last whorl with a narrow suprasutural zone of small nodules that are connected to a poorly exposed suprasutural spiral thread.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1, 3 and 4 commencing immediately, spiral 3 continuing from protoconch angulation, spiral 4 continuing from suprasutural protoconch spiral; spiral 2 appearing as a thread on 5th–7th shell whorl, gradually enlarging to resemble spiral 3 on body whorl only. Spirals 1–4 similar, strongly nodular, spiral 1 broadest, spiral 5 more weakly nodular or smooth, spiral 6 a low smooth swelling. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–24 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded toward base of inner lip; profile prosocyrt-opisthocline below a shallow, open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. South of Cape Carnot, South Australia (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62.

Holotype. AMS C.130021.

Other material examined (33 PARATYPES). *South Australia*: off Beachport, 201 m, Verco Coll. (SAM); Gulf St. Vincent, dredged and beach drift, Verco Coll. (2 lots SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off

Neptune I., 190 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m, Fisheries Bureau (AMS). *Western Australia*: 80 miles W of Eucla, 148 m, Verco Coll. (SAM); Ellenbrook, near Cowaramup, Verco Coll. (SAM).

Remarks. *E. pseudocana* is superficially very similar to *E. cana* with which it occurs sympatrically. Compared with *E. cana* it attains smaller size though it is proportionally similar, the first protoconch whorl is drawn out instead of flattened, subsequent protoconch whorls are sculptured with discrete rows of nodules instead of axial riblets, and the teleoconch spirals are never tinted with grey.

Genus *Isotriphora* Cotton & Godfrey

Isotriphora Cotton & Godfrey, 1931: 52. Type species (original designation): *Triforis tasmanica* T. Woods, 1875; Recent, southern Australia.

Cotton & Godfrey (1931) separated *Isotriphora* from *Eutriphora* (page priority) on the basis of differences in lecithotriphic larval protoconch sculpture: *Isotriphora* for species with nodular spiral cords, *Eutriphora* for species with axial riblets. However, *I. simulata* n.sp. and *E. pseudocana* n.sp. have somewhat intermediate protoconch sculpture, and there is no discontinuity in teleoconch facies between species referable to either genus on protoconch morphology. The significance of the differences between the radulae of *I. tasmanica* (Fig. 5F) and *E. cana* (Fig. 5B) is somewhat lessened by the fact that *I. amethystina* (Fig. 5G)—with a protoconch like that of *I. tasmanica*—seemingly has intermediate radular morphology. I prefer to maintain *Isotriphora* as distinct from *Eutriphora* pending knowledge of the radulae of the other species described below, grouping these on the basis of similarity to respective type species. Indeed, *Isotriphora* and perhaps *Eutriphora* may be highly polyphyletic, containing species that have independently acquired similar protoconch facies.

The phylogenetic relationships of *Eutriphora* and *Isotriphora* are uncertain, but they may be related to *Iniforis* Jousseaume and *Viriola* Jousseaume, which have radulae rather like that of *I. tasmanica,* although markedly different teleoconchs. *I. tasmanica* is strikingly similar to *Triphora* (s.s.?) *taeniolata* (Hervier, 1897) in shell facies and colour pattern, but differs markedly in radular and opercular morphology. Although some species here referred to *Isotriphora* closely resemble the type species of *Litharium* Dall, 1924 (*L. oceanida* Dall, 1924; Recent, Hawaii), I retain *Isotriphora* (and *Eutriphora*) as distinct because the genus seems to be endemic to southern Australia, and because conservative shell characters could easily mask divergent anatomy in *L. oceanida*, the animal of which is unknown.

Eutriphora and/or *Isotriphora* are represented by a great number of species (mostly undescribed) in the Balcombian Miocene of Australia, many of which exhibit extraordinary diversity in lecithotrophic larval protoconch sculpture, including types that are unknown among Recent triphorids. Apart from the species described below, I know of at least five from off central and northern New South Wales, which, although distinct, cannot be named because of inadequate material.

Isotriphora tasmanica (T. Woods, 1875)
Figs 5F, 23H-K, Table 25

Triforis tasmanica T. Woods, 1875: 28.—Tate & May, 1901: 388, text fig. 7.

Triphora tasmanica.—Hedley 1903: 612, pl. 32, fig. 22; Verco, 1909: 290 (in part)

Isotriphora echina Laseron, 1954: 155, figs 23, 23a. New synonym.

Not *Isotriphora tasmanica* Laseron, 1954: 156, fig. 24 (= *I. simulata* n.sp.).

Description. Shell 5.50–10.8 mm x 1.75–2.80 mm, of 11–15½ whorls, stout, narrowly conical or slightly cyrtoconoid, spire up to 4.7 x higher than aperture plus canal.

Colour of protoconch yellowish brown, rarely lilac. Teleoconch yellowish brown, deeper yellowish brown or reddish brown between nodules on spiral 3.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 2½ whorls, diameter of first whorl 330–430 μm. Sculptured throughout with 2 strongly nodular, rounded spiral cords, abapical cord higher.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 continuing from protoconch spirals, spiral 2 appearing as a thread on 3rd–5th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 weakly nodular, spirals 5 and 6 smooth. Axial costae straight, opisthocline, evenly traversing whorls, evanescent against spiral 4, numbering 19–30 on penultimate whorl. Base evenly or rather suddenly contracted below spiral 4. Aperture subcircular. Outer lip produced and flared basally, inner extremity deeply infolded almost to spiral 6; profile prosocyrt-opisthocline below a deep, partly enclosed posterior siphonal notch. Inner lip thick. Parietal glaze thickened

Table 25. *Isotriphora tasmanica.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	21	7.34	5.50–10.08	1.59
Diameter	21	2.10	1.65–2.75	0.34
Height/diameter	21	3.47	3.08–3.92	0.24
Diameter 1st whorl	21	0.376	0.33–0.42	0.02
No. whorls	21	12.92	11.00–15.50	1.32

beside posterior notch. Anterior siphonal canal oblique, tubular, rather long.

Operculum (as in Fig. 1I) horny, thin, externally shallowly concave, subcircular, nucleus almost central, of about 4 whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (Fig. 5F) with the formula 30 + 1 + 1 + 1 + 30. All teeth and cusps similar, each tooth about 1.5 μm wide, central tooth with 3 cusps, lateral teeth each with 4 cusps, marginal teeth each with 3 cusps.

Type localities. *T. tasmanica*: Long Bay, Tasmania, dredged, depth not recorded; *I. echina*: off Long Reef, Sydney, New South Wales, 26 m.

Types. *T. tasmanica*: LECTOTYPE (here selected from 3 syntypes) TMAG E.534a. *I. echina*: LECTOTYPE (here selected from 2 syntypes) AMS C.65852.

Other material examined (168 specimens). *New South Wales*: Shelley Bay, S of Angourie, 26 Dec. 1971 (MPM); off Crowdy Head (31°38.9′S, 153°00.8′E), 91 m, 16 Dec. 1957, HMAS *Warrego* (AMS); off Forster (32°11.2′S, 152°54.2′E) 117 m, Dec. 1957, HMAS *Warrego* (AMS); off Sugarloaf Point (32°18′S, 152°50′E), 113 m, Dec. 1957, HMAS *Warrego* (AMS); off Broughton I., 64 m, J. Brazier (AMS); Long Reef, Collaroy, Sydney, 1950–60, J. Voorwinde (AMS); off Cronulla, 24 m, N. Coleman (AMS); Cronulla Beach, T.A. Garrard (AMS); 22 miles E of Narrabeen, 146 m, Prof. Haswell (AMS); 29 km E of Little Bay, Sydney (33°58.54′S, 151°33.38′E), 183–192 m, 9 Aug. 1973 (AMS); 8 miles N of Montagu I., 110–128 m, Capt. Moller (AMS); 15 miles off Twofold Bay (37°22′S, 150°02′E), 75 m, HMAS *Gascoyne* stn G2/58/62 (AMS). *Tasmania:* E. of Grassy, King I., c. 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); Green Cape, Maria I., algae washings, 5.5 m, 26 Mar. 1970, W.F. Ponder & D.C. Wolfe, (AMS); E of Eddystone Point (41°03′S, 148°42′E), 125 m, BANZARE stn 15 (AMS); S of West Point (41°09.2′S, 144°24.2′E), 88 m, 14 Apr. 1973 MT *Sprightly*, B.M.R. stn S73-2121 (AMS); W of West Point (41°01.2′S, 144°21.5′E), 80 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2117 (AMS); off Cape Pillar, 183 m, Hedley & May (AMS); off Cape Forestier (42°10′S, 148°34.7′E), 205 m, 19 Mar. 1973, MT *Sprightly*, B.M.R. stn S73-2017 (AMS). *Victoria:* 36 miles S of Cape Conran (38°18.2′S, 148°38.4′E), 265–220 m, May 1969, *Esso-Gipps* stn 10 (AMS); off Lakes Entrance (AMS); 70 miles S of Lakes Entrance (39°00′S, 148°24.5′E), 95 m May 1969, *Esso-Gipps* stn 20 (AMS). *South Australia*: off Beachport, 73 m, 201 m, 274 m, and 549 m, Verco Coll. (4 lots SAM); Gulf St. Vincent, dredged, Verco Coll. (SAM); SE of Kangaroo I. (37°00′S, 138°33′E), 77 m, 26 June 1962, HMAS *Gascoyne* stn G2/76/62 (AMS); off Cape Borda, 101 m and 113 m, Verco Coll. (2 lots SAM); off Neptune I., 190 m, Verco Coll. (SAM); off Cape Wiles, 183 m, Aug. 1909 (AMS); S of Cape Wiles, 183 m, Verco Coll. (SAM); S of Cape Carnot (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62 (AMS); off Point Brown, 40 m, Jan. 1972, D. Pearsons (MPM); off Point Sinclair, 1972, D. Pearsons (MPM).

Remarks. *I. tasmanica* is immediately separable from other species of *Isotriphora* (and *Eutriphora*) by its almost entirely enclosed posterior siphonal notch and the deep pigmentation on teleoconch spiral 3.

In the Tasmanian Museum and Art Gallery there are three specimens gummed to a card labelled "*Triforis tasmanica* Ten. Woods" in Wood's handwriting (A. Green, pers. comm.) with the notation "type" pencilled in another hand. Two of the specimens are fresh with perfect protoconchs and lack the mature body whorls, the third specimen is bleached and lacks the early spire whorls and most of the body whorl. Assuming that these are the original syntypes, the presence of a third specimen is anomalous because Woods (1875) stated that he had only two specimens. In the absence of other specimens labelled in Wood's handwriting, I accept that these are the original syntypes. The anomalous third specimen could easily have been added subsequently, or perhaps Woods was doubtful of its identity. The dimensions of the largest specimen (8.40 x 2.20 mm; 14 whorls) are similar to those given by Woods (1875) in the original description (length 9 mm, 13 whorls) and, it is therefore selected as lectotype.

Specimens from off northern and central New South Wales, including the type material of *I. echina* Laseron, differ from Tasmanian and South Australian specimens in having more numerous axial costae (24–30 vs. 19–24) with correspondingly smaller nodules (Fig. 23K) but are otherwise indistinguishable. The few specimens known from off southern New South Wales and northern Victoria are roughly intermediate, which suggests that *I. echina* and *I. tasmanica* intergrade clinally in this region.

Isotriphora amethystina new name

Figs 4C, 5G, 24A–C, Table 26

Triphora tasmanica var. *lilacina* Verco, 1909: 291 (**not** *"Triforis" lilacina* Dall, 1889).
Isotriphora lilacina.—Cotton & Godfrey, 1931: 52.

Description. Shell 3.45–11.0 mm x 1.30–2.95 mm, of 9½–14¾ whorls, rather thick, narrowly cyrtoconoid, spire up to 4.1 x higher than aperture plus canal.

Colour of protoconch and first 1 or 2 teleoconch whorls lilac; subsequent whorls yellowish brown or orange, spiral 3 lilac, base yellowish brown or white. Spiral 3 fades to white in some dead specimens. Pure albinos are known.

Protoconch of lecithotrophic larval type, blunt-tipped, merging insensibly into teleoconch but of about 2½ whorls, diameter of first whorl 330–420 μm.

Table 26. *Isotriphora amethystina.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	18	5.45	3.45–11.0	1.86
Diameter	18	1.81	1.30–2.95	0.45
Height/diameter	18	2.96	2.65–3.72	0.27
Diameter 1st whorl	17	0.374	0.33–0.42	0.02
No. whorls	18	10.82	9.00–14.75	1.41

Sculptured throughout with 2 strongly nodular spiral cords.

Teleoconch whorls flat-sided, last whorl sometimes very shallowly convex, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 continuing from protoconch spirals; spiral 2 appearing as a thread on 5th-8th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 of similar height, interspaces narrower than each spiral, spirals 2–4 of similar size, spiral 1 slightly broader, spirals 1–3 strongly nodular, spirals 4 and 5, weakly nodular, spiral 6 smooth. Axial costae straight, orthocline or gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–23 on penultimate whorl. Base very evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity deeply infolded to spiral 6; profile prosocyrt-opisthocline below a deep, U-shaped posterior siphonal notch that is almost entirely enclosed. Inner lip thick. Parietal glaze thin, thickened beside posterior notch. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (Fig. 4C) thin, translucent, pale brownish yellow, subcircular, nucleus subcentral, spiral, of about 3 whorls. Periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, simple.

Radula (Fig. 5G) with the formula 17 + 1 + 1 + 1 + 17. Teeth about 2 μm wide, similar, with similar cusps, central tooth with 3 cusps, lateral and marginal teeth each with 4 cusps.

Type locality. Gulf St. Vincent, beach drift.

Holotype. SAM D.13442.

Other material examined (347 specimens). *Tasmania:* E of Grassy, King I., c. 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73/2111 (AMS). *Victoria:* Port Fairy, R.S. Bell (AMS). *South Australia:* off Beachport, 73 m, Verco Coll. (SAM); Gulf St. Vincent, Verco Coll. (2 lots SAM); off Cape Borda, 101 m Verco Coll. (SAM); Corney Point, Verco Coll. (SAM); off Point Brown, 40 m, Jan. 1972, D. Pearsons, (MPM); St. Francis I., beach, Verco Coll. (SAM). *Western Australia:* off Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); Hopetoun, Verco Coll. (SAM); South Point, S side of Two Peoples Bay, alive in sheltered pool on outer coast, 2 Feb. 1972, W.F. & J. M. Ponder (AMS); King George Sound, beach, Verco Coll. (SAM); Windy Harbour, beach, 3 Jan. 1972, W.F. & J.M. Ponder (AMS); Margaret River, shell sand, 20 Dec. 1971 (MPM); Ellenbrook, Verco Coll. (SAM); Yallingup, algae washings, limestone platform, 2 Jan. 1972, W.F. Ponder & B.R. Wilson (AMS); off Peppermint Grove Beach, between Bunbury & Busselton, 4.6–7.6 m, 28 Dec. 1971, W.F. & J.M. Ponder & R. Hancey; Cape Naturaliste, shell sand, Mar. 1970, J. Hewitt (AMS); Yallingup, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. *I. amethystina* is rendered highly distinctive by its unique colour pattern and blunt, heavily sculptured protoconch.

As applied to *Triphora lilacina* Verco, 1908 and *Triforis lilacina* Dall, 1889, *Triphora* and *Triforis* are obviously conceptually identical. By application of ICZN articles 33(b) and 57(b), *Triforis* sensu Dall is an incorrect subsequent spelling of *Triphora* with no status in nomenclature, so *Triphora lilacina* Verco must be interpreted as a junior primary homonym of *Triforis lilacina* Dall. Therefore I have proposed *Isotriphora amethystina* as a substitute name for Verco's species.

Isotriphora disjuncta (Verco, 1909)

Fig. 24D–G, Table 27

Triphora disjuncta Verco, 1909: 292 (in part).
Isotriphora disjuncta.—Cotton & Godfrey, 1931: 52 (in part).

Description. Shell 3.75–7.40 mm x 1.25–2.25 mm, of 8¾–12 whorls, stout, narrowly conical or slightly cyrtoconoid, spire up to 4.2 x higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white. Subsequent whorls irregularly maculate with pale yellowish brown on a buff white ground, frequently a deeper shade between nodules on spirals 2 and 3, base pale yellowish brown on and below spiral 5.

Protoconch of lecithotrophic larval type, blunt-tipped, merging insensibly into teleoconch, but of about 2½ whorls, diameter of first whorl 330–400 μm, sculptured with 2 spiral cords bearing strong, rounded, axially elongate nodules, abapical spiral higher. A weakly beaded suprasutural spiral is exposed on last half whorl.

Teleoconch whorls flat-sided or very slightly convex, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 continuing from protoconch spirals, spiral 2 appearing as a thread on about 4th shell whorl, rapidly enlarging to resemble spirals 1 and 3 after 2 or 3 whorls. Spirals 1–3 strongly or rather weakly nodular, markedly broader than high, with interspaces markedly narrower than each spiral, spiral 4 weakly nodular, spirals 5 and 6 smooth, spiral 6 a low swelling. Axial

Table 27. *Isotriphora disjuncta.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	11	5.64	3.75–7.40	1.40
Diameter	11	1.83	1.25–2.25	0.37
Height/diameter	11	3.05	2.75–3.38	0.24
Diameter 1st whorl	11	0.359	0.33–0.40	0.02
No. whorls	11	10.84	8.75–12.00	1.39

costae straight, weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–21 on penultimate whorl. Base evenly contracted. Aperture subcircular to subquadrate. Outer lip flared and produced basally, inner extremity shallowly infolded to almost contact base of inner lip, indented below insertion; profile prosocyrt-opisthocline below a broad, shallow posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Off Cape Borda, South Australia, 101 m.

Holotype. SAM D. 13445.

Other material examined (30 specimens). *Tasmania*: E of Grassy, King I., c. 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); Pirates Bay, Eaglehawk Neck, intertidal (dead), 30–31 Mar. 1970, W.F. Ponder (AMS). *South Australia*: off Beachport, 73 m, Verco Coll. (SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off Neptune I., 190 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m, Fisheries Bureau (AMS).

Remarks. *I. disjuncta* is superficially similar to *I. tasmanica* (T. Woods) with which it occurs sympatrically. *I. disjuncta* is immediately separable by its simpler outer lip, maculate colour pattern, and narrower spiral interspaces.

Isotriphora simulata n.sp.

Fig. 24I–K, Table 28

Triphora disjuncta Verco 1909: 292 (in part).
Isotriphora tasmanica.—Laseron, 1954: 156, fig. 24 (not T. Woods, 1875).

Description. Shell 3.55–5.55 mm x 1.20–1.85 mm, of 9–11¼ whorls, stout, narrowly conical, spire up to 3.9 x higher than aperture plus canal.

Colour of protoconch and first few teleoconch whorls buff white. Subsequent whorls yellowish brown, more deeply pigmented between nodules on spirals 1–3.

Protoconch of lecithotrophic larval type, blunt-tipped, merging insensibly into teleoconch but of about 2½ whorls, diameter of first whorl 280–330 μm (usually 330 μm). Sculptured throughout with 2 strongly nodular spiral cords.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, spiral 3 dividing into 2 spirals on body whorl behind outer lip of some large specimens. Spirals 1 and 3 continuing from protoconch spirals, spiral 2 appearing as a thread on 4th–6th shell whorl, gradually enlarging to resemble spiral 3 on mature whorls. Spiral cords on body whorl about as high as broad, with interspaces about as wide as each spiral; spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spiral 5 weakly nodular or smooth, spiral 6 smooth. Axial costae straight, orthocline or gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19–23 on pentultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded to overhang tip of base of inner lip; profile prosocyrt-opisthocline below a simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Off Cape Borda, South Australia, 101 m.

Holotype (ex Verco Coll.). SAM D.16243 (3.60 × 1.35 mm; 9 whorls).

Other material examined (25 PARATYPES). *New South Wales*: Long Reef, Collaroy, rock washings, 1950-60, J. Voorwinde (AMS); Little Coogee Bay, Sydney, 21 Apr. & 13 July 1895, J. Brazier (2 lots AMS); Twofold Bay, T.A. Garrard (AMS). *Tasmania*: E of Grassy, King I., c. 58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/72 (AMS); W of West Point (41°01.2′S, 144°21.5′E), 80 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2117 (AMS); off West Point (41°09.2′S, 144°24.2′E), 88 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2121 (AMS); NW of Sandy Cape (41°09.4′S, 144°10.6′E), 132 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2120 (AMS). *South Australia*: off Beachport, 73 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m, Aug. 1909, *Endeavour* (AMS).

Remarks. *I. simulata* is superficially very similar to *I. disjuncta* (Verco) and *Eutriphora pseudocana* n.sp., with which it occurs sympatrically off southern Australia. Compared with *I. disjuncta, I. simulata* differs constantly in having narrower spiral cords with broader interspaces, and in usually having a narrower first protoconch whorl (280–330 μm vs. 330–400 μm). *E. pseudocana* n.sp. has similar teleoconch sculpture but *I. simulata* differs constantly in colour pattern and protoconch sculpture.

New South Wales specimens (Fig. 24H) differ from most southern specimens in the earlier appearance of teleoconch spiral 2 (4th instead of 5th or 6th whorl) but are otherwise indistinguishable. A Twofold Bay specimen was misidentified as *I. tasmanica* (T. Woods) by Laseron (1954), a species that attains much larger size, with a different colour pattern and more strongly developed apertural features.

Table 28. *Isotriphora simulata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	15	4.16	3.50–5.55	0.64
Diameter	15	1.44	1.20–1.85	0.17
Height/diameter	15	2.88	2.57–3.14	0.17
Diameter 1st whorl	15	0.324	0.28–0.33	0.01
No. whorls	15	9.87	9.00–12.00	0.88

Isotriphora vercoi n.sp.

Fig. 25A–C, Table 29

Triphora nivea Verco, 1909: 291 (in part).

Description. Shell 3.50–6.05 mm x 1.15–1.80 mm, of 8¾–12 whorls, stout, narrowly conical, sometimes weakly cyrtoconoid, spire up to 4.2 x higher than aperture plus canal.

Uniform white.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 2½ whorls, diameter of first whorl 330–400 μm. Sculptured throughout with a subsutural row of weak nodules, and 2 similar, strongly nodular, median spiral cords.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture. Spirals 1 and 3 continuing from median protoconch spirals; spiral 2 appearing as a thread on 3rd or 4th shell whorl, enlarging to resemble spiral 3 well before body whorl. Spirals 1–4 of similar height, spirals 2–4 of similar size on body whorl, spiral 1 slightly broader, interspaces about as wide as each spiral. Spirals 1–3 strongly nodular, spiral 4 weakly nodular, spiral 5 weakly nodular or smooth, spiral 6 smooth. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19–23 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity shallowly infolded to almost overhang base of inner lip; profile prosocyrt-opisthocline below a simple, open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Off Cape Pillar, Tasmania, 183 m.

Holotype. AMS C.130022.

Other material examined (18 PARATYPES). *Tasmania*: Bass Strait (41°45.5′S, 148°31′E), 113 m, 27 Mar. 1973, MT *Sprightly*, B.M.R. stn S73-2052 (AMS); NE of Beaching Bay, Maria I., (42°27.5′S, 148°12′E), 82.5 m, 25 Mar. 1970, FRV *Penghana* (AMS). *South Australia*: Gulf St. Vincent, 26 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m, Fisheries Bureau (AMS); S of Cape Wiles, 183 m, Verco Coll. (SAM); S of Cape Carnot (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62 (AMS); off Neptune I., 190 m, Verco Coll. (SAM). *Western Australia*: 80 miles W of Eucla, 148 m, Verco Coll. (SAM).

Remarks. *I. vercoi* is distinguished from all other species of *Isotriphora* by the uniform white shell and the subsutural row of nodules on the protoconch.

Isotriphora aureovincta (Verco, 1910)

Fig. 25D–F, Table 30

Triphora tasmanica var. *lilacina* var. *aureovincta* Verco, 1910: 126.

Isotriphora aureocincta [sic].—Cotton & Godfrey, 1931: 52.

Description. Shell 2.50–3.90 mm x 0.95–1.45 mm, of 8–10 whorls, thick, narrowly cyrtoconoid, spire up to 4.3 x higher than aperture plus canal.

Colour of protoconch lilac. Colour and colour pattern on subsequent whorls variable, but spiral 4 always deep yellowish brown. Some specimens (e.g. holotype) predominantly lilac or white, with base yellowish or reddish brown on and below spiral 6, spirals 2 and 5 yellowish brown on body whorl behind outer lip. Other specimens with spiral 1 pale lilac or white, spiral 2 pale yellowish brown, spiral 3 yellowish brown, spiral 5 white; base buff white or pale yellowish brown on and below spiral 6.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch but of about 2 whorls, diameter of first whorl 320–330 μm. Sculptured throughout with 2 similar, strongly nodular spiral cords.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 continuing from protoconch spirals; spiral 2 appearing as a thread on 5th-7th shell whorl, gradually enlarging to resemble spiral 3 on body whorl only. Spirals 1–4 of similar height, spiral 1 broadest, spirals 1–3 strongly nodular, spiral 4 weakly nodular; spirals 5 and 6 strong, weakly nodular or smooth. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4. Base evenly contracted. Aperture subquadrate. Outer lip damaged in all available specimens. Inner lip very thick. Parietal glaze rather thick. Anterior siphonal canal oblique, subtubular, short.

Table 29. *Isotriphora vercoi.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	7	4.93	3.50–6.05	1.04
Diameter	7	1.51	1.15–1.80	0.23
Height/diameter	7	3.23	2.80–3.56	0.27
Diameter 1st whorl	7	0.37	0.33–0.40	0.02
No. whorls	7	10.61	8.50–12.00	1.45

Table 30. *Isotriphora aureovincta* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	7	3.10	2.50–3.90	0.58
Diameter	7	1.11	0.95–1.45	0.18
Height/diameter	7	2.79	2.63–3.08	0.17
Diameter 1st whorl	7	0.33	0.33	0.00
No. whorls	7	8.75	8.00–10.00	0.78

Animal unavailable.

Type locality. Off Cape Borda, South Australia, 101 m.

Holotype. SAM D.13444.

Other material examined (40 specimens). *Western Australia*: Great Australian Bight (33°05'S, 128°40'E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); Margaret River, shell sand, Nov. 1975 & 20 Dec. 1971 (2 lots MPM); Ellenbrook, near Cowaramup, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. *I. aureovincta* is rendered distinctive by its small size, yellowish brown spiral 4 and heavily sculptured lilac protoconch. Specimens with yellowish brown on spiral 3 may ultimately be found to represent a distinct species, but apart from colour, there do not appear to be any significant differences between the two forms.

Bouchetriphora n.gen.

Type species: *Triphoris pallidus* Pease, 1870; Recent, Indo-Pacific.

Diagnosis. Triphorinae with hemispherical granules on 1st whorl, and 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Sculpture evenly reticulate, intersections nodular. Radula with the formula 4–6 + 1 + 1 + 1 + 6–4. Central and lateral teeth exceptionally broad, multicuspid. Marginal teeth narrow, each with short outer cusps and very long median cusps. Operculum multispiral, flat or strongly convex.

Description. Shell 2.50–7.75 mm high, narrowly cyrtoconoid, spire several times higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with hemispherical granules on 1st whorl. Subsequent whorls encircled by a fine, crisp, submedian spiral thread that surmounts an increasingly prominent peripheral angulation. Adapical spiral entirely absent. Whorls entirely traversed by fine crisp axial riblets. Lecithotrophic protoconch unknown.

Teleoconch of up to 13 more or less flat-sided whorls, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, with or without very fine spiral lirae on base. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina, spiral 2 appearing as a thread on 9th–13th shell whorl, gradually enlarging to resemble spiral 3. Spirals 5 and 6 smooth. Axial costae more or less straight, opisthocline, evenly traversing whorls, evanescent below spiral 4. Base evenly contracted. Aperture ovate to subquadrate. Outer lip flared and produced basally, inner extremity rather deeply infolded to almost contact base of inner lip, indented below insertion. Posterior notch simple. Anterior siphonal canal rather short.

Operculum multispiral, flat (as in Fig. 1G) or with a pronounced external spire (as in Fig. 1E,H), periphery thin, upturned and projecting from suture externally.

Radula (Figs 5D,E,7C) with the formula 4–6 + 1 + 1 + 1 + 4–6. Central and lateral teeth exceptionally broad, multicuspid. Marginal teeth much narrower, inner teeth with 4 cusps, outer teeth with 3 cusps, median cusps extremely long, narrow and hair-like, outer cusps short.

Remarks. *Bouchetriphora* is superficially similar to *Marshallora* Bouchet, 1983 (type species *Murex adversus* Montagu, 1803) in radular morphology, but in that genus the broad central and lateral teeth are deeply medially cleft, and the marginals each comprise a single long, narrow cusp with a weakly swollen base (Bouchet and Guillemot, 1978, fig. 20; Bouchet, 1983, fig. 12). *Bouchetriphora* species are strikingly similar to species of *Obesula* Jousseaume, 1898 in protoconch facies, but they have markedly different radulae (Figs 7F, 8E).

A species of *Bouchetriphora* (*T. otsuensis* Yokoyama, 1920) formed the basis of Kosuge's (1966) concept of *Triphora* Blainville. However, if I have interpreted *Triphora* correctly (see below), *Bouchetriphora* and *Triphora* are not closely related. *Bouchetriphora* evidently originated from *Nototriphora* n.gen. (see below).

Bouchetriphora pallida (Pease, 1870)

Figs 3, 7C, 26A–G, Table 31

Triphoris pallidus Pease, 1870:774.
Triphora infelix Webster, 1906: 307, pl.38, figs 6, 6a.—Suter, 1913: 257, Atlas (1915) pl.15, fig. 3; Powell, 1979: 255, fig. 59:3. New synonym.
Trifora angasi var. *leuca* Verco, 1909:282. New synonym.
Notosinister infelix.—Finlay, 1927:384.
Teretriphora leuca.—Cotton & Godfrey, 1931:56.
Notosinister glaciala Laseron, 1954:150, figs 13, 13a. New synonym.
Mesophora albomicra Laseron, 1958: 601, figs 88, 89.
?*Notosinister candefactum* Kosuge, 1963: 247, pl.16, fig.24, text figs 5, 9.
Triphora pallida.—Kay, 1979: 148, fig. 51L.

Description. Shell 2.50–7.75 mm x 0.80–2.05 mm, of 11½–18¾ whorls, of moderate thickness, narrowly cyrtoconoid, spire up to 5.6 x higher than aperture plus canal.

Uniform translucent white, dead specimens opaque.

Protoconch of planktotrophic larval type, narrowly conical, of 4–5½ convex whorls, diameter 350–470 μm, diameter of first whorl 150–180 μm (normally about 167 μm). First whorl sculptured with minute, roughly spirally aligned, hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by a fine, crisp submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow; usually with rather poorly defined spiral lirae on anterior canal, no

Table 31. *Bouchetriphora pallida.* Shell measurements (mm) and countings. (Southern Australia.)

Character	Number	Mean	Range	S.D.
Height	19	5.49	4.15–7.50	0.95
Diameter	19	1.55	1.25–2.10	0.26
Height/diameter	19	3.54	3.10–4.14	0.27
Diameter 1st whorl	19	0.17	0.15–0.18	0.01
No. whorls	19	15.57	13.50–18.00	1.20
No. axials	19	20	17–23	1.35

microsculpture on spire. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina; spiral 2 appearing as a thread on 9th–13th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 similar, spiral 1 slightly broader, spirals 1–3 strongly nodular, spiral 4 more weakly nodular; spirals 5 and 6 weakest, similar, smooth. Axial costae straight, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 14–23 on penultimate whorl. Base evenly contracted. Aperture ovate to subquadrate. Outer lip flared and produced basally, inner extremity rather deeply infolded to almost contact base of inner lip, indented below insertion, profile prosocyrt-opisthocline below simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 4C) subcircular, thin, flat, nucleus subcentral, of about 4 whorls; periphery thinner, strongly upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, with a low, broad central swelling.

Radula (Fig. 7C) with the formula 5-6 + 1 + 1 + 1 + 6-5. Central tooth short and very broad, with 8–10 short cusps. Lateral teeth short and very broad, each with 7 short cusps. Marginal teeth much narrower than central and lateral teeth, innermost tooth with 4 cusps, median 2 cusps narrow and very long, bordering cusps short; outer marginal teeth each with 3 cusps, median cusps narrow and very long, bordering cusps short.

Type localities. *T. pallidus:* Kauai, Hawaii; *T. infelix*: Off Great Barrier I., New Zealand, 201 m; *T. leuca*: St. Francis I., beach drift; *N. glaciala*: Off Sow and Pigs Reef, Port Jackson, New South Wales, 11–17 m; *M. albomicra*: Great Barrier Reef, off Cairns; *N. candefactum*: Ankyaba, Setouchi-machi, Amami I., Japan.

Types. *T. pallida*: LECTOTYPE (here selected from 2 syntypes) MCZH 50073. *T. infelix*: HOLOTYPE NMNZ M.1674. *T. leuca*: HOLOTYPE SAM D.13452. *N. glaciala*: HOLOTYPE AMS C.65857. *M. albomicra*: HOLOTYPE AMS C.103051. *N. candefactum*: HOLOTYPE NSMT 50018.

Other material examined (c.1500 specimens). *Hawaii* (13 specimens): off Kepuhi, Oahu, 60 m, Apr. 1977, E.A. Kay Coll. (NMNZ); off Honaunau, 13 m, Aug. 1970, E.A. Kay Coll. (NMNZ); Haleiwai, Oahu, shell sand, 7 Apr. 1974, E.A. Kay & W.F. Ponder (AMS). *Solomon Is* (8 specimens): Yandina, Banika I., Russel Is, shell sand, 24 Oct. 1965, R.K. Dell (NMNZ). *Mozambique Channel* (13 specimens): off Geyser Bank 5–20 m, 21 Mar. 1977, N.O. Suroit, Benthedi stn 14 (MNHN); Sada Channel, Mayotte I., 3–35 m, 28 Mar. 1977, Benthedi stn 55–56 (MNHN). *New Caledonia* (40 specimens): Mangalia Reef, alive, low tide, 11 May 1979, P. Bouchet (MNHN); Baie Awe, Ile Art, alive, low tide, 25 Aug. 1978, P. Bouchet (MNHN); Mamié, alive, low tide, 15 Feb. 1979, P. Bouchet (MNHN); Ile Néba, alive, low tide, 22 Aug. 1978, P. Bouchet (MNHN); Yandé, alive, low tide, 22 Aug. 1978, P. Bouchet (MNHN); Pott I., Belep Is, alive, low tide, 27 Aug. 1978, P. Bouchet (MNHN). *Queensland* (20 specimens): Yam I., Torres Strait, alive, coral washings, reef edge, 5–6 July 1976, W.F. Ponder & I. Loch (AMS); Wilson I., Capricorn Group, alive, intertidal, Sept. 1969, A.N. & B.A. Boorman (AMS); E side of Eagle I., W of Lizard I., alive, algae washings on sand flat, 12 Dec. 1974, W.F. Ponder & I. Loch (AMS); Barrier Reef, off Cairns (AMS); Euston Reef off Cairns, 21 m, 30 Nov. 1972, P.H. Colman (AMS); NE of W side of Gillet Cay, Swains Reef, 64–73 m, 17–19 Oct. 1962 (AMS). *New South Wales* (15 specimens): Middle Harbour, Sydney, C. Hedley (AMS); off Sow and Pigs Reef, Port Jackson (AMS); Ocean Beach, Manly, shell sand, 1950–60, J. Voorwinde (AMS). *Tasmania* (1 specimen): SE of King I. (40°20′S, 144°36.4′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2112 (AMS). *Victoria* (9 specimens): Point Lonsdale, alive, under rock ledges, intertidal, 14 Mar. 1977 (MPM); S of Wilson's Promontory (39°19′S, 146°12′E), c. 76 m, 22 July 1962, HMAS *Gascoyne* stn G2/67/62 (AMS); off Lakes Entrance, 37–46 m (AMS); 36 km S of Cape Conran (38°08.5′S, 148°43.5′E), 107 m, *Esso-Gipps* stn 8 (AMS). *South Australia* (c.200 specimens): off Beachport, 73 m & 201 m, Verco Coll. (2 lots SAM); Backstairs Passage, 37 m, Verco Coll. (SAM); Gulf St. Vincent, Verco Coll. (SAM); Stokes Bay, Kangaroo I., alive in osculae of sponge on rock face, c. 7 m, 4 Mar. 1978, I. Loch (AMS); Knobs Bluff, Kangaroo I., algae on rocky bottom, 18 m, 5 Mar. 1978, I. Loch (AMS); off Cape Borda, 101 m, Verco Coll. (SAM); Corney Point, Verco Coll. (SAM); E of North Neptune I., 82 m, Verco Coll. (SAM); off Neptune I., 190 m, Verco Coll. (SAM); S of Cape Wiles, 183 m, Fisheries Bureau (AMS); Point Brown, Smoky Bay, alive under rocks, 5 Dec. 1975 (MPM); Smoky Bay, Nov. 1973, C. Wilcox (MPM); off St. Francis I., 27–37 m & 64 m, Verco Coll. (2 lots SAM); St. Francis I., Verco Coll. (SAM). *Western Australia* (150 specimens): 40 miles W of Eucla, 132 m, Verco Coll. (SAM); 80 miles W of Eucla, 148 m, Verco Coll. (SAM); E of Salisbury I., (34°13′S, 125°04′E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS); King George Sound, beach, Verco Coll. (SAM); Hopetoun, Verco Coll. (SAM); Ellenbrook, Verco Coll. (SAM); off Dunsborough, 16.5 m, 27 Dec. 1971, W.F. Ponder, N. Coleman & B.R. Wilson (AMS); Wyadup, S of Yallingup, among algae on rocky shore, 1 Jan. 1972, W.F. Ponder & B.R. Wilson (AMS); Rottnest I., Verco Coll. (SAM). *Lord Howe I.* (140 specimens): R.S. Bell (AMS); off NE side, 27.5 m, R.S. Bell (AMS); 31°37.2′S, 159°13′E, 51–55 m, 6 Nov. 1976, HMAS *Kimbla* stn LH4 (AMS). *Norfolk I.* (138 specimens): R.S. Bell (3 lots AMS, NMNZ); Emily Bay, dredged, R.S. Bell (3 lots AMS, NMNZ); Kingston, alive on intertidal reef, 13 Sept 1962, W. Ballantine (AMS); off Duncombe Bay, 31 m, H.

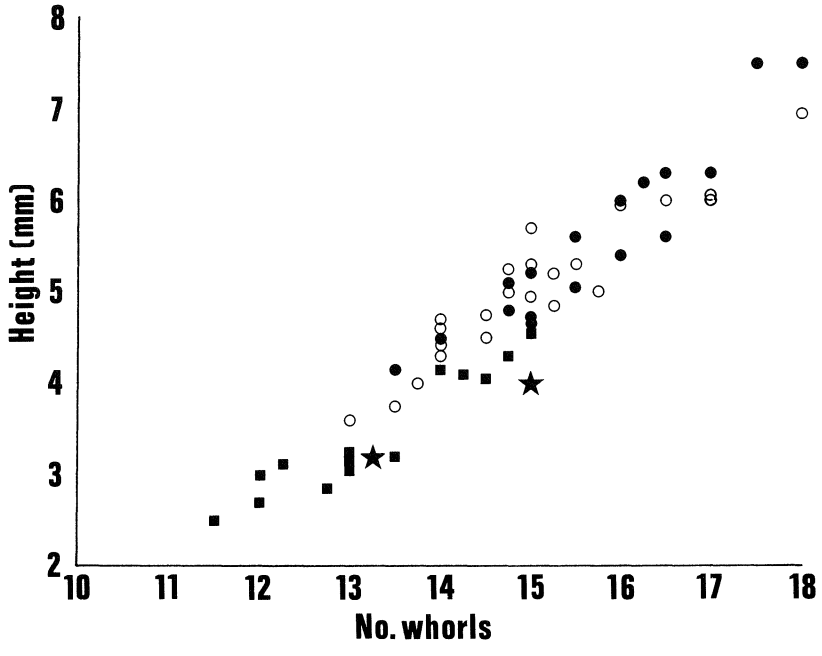

Fig. 3. *Bouchetriphora pallida.* Comparison of relative sizes of specimens from southern Australia (●), New Zealand (o), Queensland, the Solomon Islands and New Caledonia (■), and Hawaii (★).

Quintal (AMS); off Steels Point, 33 m, 38 m, 93–104 m, 201 m, 9–11 July 1962, RNZFA *Tui* (5 lots NMNZ). *Raoul I., Kermadec Is* (455 specimens): R.S. Bell 1908–10 (3 lots AMS, NMNZ); 9–37 m, 1908, W.R.B. Oliver (NMNZ); 29°14.7′S, 177°52.7′W, 27–22 m, 28 Oct. 1975, RV *Acheron* (BS 443, NMNZ); 29°15′S, 177°50.9′W, 31–45 m, 11 Sept. 1976, RV *Acheron* (BS 573, NMNZ); 29°18.9′S, 177°56.4′W, 82–100 m, 10 Sept. 1976, RV *Acheron* (BS 572, NMNZ); 29°19.1′S, 177°54.6′W, 70 m, 25 Oct. 1975, RV *Acheron* (BS 435, NMNZ). *New Zealand*: c.300 specimens in 50 lots from N of Three Kings Is, (BS 392, 34°08.5′S, 172°11′E) to off Waitotara River mouth (BS 487, 40°10′S, 174°40′E); living intertidally to 94 m, dead specimens to 102 m (details in paper in prep.).

Remarks. Among known southern Australian triphorids, *B. pallida* is immediately recognizable by its pure white shell. It should not be confused with bleached or abnormal albino specimens of other species, and the existence of other normally white species is to be anticipated from other parts of its range.

Specimens from southern Australia (Fig. 26A–C), Lord Howe Island, Norfolk Island, the Kermadec Islands and New Zealand are relatively slightly larger and attain larger absolute size than specimens from New Caledonia, Queensland (Fig. 26E,G), the Solomon Islands, and Mozambique Channel. Specimens from New Caledonia, Queensland and the Solomon Islands are of intermediate relative size between southern Australia–New Zealand specimens and Hawaiian specimens (Fig. 26D,F), the latter being relatively (but not absolutely) the smallest. Apart from size, I can detect no significant differences between samples from widely separated localities, including radulae of specimens from South Australia, Queensland, New Caledonia and New Zealand. Unfortunately animals of Hawaiian specimens were not available for study. Specimens generally attain maximum absolute size at the northern and southern extremities of the geographic range, where they are also numerically most abundant. I interpret differences in abundance, relative and absolute size, as trans-Pacific clinal variation in a single species (Fig. 3).

The protoconch is incomplete or lacking in the lectotype of *T. pallidus* and in the holotypes of *T. infelix, T. leuca* and *N. candefactum*. The illustrated topotype of *B. pallida* (Fig. 26D,F) is confidently identified because it is indistinguishable from the lectotype in teleoconch facies, and because there are evidently no strictly similar species in Hawaiian waters (E.A. Kay, pers. comm.). *T. infelix* and *T. leuca* are identified with confidence for the same reason. The inclusion of the Japanese *N. candefactum* in the synonymy is tentative pending comparison of intact specimens. However, in view of its wide distribution, it would be surprising if *B. pallida* did not occur in Japan. For that matter, the Hawaiian population probably receives regular recruitments of pelagic larvae from there, via the Kurushio Current (Zinsmeister & Emerson, 1979).

Bouchetriphora aspergata (Laseron, 1958)
Figs 5D, 26G–I, Table 32

Mesophora aspergata Laseron, 1958: 599, figs 80, 81.
Coriophora nigrogranosa Laseron, 1958: 604, figs 103, 104. New synonym.

Description. Shell 3.75–5.50 x 1.15–1.60 mm, of 13¾–16 whorls, of moderate thickness, narrowly cyrtoconoid, spire up to 4.7 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown. Teleoconch buff white or pale yellowish brown, nodules opaque white, reddish brown between axial costae on abapical sides of spirals 1 and 3. Inner lip and parietal glaze sometimes deep yellowish brown.

Protoconch of planktotrophic larval type, narrowly conical, of 4½–5½ convex whorls, diameter 380–420 μm, diameter of first whorl 140–170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by 1 fine crisp median spiral thread that surmounts an increasingly prominent angulation. A suprasutural spiral thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture apart from obscure spiral lirae on anterior canal. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, frequently a single secondary spiral between spirals 2 and 3 behind outer lip on body whorl. Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 appearing as a thread near abapical margin of spiral 1 on 11th–12th shell whorl, gradually descending to median position and enlarging to resemble spiral 3 on body whorl only. Spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 2–4 of similar size, spiral 1 slightly broader; spirals 5 and 6 similar, smooth. Axial costae more or less orthocline or shallowly prosocyrt and weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 16–19 on penultimate whorl. Base evenly contracted. Aperture ovate or sub-quadrate. Outer lip produced and flared basally, inner extremity rather shallowly infolded to almost contact base of inner lip; profile prosocyrt-opisthocline below a shallow, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1E,H) pale translucent yellowish brown, central area internally opaque white; thick, with a pronounced, convex external spire, internally shallowly concave; subcircular, nucleus almost central, of about 6 whorls. Periphery thin, upturned, strongly projecting from suture externally. Muscle attachment scar minutely pitted, no accessory peg.

Radula (Fig. 5D) with the formula 4 + 1 + 1 + 1 + 4. Central tooth 9.7 μm wide, with 21 short cusps; lateral teeth each 7.8 μm wide, with 14–16 short cusps. Marginal teeth 1.9–1.0 μm wide; marginal 1 with 4 cusps, median 2 very long and narrow, bordering cusps short; marginals 2–4 each with 3 cusps, median cusp very long and narrow, bordering cusps short.

Type localities. *M. aspergata*: Great Barrier Reef, off Cairns, Queensland; *C. nigrogranosa*: Caloundra, Queensland.

Holotypes. *M. aspergata*: AMS C.46011; *C. nigrogranosa*: AMS C.103083.

Other material examined (25 specimens). *Queensland*: Lizard I., N side of Eagle I., c. 3 m, 12 Dec. 1974, P.H. Colman (AMS); Wilson I., Capricorn Group, alive, intertidal, 8–29 Sept. 1969, A.N. & B.A. Boorman (AMS); 3 km NE of W side of Gillett Cay, Swains Reef, 64–73 m, 17–19 Oct. 1962 (AMS). *New South Wales*: Iluka Bluff, Iluka, on coralline algae, 17 Oct. 1976, I. Loch (AMS); Clarence River, A.A. Cameron (AMS); Woolgoolga, 1950–60, J. Voorwinde (AMS); SW of Solitary I., on small boulder, 15 m, 17 May 1972, Hutchings & Weate (AMS); Long Reef, Collaroy, Sydney, N side of platform near Fisherman's Beach, algae and rock washings from *Sargassum/Ecklonia* zone, 10 Jan. 1978, B. Jenkins (AMS); Long Reef, alive, under intertidal rocks, 26 May 1979, M.P. Marrow (MPM); Ocean Beach, Kurnell, 1950–60, J. Voorwinde (AMS); Sydney Harbour, C. Hedley (AMS).

Remarks. *B. aspergata* is rendered highly distinctive by its unique colour pattern. The protoconch of the holotype *C. nigrogranosa* is worn and lacks the tip, and Laseron's (1958) description and illustration are inaccurate. It is indistinguishable from *B. aspergata*, which has page priority.

Table 32. *Bouchetriphora aspergata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	7	4.43	3.75–5.50	0.65
Diameter	7	1.33	1.15–1.60	0.19
Height/diameter	7	3.33	2.93–3.64	0.23
Diameter 1st whorl	7	0.15	0.14–0.17	0.01
No. whorls	7	14.46	13.75–16.00	0.78
No. axials	7	17	16–19	1.11

Bouchetriphora marrowi n.sp.

Figs 5E, 27A–C

Triphora innotabilis Hedley, 1903: 608 (in part).

Description. Shell 3.55–4.30 mm x 1.15–1.30 mm of 13¼–14¾ whorls, rather lightly built, narrowly cyrtoconoid, spire up to 4.4 x higher than aperture plus canal.

Colour of protoconch reddish brown, teleoconch bright reddish brown, fading to yellowish brown, nodules opaque white.

Protoconch of planktotrophic larval type, narrowly conical, of 6–6¼ convex whorls, diameter 430–470 μm, diameter of first whorl 130 μm. First whorl sculptured with minute, roughened, hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets; and encircled by a fine crisp submedian spiral thread that surmounts an increasingly prominent angulation; a suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture apart from obscure spiral lines on anterior canal. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 appearing as a thread on 10th shell whorl, near abapical margin of spiral 1, gradually descending to a median position and enlarging to resemble spiral 3 on body whorl. Spirals 1–3 strongly nodular, spiral 1 broadest on body whorl, spirals 2–4 of similar size, spiral 4 more weakly nodular; spirals 5 and 6 smooth, similar. Axial costae straight, orthocline or weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 16–17 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather shallowly infolded to almost contact base of inner lip, profile opisthocyrt below a broad, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1G) translucent light yellowish brown, of moderate thickness, flat, ovate, nucleus subcentral, of about 3 whorls; periphery thin, upturned, weakly projecting above plane of external surface. Muscle scar well defined, no accessory peg.

Radula (Fig. 5E) with the formula 5 + 1 + 1 + 1 + 5. Central tooth 9.7 μm wide, with 11 short cusps; lateral teeth each 6.8 μm wide, with 11 short cusps. Marginal teeth 2.9–1.9 μm wide; marginal 1 with 4 cusps, median 2 very long and narrow, bordering 2 short; marginals 2–5 each with 3 cusps, median cusp very long and narrow, bordering cusps short.

Type locality. Long Reef, Collaroy, Sydney, New South Wales, alive under intertidal rocks, M.P. Marrow, 26 May 1979.

Holotype. AMS C.130020. PARATYPES AMS, MPM.

Other material examined (7 PARATYPES). *New South Wales*: Long Reef, Sydney, 1950–60, J. Voorwinde (AMS); Long Reef, near Fisherman's Beach, alive in algae and rock washings from *Sargassum/Ecklonia* zone, 10 Jan. 1978, B. Jenkins (AMS); Sydney Harbour, C. Hedley (AMS); Middle Harbour, Sydney, C. Hedley (AMS).

Remarks. *B. marrowi* is rendered distinctive by its dark coloration, unicarinate protoconch, and similar-sized teleoconch spirals. *Hedleytriphora innotabilis* (Hedley), with which it was confused by Hedley (1903, pl.32, fig.25), is superficially similar but differs markedly in having interrupted axial riblets on the protoconch. Faded specimens superficially resemble *Mesophora granosa* (Pease), which differs, however, in having spirally dislocate axial costae, a more deeply infolded inner lip, and a longer anterior canal.

B. marrowi is named in honour of Mr Maxwell Marrow, Victoria, who collected the holotype and generously lent much valuable material for this revision.

Nototriphora n.gen.

Type species: *Notosinister aupouria* Powell 1937; Recent, New Zealand.

Diagnosis. Triphorinae with hemispherical granules on 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Sculpture evenly reticulate, intersections nodular. Radula with the formula 9 + 1 + 1 + 1 + 9. Central tooth with 3 cusps, laterals with 4 cusps, outer cusps of marginal teeth short, median cusps long. Operculum thick and multispiral.

Description. Shell 3.45–7.15 mm high, narrowly cyrtoconoid, spire several times higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with hemispherical granules on 1st whorl. Subsequent whorls encircled by 2 median spiral threads that surmount weak angulations. Abapical spiral strong throughout; adapical spiral commencing strong, soon after its appearance either weakening and remaining weak throughout, or vanishing and reappearing later and enlarging to resemble abapical spiral. Whorls entirely traversed by fine crisp axial riblets. Lecithotrophic protoconch smooth or unicarinate.

Teleoconch of 8–11 flat-sided whorls, suture shallow, reticulately sculptured with spiral cords and axial costae, intersections nodular. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical protoconch spiral, spiral 2 appearing as a thread on 6th–10th shell whorl, gradually enlarging to resemble spiral 3. Spiral 5 weakly nodular, spiral 6 weakly nodular or smooth. Axial costae more or less straight, opisthocline, evenly transversing whorls, evanescent below spirals 4 or 5. Base very evenly contracted. Columella very broad. Aperture subcircular. Outer lip flared and produced basally, inner extremity rather deeply infolded to overhang base of inner lip. Posterior notch U-shaped, open or partly enclosed in front. Anterior canal short and broad.

Operculum (as in Fig. 1E,H) multispiral, thick, with a prominent external spire, periphery thin, strongly upturned and projecting from suture.

Radula (*N. aupouria*—Fig. 5H) with the formula 9 + 1 + 1 + 1 + 9. Central and lateral teeth short and rather narrow, with 3 and 4 short, similar cusps respectively. Marginal teeth narrower; marginals 1–3 with 4 cusps, outer cusps short, median cusps long and narrow; marginal 4 with 3 cusps, outer cusps short, median cusp long and narrow.

Nototriphora and *Bouchetriphora* species share similar, highly distinctive marginal radular teeth and opercula, and these genera are undoubtedly very closely related. Compared with *Bouchetriphora* the central and lateral teeth in *Nototriphora* are much narrower with fewer cusps, there are four instead of three cusps on marginals 2 and 3, and the central cusps on the mar-

ginals are shorter. Evidently *Nototriphora* is ancestral to *Bouchetriphora* n.gen., the latter having undergone broadening of the central lateral teeth with cusp multiplication, loss of a cusp on marginals 2 and 3, great elongation of the median cusps on the marginal teeth, reduction in number of marginal teeth, and total loss of the adapical protoconch spiral.

Nototriphora species are strikingly similar to the type species of *Cosmotriphora* Olsson and Harbison, 1953 (*Cerithium melanura* C.B. Adams, 1850; Recent, West Indies), the specimen of which illustrated here (Fig. 27D–F) is indistinguishable from the lectotype (MCZH 186159) (Clench and Turner 1950, pl.38, fig. 10). While *Cosmotriphora* and *Nototriphora* are probably closely related, *C. melanura* differs from the present species in having a flat, ovate, more loosely coiled operculum, three cusps on marginal 1, and short median cusps on marginals 1–3 (Bouchet, 1983, fig. 16). *C. pseudocanarica* Bouchet, 1983 has a multispiral operculum and is probably better placed in *Nototriphora*.

Nototriphora regina (Hedley, 1903)

Fig. 27G–I, Table 33

Triphora regina Hedley, 1903: 608, pl. 32, fig. 21.—Verco, 1909: 285.
Cautor regina.—Cotton & Godfrey, 1931:55.
Notosinister regina.—Laseron, 1954: 152, figs 17, 29.

Description. Shell 3.45–5.75 mm x 1.10–1.65 mm, of 12–16 whorls, lightly built, narrowly cyrtoconoid, spire up to 4.7 x higher than aperture plus canal.

Colour of protoconch deep yellowish brown. Teleoconch white, yellowish brown on spiral 3 and on base below spiral 5.

Protoconch of planktotrophic larval type, narrowly conical, of 4½–5¼ convex whorls, diameter 330–380 μm, diameter of first whorl 140–170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 2 median spiral threads. Spiral threads similar on first half of second whorl, adapical spiral absent from following whorl, reappearing and slowly developing to resemble abapical spiral on last whorl, again vanishing on last half whorl. Abapical spiral crisp throughout, surmounting an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Table 33. *Nototriphora regina*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	9	4.27	3.45–5.75	0.99
Diameter	9	1.28	1.10–1.65	0.22
Height/diameter	9	3.29	2.91–3.83	0.27
Diameter 1st whorl	9	0.15	0.14–0.17	0.01
No. whorls	9	13.67	12.00–16.00	1.56
No. axials	9	19	18–21	1.13

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 appearing as a thread on 9th or 10th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 of similar height, spirals 2–4 of similar size, spiral 1 slightly broader, spirals 1–3 strongly nodular, spiral 4 strongly or weakly nodular, spiral 5 weakly nodular or smooth, spiral 6 smooth. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–21 on penultimate whorl. Base evenly contracted. Aperture subcircular. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip; profile prosocyrt-opisthocline below a deep, partly enclosed, U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin, thickened beside posterior notch. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Balmoral Beach, Middle Harbour, Sydney, New South Wales.

Holotype. AMS C.13511.

Other material examined (120 specimens). *New South Wales:* Cronulla, Sydney, L. Woolacott (AMS); off Crookhaven, 55–64 m (AMS). *South Australia*: off Beachport, 201 m, Verco Coll. (SAM); off Cape Jaffa, 165 m & 238 m, Verco Coll. (2 lots SAM); off Cape Borda, 101 m, Verco Coll. (SAM); E of North Neptune I., 82 m Verco Coll. (SAM); off Neptune I., 190 m, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m (AMS); S of Cape Carnot (35°15′S, 134°32′E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62 (AMS); St. Francis I., beach, Verco Coll. (SAM). *Western Australia*: W of Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); 80 miles W of Eucla, 148 m, Verco Coll. (SAM).

Remarks. *N. regina* is well characterized by its very distinctive colour pattern. It is very similar to the New Zealand *N. aupouria* (Powell, 1937), which differs primarily in being yellowish brown instead of white on spiral 1. *N. aupouria* probably arose from *N. regina* stock that reached New Zealand in eastward-moving watermasses (Hamon, 1970; Heath, 1973, 1980).

Nototriphora vestita n.sp.

Fig. 28B–D, Table 34

Description. Shell 4.20–7.15 mm x 1.35–2.10 mm, of 12¾–16 whorls, rather thick, narrowly cyrtoconoid, spire up to 4.5 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown. First 4 teleoconch whorls white; subsequent whorls white with bold opisthocline yellowish or reddish brown maculations, most deeply pigmented on sides of spirals 1–3. Mature body whorl uniform yellowish brown below spiral 1.

Table 34. *Nototriphora vestita.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	8	5.40	4.20–7.15	0.85
Diameter	8	1.67	1.35–2.10	0.23
Diameter 1st whorl	8	0.18	0.17–0.18	0.01
No. whorls	8	14.06	12.75–16.00	0.90
No. axials	8	22	20–24	1.31

Protoconch of planktotrophic larval type, narrowly conical, of 3¾–4¾ rather evenly convex whorls, diameter 320–400 μm, diameter of first whorl 170–180 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 1 fine crisp submedian spiral thread and traces of a former adapical spiral. A suprasutural spiral is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from submedian protoconch spiral; spiral 2 appearing as a thread on 8th or 9th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 of similar height, spirals 2–4 of similar size, spiral 1 slightly broader, spirals 1–3 strongly nodular, spiral 4 more weakly nodular; spirals 5 and 6 of similar size, spiral 5 weakly nodular, spiral 6 smooth. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 20–24 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded to overhang base of inner lip. Profile prosocyrt-opisthocline below a U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin, thickened beside posterior notch. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1E,H) thick, brownish yellow, central area of interior white, externally convex, internally shallowly concave, subcircular, nucleus subcentral, spiral, of 5 whorls. Periphery thin, upturned, projecting from suture externally. Muscle scar minutely pitted, simple. Radula unknown—only available animal decayed.

Type locality. Gulf St. Vincent, South Australia, dredged in shallow water.

Types. HOLOTYPE (ex Verco Coll.) SAM D.16242 (7.15 x 2.10 mm; 16 whorls). PARATYPES SAM, AMS, NMNZ.

Other material examined (55 specimens, including paratypes). *Tasmania*: SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn 73-2111 (AMS). *South Australia*: Off Beachport, 201 m, Verco Coll. (SAM); Gulf St. Vincent, dredged & beach, Verco Coll. (2 lots SAM); Henley Beach, Gulf St. Vincent, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off St. Francis I., 11 m, Verco Coll. (SAM); St. Francis I., beach, Verco Coll. (SAM); 40 miles S of Cape Wiles, 183 m (AMS); off Point Sinclair, 40 m, Dec. 1972 (MPM). *Western Australia*: Off Eucla (33°05′S, 128°40′E), 75 m, 5 July 1962, HMAS *Gascoyne* stn G2/97/62 (AMS); Margaret River, shell sand, Nov. 1975 & 20 Dec. 1979 (2 lots MPM); Rottnest I., Verco Coll. (SAM).

Remarks. *N. vestita* is immediately recognizable by its narrowly conical protoconch and extremely distinctive colour pattern. The New South Wales *N. sarcira* (Laseron) (see below) has an identical teleoconch and colour pattern, but differs in having a smooth, blunt-tipped lecithotrophic larval protoconch. As yet they have not been collected sympatrically, but they may occur together in southern New South Wales or in north-eastern Victoria. Specimens lacking the protoconch in sympatric populations would probably be indistinguishable.

Nototriphora sarcira (Laseron, 1954)
Fig. 28a

Notosinister sarcira Laseron, 1954: 146, Fig. 5.

Description. Shell 5.80 x 1.95 mm, of 12 whorls (holotype), teleoconch sculpture, colour and colour pattern as in *C. vestita* n.sp.

Protoconch of lecithotrophic larval type, of 2¼ smooth convex whorls, diameter 370 μm, diameter of first whorl 300 μm.

Type locality. Off Long Reef, New South Wales, 26 m.

Holotype. AMS C.65855.

Other material examined. 1 paratype from the type locality.

Remarks. See *N. vestita* n.sp.

Nototriphora unicarinata n.sp.
Fig. 28E–G

Description. Shell 4.15 x 1.20 mm, of 11½ whorls (holotype), stout, narrowly conical, spire 4.3 x higher than aperture plus canal.

Colour uniform medium yellowish brown.

Protoconch of lecithotrophic larval type, poorly demarcated from teleoconch but of about 2½ whorls, diameter about 470 μm, diameter of first whorl 330 μm. First whorl convex, sculptured with minute, widely spaced, spirally aligned, hemispherical granules. Subsequent whorls with a prominent, smooth, submedian carina, and traversed by broken axial riblets of irregular length and inclination.

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire.

Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina; spiral 2 appearing as a thread on 6th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–3 strongly nodular, of similar height, about as high as broad; spiral 4 more weakly nodular, spirals 5 and 6 smooth, spiral 6 broader than spiral 5. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 22 on penultimate whorl. Base evenly contracted. Aperture subcircular. Outer lip damaged. Inner lip thick. Parietal lip thick. Anterior siphonal canal oblique, rather short.

Animal unavailable.

Type locality. 22 miles east of Narrabeen, Sydney, New South Wales, 146 m.

Holotype (unique specimen). AMS C.130015.

Remarks. *N. unicarinata* is rendered highly distinctive by the combination of granulate first whorl, unicarinate subsequent protoconch whorl, flat-sided teleoconch whorls, rather early appearance of spiral 2, and strong spiral 6. Placement in *Nototriphora* is tentative pending knowledge of the radula—it may be more closely related to some species currently placed in *Isotriphora* Cotton & Godfrey.

Genus *Triphora* Blainville

Triphora Blainville, 1828: 344. Type species (by monotypy): *Triphora gemmatum* Blainville, 1828; Recent, Mauritius.
Tristoma "Deshayes" Menke, 1830: 57 (listed in synonymy of *Cerithium*—nomen nodum).
Triphoris Deshayes, 1832: 1052 (orthographic variant).
Not *Triforis* Deshayes, 1834: 429. Type species (by monotypy): *Triforis plicatus* Dehayes, 1834; Eocene, Paris Basin (see Marshall, 1980).

The type specimen of *T. gemmatum* was collected at Mauritius by one Colonel Mathieu (Blainville, 1828: 344), some of whose material is known to be deposited at the Muséum d'Histoire Naturelle, Toulouse (P. Bouchet, pers. comm.). Unfortunately this collection is entirely uncurated and seems likely to remain in this state for the forseeable future (P. Bouchet, pers. comm.). I have tried in vain to secure the potential type from Toulouse and I have been unable to obtain topotypic material from Mauritius.

Despite inherent inadequacies, the original description and illustration (Blainville, 1827, pl.20, fig.3) reveal *T. gemmatum* to be a highly distinctive species that could be confused with few others. Distinctive characters include the large size (length 6 lignes = 13.5 mm), narrowly cyrtoconoid contour, numerous small nodules, strongly developed aperture, early development of spiral 2, and particularly the colour: *"Plus au moins rousse; l'intervalle des tubercules de la grande serie* [i.e. spiral 3] *rouge pourpre."*

Laseron (1958, p.570) assumed that *T. gemmatum* has a tubular posterior siphonal canal as in *Iniforis* Jousseaume, 1884 and *Triforis* Deshayes, 1834, but correctly indicated (p.579) that this would be unusual since in the great majority of species with a truly tubular posterior canal (e.g. *Mastoniaeforis* Jousseaume, 1884) spiral 2 commences very late on the teleoconch—much later than in *T. gemmatum*. Although Blainville did not describe features of the posterior canal, the original illustration clearly shows a spot behind the rim of the outer lip that might represent an enclosed or partly enclosed siphonal foramen. Moreover, the very deep infolding on the inner extremity of the outer lip is a character frequently associated with a partly or entirely enclosed siphonal canal.

Among known tropical Indo-Pacific triphorids only the western Pacific *T. taeniolata* Hervier, 1897 (= *T. eupunctata* Sowerby, 1907 = *Coriophora monovitta* Laseron, 1958) (Fig. 28H–J) is strictly comparable with *T. gemmatum*, resembling it in size, shape, sculpture, apertural features, colour and colour pattern. The posterior siphonal notch in *T. taeniolata* is very deep and almost enclosed, often appearing as a foramen when viewed from the front of the aperture. Whether or not *T. taeniolata* occurs in the Indian Ocean is unknown to me, but I illustrate here (Fig. 20K) a single immature specimen of a species with an extremely similar teleoconch from the Comoro Archipelago, Mozambique Channel (MNHN, 12°45.1′S, 45°17.9′E, 15–20 m), about 1600 km north-west of Mauritius. This species, which may well be *T. gemmatum*, differs from *T. taeniolata* in having planktotrophic instead of lecithotropic larval development.

Accepting that *T. taeniolata* and the Mozambique Channel species may be congeneric with *T. gemmatum*, the following characters are tentatively taken as diagnostic of *Triphora* (s.s.).

Planktotrophic larval protoconch (*T.* cf. *gemmatum*, Fig. 28K) with hemispherical granules on first half whorl. Subsequent whorls entirely traversed by axial riblets, and encircled by 2 median spiral threads, and a suprasutural thread that is exposed only on second half of first whorl and on last whorl.

Operculum *(T. taeniolata)* pale brownish yellow, rather thick, flat, almost circular, nucleus almost central, of 5 whorls; periphery thin, upturned, projecting from suture externally. Muscle attachment scar well defined, minutely pitted, no accessory peg.

Radula (*T. taeniolata,* Fig. 7D) with the formula 9+1+1+1+9. Central tooth 2.4 μm wide, with 3 cusps, the median cusp smaller. Lateral teeth each 2.9 μm wide, with 5 cusps that elongate outwards. Marginal teeth 2.4–1.9 μm wide, cusps elongating outwards; marginals 1, 2 and 5–7 with 4 cusps, others with 3 cusps.

Incidentally, *Coriophora monovitta* Laseron (i.e. *T. taeniolata* Hervier) is certainly not a synonym of *Cerithium (Triforis) levukensis* Watson, 1880 as stated by Habe & Kosuge (1966, p.106), differing markedly in shape, size and sculpture, and in details of colour pattern. *Notosinister rufotinctus* Kosuge, 1963 is a synonym of *T. levukensis*, which is tentatively referred to *Bouchetriphora* n.gen.

Triphora (s.s.?) *nivea* (Verco, 1909)
Figs 7E, 29A–D, Table 35

Triphora tasmanica var. *nivea* Verco 1909: 291.
Isotriphora nivea.—Cotton & Godfrey, 1931: 52.
Triphora cana.—Verco, 1909: 289 (in part).

Description. Shell 3.20–9.30 x 1.15–2.85 mm, with 9–13¼ whorls, narrowly cyrtoconoid, stout, spire up to 4.3 x higher than aperture plus canal.

Colour: Protoconch and first few teleoconch whorls white. Subsequent whorls yellowish or orange brown, spiral 3 and canal white, rarely uniform white (albino or bleached holotype).

Protoconch of lecithotrophic larval type, of 2¾–3½ convex whorls, demarcated by disappearance of adapical median spiral, diameter 480–680 μm, diameter of 1st whorl 330–470 μm. Sculptured with a low, nodular subsutural spiral; 2 similar, prominent, nodular median spirals, and a smooth suprasutural spiral that is exposed on last whorl. Adapical median spiral vanishing on last whorl or climbing adapically and fusing with subsutural spiral.

Teleoconch whorls flat-sided or shallowly convex, reticulately sculptured with well-defined spiral cords and axial costae, intersections nodular, suture shallow but position clear, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 1 continuing from adapical protoconch spiral, spiral 3 continuing from abapical protoconch spiral; spiral 4 continuing from suprasutural spiral, spiral 2 appearing as a thread on 4th–5th shell whorl, rapidly enlarging to resemble adjacent spirals after about 2 whorls from point of appearance. Spirals 1–4 similar, interspaces about as wide as each spiral, spirals 1–3 strongly nodular, spiral 4 more weakly nodular; spirals 5 and 6 weak, similar, smooth. Axial costae straight or very shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19–26 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip gently flared and produced basally, inner extremity broken in all specimens, profile opisthocline; posterior siphonal notch shallow and simple. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short.

Table 35. *Triphora nivea.* Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls	No. axials
3.20	1.15	2.78	0.33	9.00	19
3.60	1.25	2.88	0.33	9.75	20
5.00	1.60	3.13	0.37	11.00	23
6.95	2.05	3.39	0.33	12.00	23
8.10	2.40	3.38	0.37	13.25	25

Operculum (as in Fig. 1I), thin, very pale brownish yellow, flat, almost circular, of about 3½ whorls, nucleus almost central. Periphery thin, gently upturned, weakly projecting from suture externally. Muscle attachment scar ill-defined, no accessory peg.

Radula (Fig. 7E) with the formula 6+1+1+1+6. Central tooth 5.8 μm wide, with 3 cusps, median cusp small. Lateral teeth each 6.8 μm wide, with 4 subequal cusps. Marginal teeth 5.8–2.4 μm wide, with 3 or 4 subequal cusps (3 apparently normal).

Type locality. Gulf St. Vincent, South Australia, 18 m.

Holotype. SAM D.13443.

Other material examined (30 specimens). *Tasmania*: SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2111 (AMS). *South Australia*: Off Beachport, 73 m, Verco Coll. (SAM); off Cape Jaffa, 238 m, Verco Coll. (SAM); Gulf St. Vincent, "depth?", Verco Coll. (SAM); Backstairs Passage, 37 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); Corny Point, Verco Coll. (SAM); off Point Brown, 20 m, Dec. 1972 (MPM). *Western Australia*: King George Sound, beach drift, Verco Coll. (SAM); Margaret River, shell sand (MPM); Ellenbrook, Verco Coll. (SAM); Hopetoun, Verco Coll. (SAM); Rottnest I., Verco Coll. (SAM).

Remarks. This species superficially resembles *Monophorus nigrofusca* (A. Adams) and species of *Isotriphora* Cotton & Godfrey, but differs in details of colour pattern, sculpture, and radular morphology. The specific name is misleading because the holotype is an albino or a bleached specimen.

T. nivea is referred to *Triphora* on account of its close similarity to *T. taeniolata* (Hervier) in opercular and radular characters, and because of general similarities in teleoconch facies.

Genus *Obesula* Jousseaume

Obesula Jousseaume, 1898: 75. Type species (original designation): *Mastonia obesula* Jousseaume, 1884; Recent, New Caledonia.

Diagnosis. Triphorines with hemispherical granules on the 1st whorl, and 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3. Sculpture evenly reticulate, intersections nodular. Radula with the formula 3+1+1+1+3. Central tooth with 3 cusps, laterals with 4 cusps, cusps of marginals webbed between.

Description. Shell 2.50–6.50 (est.) mm high, narrowly cyrtoconoid, spire of moderate length, several times longer than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with hemispherical granules on first whorl. Subsequent whorls entirely traversed by axial riblets, and encircled by 1 median spiral thread. Lecithotrophic larval protoconch with axial riblets and a submedian spiral thread on last whorl, first whorl smooth.

Teleoconch of up to 10 flat-sided whorls, reticulately sculptured with crisp, well-defined spiral cords and axial costae, intersections nodular, suture very shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 2 commencing on 3rd–9th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 2–4 similar on body whorl, spiral 1 slightly broader, spirals 1–4 strongly nodular, spirals 5 and 6 weakest, spiral 5 weakly nodular, spiral 6 weakly nodular or smooth. Axial costae straight, evenly traversing whorls, evanescent below spiral 5. Base evenly contracted. Aperture ovate or subquadrate. Outer lip produced and flared basally, inner extremity infolded to contact base of inner lip, profile prosocyrt-opisthocline below a shallow, simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, short or of moderate length.

Operculum (*O. obesula* and *O. mamillata* as in Fig. 1I) horny, rather thick, externally shallowly concave, subcircular, nucleus almost central, of about 4 whorls. Muscle attachment scar minutely pitted, without accessory peg or callus.

Radula (*O. obesula* and *O. mamillata*, Figs 7F, 8E) with the formula 3 + 1 + 1 + 1 + 3. Central tooth with 3 conical cusps. Lateral teeth each with 4 conical cusps. Marginal 1 with 3 or 6 cusps, all cusps conical or inner cusps conical and outer 2 cusps flattened and distinctly webbed between. Marginal 2 with 2 or 3 rather long, narrow, flattened cusps that are webbed between. Marginal 3 without cusps or with 2 small flattened cusps that are webbed between.

Remarks. The central and lateral teeth of *Obesula* are similar to those of *Triphora* (s.s.?), but there are fewer marginal teeth with different-shaped cusps. Species of *Bouchetriphora* n.gen., have similar shell facies but very different radulae and opercula. The specimen of *O. obesula* illustrated here (Fig. 26H–J) is indistinguishable from syntypes (MNHN). That yielding the radula (Fig. 8E) came to hand after the plates were assembled so the illustrations could not be placed in systematic sequence.

Obesula albovittata (Hedley, 1903)

Fig. 29E–G, Table 36

Triphora albovittata Hedley, 1903:609, pl.32, figs 26, 27.
Notosinister alborda Laseron, 1954: 149, fig. 12. New synonym.
Notosinister albovittata Laseron, 1954: 151, figs 15, 15a.
Not *Triphora albovittata* May, 1910: 4 (= *T. mamillata* Verco).

Description. Shell 2.50–5.15 mm x 0.95–1.70 mm, of 10½–14 whorls, narrowly cyrtoconoid, stout, spire up to 4.4 x higher than aperture plus canal.

Colour of protoconch reddish to yellowish brown. First teleoconch whorl white. Subsequent whorls pale yellowish brown or buff white; summit of spiral 1 pure opaque white, becoming reddish brown on mature body whorl immediately behind outer lip; abapical margin of spiral 1 and occasionally adapical margin of spiral 4 deep yellowish brown; base reddish brown on and below spiral 5. In some deep water specimens teleoconch translucent white, spiral 1 opaque white, and spiral 5 and/or anterior canal yellowish brown.

Table 36. *Obesula albovittata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	9	3.78	2.50–5.15	0.84
Diameter	9	1.27	0.95–1.70	0.24
Height/diameter	9	2.95	2.71–3.21	0.22
Diameter 1st whorl	9	0.15	0.14–0.17	0.01
No. whorls	9	12.44	10.50–14.00	1.18
No. axials	9	18	16–20	1.24

Protoconch of planktotrophic larval type, narrowly conical, of 4–5½ convex whorls, diameter 370–470 μm, diameter of first whorl 140–170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by numerous fine, crisp, weakly flexuous axial riblets; and encircled by a crisp submedian spiral thread that surmounts a sharp peripheral carina on last whorl. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well-defined spiral cords and axial costae; intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 developing from a thread that appears on 6th–8th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 strongly nodular, spiral 1 slightly broader than spirals 2–4, spiral 5 more weakly nodular, spiral 6 smooth. Axial costae straight, weakly opisthocline, evenly traversing whorls, evanescent below spiral 5, numbering 16–20 on penultimate whorl. Base very evenly and gently contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity infolded to almost contact base of inner lip, indented below insertion; profile rather strongly prosocyrt-opisthocline below a broad, shallow, simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type localities. *T. albovittata*: Balmoral, Sydney, New South Wales; *N. alborda*: off Long Reef, Sydney, 26 m.

Holotypes. *T. albovittata*: AMS C.13512; *N. alborda*: AMS C.65848.

Other material examined (27 specimens). *New South Wales*: Ocean Beach, Kurnell, 1950-60, J. Voorwinde (AMS);

Shelly Beach, near Manly, Sydney, T.A. Garrard (AMS); off Doll's Point, Georges River, Sydney, 15 m (AMS); Middle Harbour, Sydney, 5m, T.A. Garrard (AMS); Balmoral, Sydney, C. Hedley (AMS); Shelly Beach, S of Angourie, 1976, D. Tarrant (MPM); Port Stevens, shell sand, T.A. Garrard (AMS). *South Australia*: Off Beachport, 73 m, Verco Coll. (SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); Gulf St. Vincent, beach drift, Verco Coll. (SAM); St. Francis I., beach drift, Verco Coll. (SAM). *Western Australia*: E of Salisbury I. (34°13'S, 125°04'E), 123–125 m, HMAS *Gascoyne* stn G2/105/62 (AMS); off Dunsborough, 16.5 m, 27 Dec. 1971, W.F. Ponder & N. Coleman & B.R. Wilson (AMS); Ellenbrook, S of Cowaramup, Verco Coll. (SAM); Wyadup, S of Yallingup, algae on exposed rocks, 1 Jan. 1972, W.F. Ponder & B.R. Wilson (AMS).

Remarks. *O. albovittata* and *O. mamillata* (Verco) (see below) are rendered extremely distinctive by their striking colour patterns. *O. mamillata* has an identical teleoconch, but differs in having lecithotophic instead of planktotrophic larval development. Where the species occur sympatrically (i.e. South Australia), it is impossible to distinguish specimens lacking the protoconch. There are no significant differences between the holotypes of *T. albovittata* and *N. alborda*, the former having priority.

Obesula mamillata (Verco, 1909)

Figs 7F, 29H–J, Table 37

Triphora albovittata var. *mamillata* Verco, 1909: 285.
Triphora albovittata.—May, 1910: 4 (**not** Hedley, 1903).
Triphora mamillata.—May, 1923: pl.27, fig.22.
Notosinister mammillata [sic].—Cotton & Godfrey, 1931: 53.

Description. Shell 3.40–5.40 mm x 1.10–1.70 mm, of 9–11¾ whorls, spire up to 4.1 x higher than aperture plus canal, teleoconch spiral 2 appearing on 5th–7th shell whorl, axial costae numbering 18–22 on penultimate whorl. Colour, colour pattern and other teleoconch features as in *O. albovittata*.

Protoconch of lecithotrophic larval type, yellowish brown, short and broad, of 2–2½ convex whorls, diameter 400–570 μm, diameter of first whorl 300–420 μm. First whorl rather evenly convex, smooth, more or less bulbous. Last whorl traversed by crisp flexuous axial riblets and encircled by a suprasutural thread and a submedian spiral thread that surmounts a prominent angulation.

Operculum (as in Fig. 1I) and radula (Fig. 7F) described under *Obesula* Jousseaume.

Type locality. Gulf St. Vincent, South Australia, beach drift.

Holotype. SAM D.13446.

Other material examined (32 specimens). *Victoria*: Bear's Gully, Waratah Bay, 25 July 1975 (MPM); Point Leo, Western Port Bay, J. Kerslake, 1956–57 (AMS); Point Lonsdale, 14 Mar. 1977 (MPM); Point Arlington, Port Phillip Bay, alive under stones, low tide, 13 Mar. 1977 (MPM). *South Australia*: Macdonnell Bay, Verco Coll. (SAM); Gulf St. Vincent, Verco Coll. (3 lots SAM); off Cape Borda, 101 m, Verco Coll. (SAM); off Point Brown, Smoky Bay, 40 m, Jan. 1972, D. Pearsons (MPM); off St. Francis I., 64 m, Verco Coll. (SAM). *Western Australia*: Hopetoun, shell sand, W.J. Paul Coll. (NMNZ); King George Sound, beach drift, Verco Coll. (SAM).

Remarks. See *O. albovittata* (Hedley).

Obesula profundior n.sp.

Fig. 30A–D, Table 38

Description. Shell 2.70–5.90 mm x 0.95–1.55 mm, with 7½–12½ whorls, rather thin but stout, narrowly cyrtoconoid, spire up to 4.6 x higher than aperture plus canal.

Colour: Protoconch and teleoconch translucent white, spiral 1 opaque white, base pale yellowish brown on and below spiral 5.

Protoconch of lecithotrophic larval type, short and broad, of 2–2½ convex whorls, diameter 470–520 μm, diameter of first whorl 300–400 μm. First whorl smooth, somewhat bulbous, rather evenly convex. Last whorl traversed by fine crisp axial riblets, and encircled by a suprasutural thread and a fine crisp submedian spiral thread that surmounts a prominent angulation.

Teleoconch whorls flat-sided, reticulately sculptured with well-defined spiral cords and axial costae with nodular intersections, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, spiral 6 at top of columella. Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 developing from a thread that appears on 3rd–4th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 similar, strongly nodular, spiral 1 broadest, spiral 4 sometimes

Table 37. *Obesula mamillata*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	12	4.39	3.40–5.40	0.66
Diameter	12	1.44	1.10–1.70	0.17
Height/diameter	12	3.03	2.61–3.31	0.21
Diameter 1st whorl	12	0.34	0.30–0.42	0.03
No. whorls	12	10.38	9.00–12.00	1.14
No. axials	12	19	18–22	1.21

Table 38. *Obesula proundior*. Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	16	3.97	2.70–5.90	0.79
Diameter	16	1.19	0.95–1.55	0.16
Height/diameter	16	3.31	2.70–3.80	0.26
Diameter 1st whorl	16	0.35	0.30–0.40	0.02
No. whorls	16	9.95	7.50–12.50	1.17
No. axials	16	19	17–21	0.98

more weakly nodular, spiral 5 weakly nodular or smooth, spiral 6 smooth. Axial costae straight, weakly opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 17–20 on penultimate whorl. Base evenly contracted. Columella smooth. Aperture ovate. Outer lip flared and produced basally, inner extremity rather deeply infolded to almost contact base of inner lip; profile prosocyrt-opisthocline below a broad, shallow, simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Animal unavailable.

Type locality. Off Neptune Island, South Australia, 190 m.

Holotype (ex Verco Coll.). SAM D.16244.

Other material examined (51 PARATYPES). *South Australia*: off Beachport, 549 m, Verco Coll. (SAM); off Cape Jaffa, 165 m, Verco Coll. (SAM); off Cape Borda, 101 m, Verco Coll. (SAM); 40 miles S of Cape Wiles (2 lots AMS); S of Cape Carnot (35°15'S, 134°32'E), 150–178 m, 12 July 1962, HMAS *Gascoyne* stn G2/128/62 (AMS); off Neptune I., 190 m, Verco Coll. (SAM). *Western Australia*: Off Eucla, 148 m, Verco Coll. (SAM); 40 miles W of Eucla, 132 m, Verco Coll. (SAM).

Remarks. *O. profundior* bears a superficial resemblance to *O. mamillata* (Verco), but differs in colour, in the earlier appearance of teleoconch spiral 2, and in usually being somewhat narrower and more weakly nodular. In South Australia, *O. mamillata* becomes rare below 73 m, while *O. profundior* is most common at 183–190 m. Since specimens from intermediate depths are not morphologically intermediate, it seems clear that *O. profundior* is a distinct species, and not a deep water form of *O. mamillata.*

Obesula tribulationis (Hedley, 1909)
Fig. 30E–G

Triphora tribulationis Hedley, 1909: 440, pl.40, figs 53, 54.

Description. Shell 3.90 x 1.30 mm, of 12½ whorls, lightly built, narrowly cyrtoconoid, spire 4 x higher than aperture plus canal.

Colour of protoconch pale yellow. Teleoconch translucent white, regularly maculate with yellowish brown. Base yellowish brown on and below spiral 5.

Protoconch of planktotrophic larval type, clearly demarcated, conical, of 5 convex whorls, diameter 380 μm, diameter of first whorl 170 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine, crisp, flexuous axial riblets, and encircled by a single fine, crisp submedian spiral thread that surmounts an increasingly prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with prominent, well defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 slightly exposed at suture on spire, a single secondary spiral between spirals 2 and 3 on body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch angulation; spiral 2 appearing as a thread on 9th shell whorl, gradually enlarging to resemble spiral 3 on body whorl only. Spirals 1–4 strongly nodular, spiral 1 broadest, spirals 2–4 similar, spirals 5 and 6 weakest, spiral 5 weakly nodular, spiral 6 smooth. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 19 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity moderately strongly infolded to overhang base of inner lip, indented below insertion, profile prosocyrt-opisthocline below a small U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Animal unavailable.

Type locality. Hope Islands, northern Queensland.

Lectotype (here selected from 3 syntypes). AMS C.127685.

Other material examined (1 specimen). SW of Solitary I., northern New South Wales, on small boulder, 15 m, 17 May 1972, Hutchings & Weate (AMS).

Remarks. The lectotype agrees well with the original description and illustration. It now lacks all but the last protoconch whorl, but is otherwise well preserved. With height estimated the dimensions (4.25 x 1.25 mm) are accordant with those given by Hedley. One of the paralectotypes (C.127686) is faded and lacks the protoconch and outer lip, but is evidently conspecific. The other paralectotype (C.127687) has an intact protoconch but clearly represents another species, differing in details of colour and colour pattern, and in having two protoconch spirals. The New South Wales specimen is indistinguishable from the lectotype. *O. tribulationis* superficially resembles *Sagenotriphora ampulla* (Hedley) in shell facies and colour pattern, but differs markedly in protoconch sculpture and radular morphology.

Laseron's (1958, p.598) placement of *O. tribulationis* as a synonym of *Triphora dolicha* Watson, 1886 is incorrect because the holotype of *T. dolicha* is narrower with spirally dislocate axial costae, and is almost certainly referable to *Mesophora* Laseron. I have not seen the specimens identified as *M. dolicha* by Laseron (1958, figs 76–79), so I can offer no comment on their true identity.

Genus *Aclophora* Laseron

Aclophora Laseron, 1958: 627. Type species (original designation): *Aclophora robusta* Laseron, 1958; Recent, Queensland.

A. robusta (Fig. 30H) is outstanding among reticulately sculptured triphorines in its large size (10.0 [est.] x 3.00 mm), rather broadly cyrtoconoid spire; and

the early appearance of teleoconch spiral 2, which enlarges to resemble the adjacent spiral well before the body whorl. It is unfortunate that its radula and protoconch are unknown, because species with very similar teleoconchs fall into two groups with highly divergent radulae and protoconchs.

The first group, typified by *Inella xystica* Jousseaume (Fig. 8B) has the radular formula 24+1+1+1+24. All teeth are about 1.9 μm wide and considerably longer than broad. The central tooth has one long, narrow cusp. The lateral and inner marginal teeth are similar, each with three cusps, the inner two very small, the outer cusp long and narrow. The outer marginal teeth resemble the inner marginals, but usually lack the innermost cusp. The outermost few pairs of marginals each have three cusps.

The second group, typified by *A. hedleyi* n.sp. (Fig. 8A), has the radular formula 4–5 +1+1+1 +5–4. The central and lateral teeth are 13.6 μm and 12.6 μm wide respectively, each with three cusps, the outer cusps are large and broadly conical, the median cusp smaller and narrower. The marginal teeth are 9.7–4.8 μm wide, decreasing in size outward. The inner marginals each have three cusps, the innermost cusp very small and the outer two large and similar. The outermost marginal has a single strong cusp.

Compared with *I. xystica,* the protoconch of *A. hedleyi* is more bluntly conical with fewer whorls, and the spiral threads are less crisp and do not surmount prominent angulations before the last whorl.

I regard these differences as of generic value, but without comparable knowledge of *A. robusta* it is impossible to ascertain which if either species represents *Aclophora* (s.s.).

The species identified as *Notosinister/Triphora granulata* (Adams & Reeve, 1850) by Kosuge (1963, pl.14, fig. 3) and Habe & Kosuge (1966, pl.41, fig. 27) may well be *A. robusta.* However *A. robusta* is not a synonym of *T. granulata* Adams & Reeve, 1850 as stated by Kosuge (1965, p.215). The best preserved syntype (BMNH 1878.1.28.422—separated as potential lectotype) has a unicarinate planktotrophic larval protoconch, and differs from *A. robusta* in being narrower and relatively smaller (6.35 [est.] x 1.70 mm; 11½ teleoconch whorls), in lacking microscopic spiral lirae in the spiral interspaces, and in being rather uniform yellowish brown. *T. granulata* is probably referable to *Bouchetriphora* n.gen.

Aclophora xystica (Jousseaume, 1884)
Figs 8B, 31A–FJ, Table 39

Inella xystica Jousseaume, 1884: 247, pl.4, fig.8.
Notosinister grandiosa Laseron, 1954: 155, fig. 30. New synonym.
Aclophora grandiosa.—Laseron, 1958: 628, fig. 177.
?*Notosinister alveolatus.*—Kosuge, 1962b: 88, pl.9, fig.2; Kosuge 1963: 240, pl.14, fig. 2 (? not Adams & Reeve, 1850).

Description. Shell 4.15–16 (est.) mm x 1.45–4.20 mm, of 13½–20 (est.) whorls, thick and heavy, narrowly to rather broadly cyrtoconoid, spire up to 4.2 x higher than aperture plus canal.

Colour of protoconch yellowish brown. First 2 teleoconch whorls white, subsequent whorls deep reddish to blackish brown; nodules a paler shade or white.

Protoconch of planktotrophic larval type, very fragile, narrowly conical, of 5–6 convex whorls, diameter 370–420 μm, diameter of first whorl 130–150 μm. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 2 crisp, strongly angulating median spiral threads. First half of 2nd whorl with 2 similar spiral threads, adapical spiral vanishing, reappearing near end of 3rd whorl and rapidly enlarging to resemble abapical spiral. A suprasutural spiral thread is exposed on last whorl.

Teleoconch whorls flat-sided, last few whorls shallowly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture channelled. Sculptured throughout with fine, poorly to rather well-developed spiral lirae and axial growth lamellae. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture, a secondary spiral in each interspace of spirals 1–5 on body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 appearing as a thread on 9th–10th shell whorl, gradually enlarging to resemble adjacent spirals on body whorl (small specimens), or from about 15th whorl. Spirals 1–4 similar, strongly nodular; spirals 5 and 6 weaker though strong and nodular. Axial costae shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent against spiral 6, numbering 18–30 on penultimate whorl. Base very evenly contracted. Columella very broad. Aperture ovate. Outer lip produced and flared basally, inner extremity deeply infolded to overhang base of inner lip, profile prosocyrt-opisthocline; posterior siphonal notch simple, open. Inner lip thick. Parietal glaze thin.

Table 39. *Aclophora xystica.* Shell measurements (mm) and countings.
* = Mozambique Channel, others Wilson I., Queensland.

Height	Diameter	Height/ Diameter	Diameter 1st whorl	No. whorls	No. axials
4.15	1.45	2.86	0.14	13.50	19
4.40*	1.60	2.75	0.13	13.00	19
4.55*	1.55	2.94	0.14	13.25	18
4.80	1.75	2.74	0.14	13.75	18
5.20	1.90	2.74	0.14	13.50	18
5.75	1.80	3.19	0.14	15.00	20
6.35	2.10	3.02	0.13	15.50	19
11.0(est.)	3.20	3.44	—	19 (est.)	21
12.8(est.)	3.30	3.88	—	20.5 (est.)	25

Anterior siphonal canal oblique, subtubular, rather long.

Operculum (as in Fig. 4B) rather thick, flat, translucent, pale brownish yellow, ovate, nucleus subcentral, spiral, of about 5 whorls. Periphery thin, upturned, strongly projecting from suture externally. Muscle attachment scar minutely pitted, no accessory peg.

Radula (Fig. 8B) described under *Aclophora*.

Type localities. *I. xystica*: Madagascar; *N. grandiosa*: Woolgoolga, northern New South Wales.

Holotypes. *I. xystica*: MNHN. *N. grandiosa*: AMS. C.103119.

Other material examined (34 specimens). *Comoro Is, Mozambique Channel*: W of Grande Glorieuse I. (11°32.4'S, 47°16.8'E), 10 m, 7 Apr. 1977 (Benthedi stn 100, MNHN); SE of Glorieuse Is. (11°32'S, 47°23.1'E), 24 m, 12 Apr. 1977 (Benthedi stn 124, MNHN). *New Caledonia*: Lifu, C. Hedley (2 lots AMS). *New Hebrides*: S coast, Espiritu Santo I., intertidal, 2 Aug. 1976 (R.C. Willan Coll.). *Queensland*: Wreck Reef, C. Hedley (AMS); Barrier Reef, off Cairns, D. Pitt (AMS); Tryon I., Capricorn Group, A. & B. Boorman, Sept. 1972 (AMS); Shoal Point, Mackay, reef between Green I. and shore, low tide, 29 June 1973, F.H. Plant (AMS); E side Wilson I., Capricorn Group, alive under coral blocks on dead reef, 8–11 Sept. 1970, P.H. Colman (AMS).

Remarks. The holotype of *N. grandiosa* is worn and lacks the early spire whorls and most of the body whorl. In teleoconch characters it is indistinguishable from the holotype of *I. xystica* (Fig. 31A) and Queensland (Fig. 31B–D,F) and Mozambique Channel (Fig. 31E,J) specimens here so identified. However, in the absence of protoconchs from the holotypes of *I. xystica* and *N. grandiosa* the identification must be tentative.

The species is locally common in Queensland, where no other strictly similar species are known to occur. The holotype of *N. grandiosa* is the only known specimen from New South Wales, and is evidently a stray that entered from the north as a planktonic larva. A superficially similar, as yet undescribed species, occurs at the Solomon Islands and New Caledonia, and may ultimately be discovered in Queensland waters. This differs in having a subcylindrical protoconch with an obsolete adapical spiral, spirally elongate teleoconch nodules, and much crisper teleoconch microsculpture. Its radula is essentially similar to that of *A. hedleyi*.

The species identified as *Notosinister alveolatus* (Adams & Reeve, 1850) by Kosuge (see synonymy) is probably *A. xystica*. *T. alveolatus* is probably referable to *Inella* (potential lectotype BMNH 196515), being similar to *I. japonica* Kuroda & Kosuge, 1963, which Habe & Kosuge (1966, p.108) later placed as a synonym.

Aclophora hedleyi n.sp.

Figs 8A, 30I–L, Table 40

Description. Shell 4.40–9.80 mm x 1.80–3.45 mm, of 10¼–14½ whorls, rather thin but stout, narrowly cyrtoconoid, spire up to 3.7 x higher than aperture plus canal.

Table 40. *Aclophora hedleyi*. Shell measurements (mm) and countings.
Holotype in bold face.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls	No. axials
4.40	1.80	2.44	0.18	10.25	19
4.75	**1.90**	**2.50**	**0.18**	**11.00**	**19**
5.15	2.00	2.58	0.18	11.00	20
5.20	1.90	2.74	0.20	11.00	18
8.50(est.)	2.90	2.93	—	14.50	22
9.80(est.)	3.15	3.11	—	14.50	20

Colour of protoconch yellowish brown. First 2 teleoconch whorls white, next 2–2½ whorls reddish brown. Subsequent whorls white or pinkish white, either sparsely and irregularly maculate with pale yellowish brown, or reddish to yellowish brown on and between spirals 3–5, and occasionally on spiral 2, nodules a paler shade or opaque white. More deeply pigmented on mature body whorl where spiral 1 is reddish brown immediately behind outer lip. Base white below spiral 5.

Protoconch of planktotrophic larval type, narrowly conical, of 3½–4 convex whorls, diameter 330–370 μm, diameter of first whorl 180–200 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets and encircled by 2 similar fine crisp median spiral threads; adapical spiral vanishing on last half whorl and abapical spiral surmounting a prominent angulation. A suprasutural thread is exposed on last whorl.

Teleoconch whorls shallowly but distinctly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture well-defined. Spiral microsculpture consisting of fine, indistinct spiral lines. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, usually a secondary spiral in each interspace of spirals 2–4 behind outer lip on body whorl. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical median protoconch spiral; spiral 2 appearing as a thread on 7th–8th shell whorl, gradually enlarging to resemble adjacent spirals from 10th whorl. Spirals 1–5 of similar size, spiral 6 weaker. Spirals 1–3 strongly nodular, spirals 4 and 5 strongly though more weakly nodular, spiral 6 smooth. Spiral interspaces about as wide as each spiral. Axial costae straight or shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–23 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded and overhanging base of inner lip, profile prosocyrt-opisthocline below a simple, open, posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 4B) translucent, pale yellow, thin, ovate, nucleus rather strongly eccentric, of about

2 whorls. Periphery thinner, not projecting from suture externally. Muscle attachment scar well-defined, no accessory peg.

Radula (Fig. 8A) described under *Aclophora.*

Type locality. West side of Thevenard, near Ceduna, South Australia, alive on semi-sheltered rock platform, W.F. & J.M. Ponder, 6 Dec. 1971.

Holotype. AMS C.130016.

Other material examined (11 PARATYPES). *South Australia:* TOPOTYPES (AMS, NMNZ). *Western Australia:* King George Sound, beach drift, Verco Coll. (SAM); Dunsborough, 0–3.6 m, 25–27 Dec. 1971, W.F. & J.M. Ponder & B.R. Wilson (AMS).

Remarks. Among known South and south-western Australian triphorids, *A. hedleyi* is easily recognized by its distinctive colour pattern and large size. It differs very markedly from *A. xystica* in colour pattern, protoconch sculpture and radular morphology.

Aclophoropsis n.gen.

Type species (here designated): *Triphoris festivus* A. Adams, 1851: Recent, southern Australia.

Diagnosis. Triphorinae with minute hemispherical granules on 1st whorl, and with 1 spiral thread and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spirals commencing simultaneously or spiral 2 commencing later than spiral 1 and 3. Sculpture evenly reticulate, intersections nodular. Radula with the formula 6–8 + 1 + 1 + 1 + 8–6, exhibiting size reduction of median cusps of inner teeth. Central tooth with 3 cusps, lateral teeth with 4 cusps, most marginals with 3 cusps.

Description. Shell 3.40–12.0 mm high, narrowly cyrtoconoid; spire of moderate height, several times higher than aperture plus canal.

Protoconch: First whorl of planktotrophic larval protoconch sculptured with minute hemispherical granules; subsequent whorls entirely traversed by axial riblets, and encircled by a submedian spiral thread; adapical spiral obsolete, former position indicated by slight flexure of axial riblets and a faint spiral trace. Lecithotrophic larval protoconch smooth, evenly convex or with an angulation on last whorl.

Teleoconch of up to 12½ flat-sided or very shallowly convex whorls, reticulately sculptured with well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from submedian protoconch spiral. Spiral 2 commencing either immediately or on 5th–10th shell whorl, gradually enlarging to resemble spiral 3. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 smooth. Axial costae strong, straight or shallowly prosocyrt, gently opisthocline, evenly traversing whorls, evanescent below spiral 4. Base evenly contracted. Outer lip produced and flared basally, inner extremity rather deeply infolded over base of inner lip. Posterior siphonal notch simple. Anterior siphonal canal oblique, subtubular, short or of moderate length.

Operculum horny, thin, subcircular, nucleus subcentral, of about 2 whorls. Muscle attachment scar without accessory peg or callus.

Radula with the formula 6–8 + 1 + 1 + 1 + 8–6. Central tooth 5.8–11.7 μm wide, with 3 cusps, median cusp very small. Lateral teeth each 6.8–11.7 μm wide, with 4 cusps, median 2 cusps small. Marginal teeth 8.7–1.9 μm wide, marginal 1 with 3 or 4 cusps, outer marginals each with 3 cusps; median cusp small on inner marginal teeth, progressively enlarging and elongating outward.

Remarks. The relationships of *Aclophoropsis* are uncertain but I suspect that it may be related to *Aclophora* Laseron, species of which exhibit a similar tendency toward marked size reduction of the cusps of certain teeth. *Aclophora* (s.l.) species have three cusps on each lateral tooth and exhibit size reduction of the innermost cusps on each marginal tooth. By contrast, species of *Aclophoropsis* have four cusps on each lateral tooth and have reduced median cusps on the lateral and inner marginal teeth.

Aclophoropsis festiva (A. Adams, 1851)

Figs 5K, 31G–I, Table 41

Triphoris festivus A. Adams, 1851: 278.
Triphora festiva.—Verco, 1909: 288 (in part).
Notosinister festiva.—Cotton & Godfrey, 1931: 54.
Cautor maculosa.—Cotton & Godfrey, 1931: 55, pl.1, fig. 13 (**not** Hedley, 1903).

Description. Shell 3.30–12 (est.) mm x 1.25–3.60 mm, of 10¼–17½ (est.) whorls, narrowly conical or weakly cyrtoconoid, strongly built, spire up to 4.7 x higher than aperture plus canal.

Colour of protoconch yellowish brown. First 2 or 3 teleoconch whorls white. Subsequent whorls white, alternately maculate with white and yellowish to blackish brown on sides of spiral 1 and sometimes spiral 2; base yellowish to blackish brown below spiral 4.

Protoconch of planktotrophic larval type, narrowly conical, of 3–4½ convex whorls, diameter 320–450 μm, diameter of first whorl 170–210 μm. First whorl sculptured with minute hemispherical granules. Subsequent whorls entirely traversed by fine, crisp, weakly flexuous axial riblets, and encircled by a single fine, crisp submedian spiral thread that surmounts an angulation on last whorl. A suprasutural spiral thread is exposed on last whorl. The position of a former adapical median spiral is indicated by slight riblet flexure.

Teleoconch whorls flat-sided, reticulately sculptured with prominent well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire.

Table 41. *Aclophoropsis festiva.* Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls	No. axials
12.0(est.)	3.60	3.33	—	17(est.)	18
12.0(est.)	3.50	3.42	—	18(est.)	21
12.0(est.)	3.40	3.52	—	17(est.)	20
11.5	3.40	3.38	0.20	16.00	23
7.60	2.25	3.37	0.18	14.25	16
6.55(est.)	2.15	3.04	—	—	18
5.10(est.)	1.75	2.91	—	—	17
5.00	1.75	2.85	0.18	12.00	17
4.00	1.55	2.58	0.17	11.00	16
3.90	1.35	2.88	0.17	11.00	18
3.30	1.25	2.64	0.17	10.25	18

Spirals 1 and 3 commencing immediately, spiral 3 continuing from median protoconch spiral; spiral 2 appearing as a thread on 6th–10th shell whorl, gradually enlarging to resemble spiral 3 on body whorl. Spirals 1–4 strongly nodular, spiral 1 broadest, spirals 2–4 of similar size, spiral 5 weakly nodular or smooth, spiral 6 smooth. Axial costae straight, orthocline or gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 16–23 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather deeply infolded to contact base of inner lip, indented below insertion; profile prosocyrt-opisthocline below a simple posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (as in Fig. 1I) pale yellow, thin, subcircular, nucleus subcentral, of about 2 whorls. Muscle attachment scar minutely pitted, no accessory peg.

Radula (Fig. 5K) with the formula 7 + 1 + 1 + 1 + 7. Central tooth 11.7 μm wide, with 3 cusps, median cusp very small, outer cusps large. Lateral teeth each 11.7 μm wide, with 4 cusps, median cusps small, outer cusps large. Marginal teeth 8.7–3.9 μm wide, each with 3 cusps; outer cusps large, median cusps small on innermost teeth, as large as adjacent cusps on outermost teeth.

Type locality. Port Lincoln, South Australia.

Types. LECTOTYPE (here selected from 2 syntypes) BMNH 16559.

Other material examined (349 specimens). *Tasmania*: Murray Pass, Deal I., Bass Strait, 30–35 m, 9 May 1974 (AMS); Deal I., algae washings, 6 m, 6 May 1974, S.A. Shepherd (AMS); E of Grassy, King I., c.58–77 m, 23 July 1962, HMAS *Gascoyne* stn G2/68-70/62 (AMS); SE of King I. (40°20′S, 144°22.9′E), 55 m, 12 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2111 (AMS); S of West Point (41°09.2′S, 144°24.2′E), 88 m, 14 Apr. 1973, MT *Sprightly*, B.M.R. stn S73-2121 (AMS); SW of Cape Raoul (43°25′S, 147°45′E), 117 m, 24 Mar. 1970, FRV *Penghana* (AMS). *Victoria*: off SSE side of Gabo I., among red algae, 28 m, Feb. 1973, S.A. Shepherd (AMS); off Lakes Entrance, 37–46 m & 55 m (2 lots AMS); Lorne, 3 Mar. 1957, J. Kerslake (AMS); Bear's Gully, Waratah Bay, 30 July 1977 (MPM); Point Lonsdale, 17 Apr. 1975 (MPM). *South Australia*: off Edithberg, alive on broken rubble and sponges, 16 Dec. 1970, N. Coleman (AMS); Largs Bay, Verco Coll. (SAM); Port Willunga, Verco Coll. (SAM); Henley Beach, Gulf St. Vincent, Verco Coll. (SAM); Gulf St. Vincent, Verco Coll. (2 lots SAM); off Cape Borda, 101 m, Verco Coll. (SAM); Hardwick Bay, H.L. Kesteven (AMS); Corney Point, Verco Coll. (SAM); Arno Bay, T.A. Garrard (AMS); Point Brown, Dec. 1972 (MPM); Port Lincoln, Verco Coll. (SAM); Smoky Bay, alive, 7 m, Nov. 1920, A.R. Riddle (SAM); Ceduna, 2 Apr. 1975, F.H. Plant (AMS); St. Francis I., beach drift, Verco Coll. (SAM). *Western Australia*: King George Sound, beach drift, Verco Coll. (SAM); Albany, shell sand, Dec. 1979 (MPM); Hopetoun, Sept. 1971, W. Anson (AMS); Margaret River, shell sand, Nov. 1975 & 20 Dec. 1979 (2 lots MPM); off Peppermint Grove Beach, between Bunbury and Busselton, 4.6–7.6 m, 28 Dec. 1971, W.F. & J.M. Ponder & R. Hancey (AMS); Yallingup, Verco Coll. (SAM).

Remarks. The colour pattern of this species is unique among known southern Australian triphorids. *A. festiva* superficially resembles *A. maculosa* (Hedley), with which it occurs sympatrically in Victoria, but differs markedly in protoconch characters, in details of colour pattern, and in the later appearance of teleoconch spiral 2. *A. festiva* is frequently misidentified as *A. maculosa* in collections, and Cotton & Godfrey's (1931) South Australian records of *A. maculosa* refer to this species. Specimens obtained living from 7 m in Smoky Bay, South Australia (SAM D.16247) are exceptionally large, attaining almost twice the size of the average specimen (height up to 12 mm). The lectotype is an immature specimen exhibiting the characteristic colour pattern, and was selected because it is the only syntype retaining part of the protoconch.

Aclophoropsis maculosa (Hedley, 1903)

Fig. 31K–M, Table 42

Triphora maculosa Hedley, 1903: 614, pl.32, figs 32, 33.
Notosinister maculosa.—Laseron, 1954: 145, fig.1.
Triphora masculosa [sic].—May, 1923: pl.27, fig.21.
Notosinister robusta Laseron, 1954: 147, fig.7. New synonym.
Aclophora maculosa.—Laseron, 1958: 572.
Not *Cautor maculosa.*—Cotton & Godfrey, 1931: 55, pl.1, fig. 13 = *A. festiva* (A. Adams).

Description. Shell 3.40–8.00 (est.) mm x 1.40–2.70 mm of 8¼–12 (est.) whorls, narrowly cyrtoconoid, rather thick, spire up to 3.1x higher than aperture plus canal.

Colour: Protoconch and first 1 or 2 teleoconch whorls white. Subsequent whorls white or buff white and alternately maculate; maculations deep yellowish or reddish brown on sides and between nodules of spiral 1, yellowish brown between spirals 1 and 4. Base reddish or deep yellowish brown below spiral 4.

Protoconch of lecithotrophic larval type, merging rather insensibly into teleoconch but of about 2–2½ convex whorls, diameter about 370–543 μm, diameter

Table 42. *Aclophoropsis maculosa.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	9	5.41	3.40–7.50	1.30
Diameter	9	2.07	1.40–2.70	0.40
Height/diameter	9	2.59	2.41–2.80	0.16
Diameter 1st whorl	9	0.33	0.28–0.38	0.04
No. whorls	9	9.78	8.25–11.50	1.00
No. axials	9	21	18–23	1.92

of first whorl 280–380 μm. First whorl smooth, last whorl with a low, rounded submedian angulation.

Teleoconch whorls flat-sided at first, usually becoming very shallowly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture, a secondary spiral between spirals 2 and 3 on body whorl behind outer lip. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch angulation; spiral 2 appearing as a thread on 5th–6th shell whorl, gradually enlarging and resembling spiral 3 from 7th or 8th whorl. Spirals 1–4 of similar size, spiral 1 slightly broader, spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spiral 5 weakly undulate, spiral 6 smooth. Axial costae straight, orthocline, or gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–23 on penultimate whorl. Base evenly contracted. Aperture subquadrate. Outer lip produced and flared basally, inner extremity rather deeply infolded over base of inner lip, indented below insertion; profile prosocyrt-opisthocline below simple, open posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type localities. *T. maculosa*: Balmoral Beach, Sydney, New South Wales; *N. robusta*: Off Sow and Pigs Reef, Sydney.

Types. *T. maculosa*: LECTOTYPE (here selected from 2 syntypes) AMS C.13520. *N. robusta*: LECTOTYPE (here selected from 2 syntypes) AMS C.103075.

Other material examined (228 specimens). *New South Wales*: Clarence River, A.A. Cameron (AMS); Shelly Bay, S of Angourie, 26 May 1979 (MPM); Port Stephens, M. Ward (AMS); Long Reef, Collaroy, Sydney (4 lots AMS); Collaroy Beach (2 lots AMS); Cronulla Beach, 31 May 1893, J. Brazier (AMS); Port Jackson, Hargreaves Coll. (AMS); off Georges Head, Port Jackson, alive, 24 m, J. Brazier (AMS); off Chinaman's Beach, 27 Apr. 1952, J. Kerslake (AMS); Little Coogee Bay, Sydney, 1895, J. Brazier (8 lots AMS); Balmoral, J. Kerslake (AMS); Balmoral, Cox Coll. (AMS); Balmoral, C. Hedley (AMS); Ocean Beach, Kurnell, 1950–60, J. Voorwinde (AMS); 1 km E of Little Bay (33°58.43'S, 151°15.53'E), 35 m, 16 May 1972, MV *Shipek* (AMS); off Sow and Pigs Reef, 9 Jan. 1879, J. Brazier (AMS); Crookhaven Heads (AMS); Shell Harbour, J. Voorwinde (AMS); Wreck Bay, C. Hedley (AMS); Ulladulla, shell sand, 1950–60, J. Voorwinde (AMS). *Victoria*: Off SSE side of Gabo I., among red algae, 28 m, Feb. 1973, S.A. Shepherd (AMS).

Additional record. North Coast, Tasmania (May, 1923, pl.27, fig.21).

Remarks. *A. maculosa* is one of the most common and distinctive triphorids on the New South Wales coast, and is easily recognized by its distinctive colour pattern. *A. festiva* (A. Adams) has a very similar colour pattern on spiral 1, but is never maculate between spirals 1 and 4—their protoconchs are totally different. The species are sympatric in northern Victoria.

The lectotype of *N. robusta* is an unusually lightly pigmented, though otherwise typical, specimen of *A. maculosa*. The paralectotype has a pure white spire and a brown base and is probably a partial albino.

Aclophoropsis univitta (Laseron, 1954)
Figs 4B, 5J, 32A–C

Notosinister univitta Laseron, 1954: 145, fig. 2

Description. Shell 4.00–6.90 (est.) mm x 1.45–2.15 mm, of 8–11½ (est.) whorls, narrowly cyrtoconoid, of moderate thickness, spire up to 4 x higher than aperture plus canal.

Colour: Protoconch and first teleoconch whorl white, next 2 teleoconch whorls at first yellowish brown, darkening to reddish brown, then lightening to yellowish brown. Subsequent whorls white, spiral 3 and sometimes spiral 2 yellowish brown between nodules, base yellowish brown on and below spiral 5.

Protoconch of lecithotrophic larval type, merging insensibly into teleoconch, subcylindrical, of about 2¼–2¾ smooth convex whorls; first whorl somewhat bulbous, diameter 370–470 μm.

Teleoconch whorls very shallowly convex, reticulately sculptured with prominent, well-defined spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire, a secondary spiral between spirals 2 and 3 on body whorl behind outer lip. Spirals 1–3 commencing immediately, spirals 1–4 of similar size throughout, spirals 1–3 strongly nodular, spiral 4 more weakly nodular, spirals 5 and 6 weaker, smooth, spiral 6 sometimes very weak. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 15–16 on penultimate whorl. Base rather evenly contracted. Aperture subquadrate. Outer lip flared and produced basally, inner extremity rather deeply infolded to contact columellar edge of base of inner lip, indented below insertion, profile strongly opisthocline, posterior siphonal notch simple. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, of moderate length.

Operculum (as in Fig. 4B) pale yellow, thin, ovate, nucleus subcentral, externally shallowly concave, of

about 2½ whorls; periphery thin, upturned, slightly projecting from suture externally. Muscle attachment scar ill-defined, no accessory peg.

Radula (Fig. 5J) with the formula 8 + 1 + 1 + 1 + 8. Central tooth 5.8 μm wide, with 3 cusps, median cusp very small. Lateral teeth each 6.8 μm wide, with 4 cusps, median 2 cusps small. Marginal teeth 6.8–1.9 μm wide, each with 3 cusps; median cusp shorter than adjacent cusps on marginals 1–3, longer than adjacent cusps on outer teeth.

Type locality. Off Long Reef, Sydney, New South Wales, 26 m.

Lectotype (here selected from 4 syntypes). AMS C.65854 (5.25 x 1.90 mm; 9.50 whorls).

Other material examined (2 specimens). *New South Wales*: Reef off Avalon, Sydney, among sponges and ascidians, 37 m, 31 Jan. 1973, P. Hutchings (AMS); between Balls Head and Goat I., Port Jackson, alive, 33 m, 25 June 1884, J. Brazier (AMS).

Remarks. *A. univitta* is well characterized by the combination of distinctive colour pattern, smooth subcylindrical protoconch, and immediate appearance of teleoconch spiral 2.

Genus *Nanaphora* Laseron

Nanaphora Laseron, 1958: 614. Type species (original designation): *Nanaphora torquesa* Laseron, 1958 (? = *T. leucomys* Hervier, 1897); Recent, Queensland.

N. torquesa (Fig. 32H, I) is one of a large number of species (many unnamed) that superficially resemble *Mastonia* Hinds in having a late or very late-developing teleoconch spiral 2, a more or less bottle-shaped shell, and usually well-developed teleoconch microsculpture. They differ from *Mastonia* in usually attaining somewhat smaller size, and in having teleoconch axials that are evenly developed as they traverse the whorls instead of being spirally dislocate. *N. torquesa* is superficially similar to the type species of *Obesula* Jousseaume, 1898 (*O. obesula* Jousseaume, 1884) (Fig. 26H–J) and *Opimaphora* Laseron, 1958 (*O. sarcira* Laseron, 1958) (Fig. 32D). Regrettably the radulae of the type species of *Opimaphora* and *Nanaphora* are unknown, and *N. torquesa* has a lecithotrophic protoconch that exhibits no characters suggestive of its affinities. The situation is complicated by the fact that *Nanaphora* and *Opimaphora* (as limited by Laseron, 1958) are obviously highly polyphyletic, containing species with or without teleoconch microsculpture, with hemispherical granules, T-shaped granules or reticulate sculpture on the first whorl, and with one or two median spiral threads on subsequent protoconch whorls.

Besides other differences, *N. torquesa* differs from *O. obesula* in having weak spiral microsculpture in all spiral interspaces instead of on the anterior canal alone. *N. tricolor* Laseron, 1958 (Fig. 32E–G) and *Opimaphora albogemmata* Laseron, 1958 (? = *triticea* Pease, 1861 = *crassulus* Martens, 1880) (Fig. 32J,K) closely resemble *N. torquesa* in teleoconch facies, but have stronger teleoconch microsculture. If it transpires that *O. albogemmata* is referable to *Nanaphora, Nanaphora* and *Obesula* should be separable on protoconch sculpture, because *O. albogemmata* has T-shaped granules on the first whorl and two spiral threads on subsequent protoconch whorls, instead of hemispherical granules and one spiral thread as in *O. obesula.*

Opimaphora sarcira resembles *N. tricolor* and *O. albogemmata* in having two protoconch spirals, but differs in having hemispherical granules on the first whorl. Laseron's (1958) paratypes of *O. sarcira* represent two different species, and his illustration of the protoconch (fig. 158) is from one of these. It resembles *N. torquesa* in teleoconch facies but has stronger microsculpture like that of *N. tricolor.* Accepting that *O. albogemmata* is referable to *Nanaphora, Opimaphora* species should be separable by the sculpture of the first whorl. Whatever the affinities of *O. albogemmata,* the possibility remains that *O. sarcira* is a species of *Nanaphora* with planktotrophic larval development (*Nanaphora* has page priority over *Opimaphora*). *Nanaphora albogemmata* has a quite extraordinary radula (Fig. 5I) and operculum (Fig. 1F), most unlike those of species herein referred to *Obesula.* Species with reticulate sculpture on the first whorl are referable to *Tetraphora* Laseron or *Sagenotriphora* n.gen.

Nanaphora (?) tricolor Laseron, 1958
Fig. 32E–G

Nanaphora tricolor Laseron, 1958: 618, figs 151, 152.
? *Notosinister cingulifera.*—Kosuge, 1962b: 88, pl.9, fig. 6; Kosuge, 1963: 241, pl.14, fig. 4 (**not** Pease, 1861).

Description. Shell 3.15 (est.)–4.40 (est.) mm x 1.35–1.90 mm, of 11 (est.)—12½ (est.) whorls, strongly cyrtoconoid, thick and heavy, spire up to 3.4 (est.) x higher than aperture plus canal.

Colour of protoconch yellowish brown. Teleoconch spiral 1 pure white, spiral 3 deep reddish brown; pale orange or yellowish brown between spirals 1 and 3, on spiral 2 and on base below spiral 3.

Protoconch of planktotrophic larval type, narrowly conical, diameter 370 μm, diameter of first whorl 130 μm. First whorl lightly worn, so sculpture unknown. Subsequent whorls entirely traversed by fine, crisp, flexuous axial riblets and encircled by 2 fine, crisp, angulating, median spiral threads. Spiral threads similar on first half of second whorl. Adapical spiral vanishing, reappearing near end of third whorl, rapidly enlarging to resemble abapical spiral, again vanishing on last quarter whorl where abapical spiral surmounts a prominent carina. A suprasutural spiral is exposed on last whorl.

Teleoconch whorls flat-sided, reticulately sculptured with strong spiral cords and rather subdued axial costae, intersections nodular, suture shallow. All spiral interspaces with a microsculpture of very fine, close, crisp, weakly granulate spiral threads. Spiral cords numbering 4 on body whorl and 2 on base, adapical margin of

spiral 4 exposed at suture on spire, spiral 6 at top of columella, sometimes an additional spiral on columella below spiral 6, or a narrow secondary spiral between spirals 5 and 6. Spirals 1 and 3 commencing immediately, spiral 3 continuing from protoconch carina; spiral 2 appearing as a thread on about 10th shell whorl near abapical margin of spiral 1, gradually descending to a median position and enlarging to resemble spiral 3 on body whorl only. Spirals 1–4 strongly nodular, basal spirals more weakly nodular. Spirals 1 and 3 similar on spire, spirals 2–4 similar and narrower than spiral 1 on body whorl following weakening of spiral 3. Spirals 5 and 6 weakest, similar. Axial costae straight, gently opisthocline, evenly traversing whorls, evanescent below spiral 6, numbering 18–22 on penultimate whorl. Base very evenly contracted. Columella very broad. Aperture ovate. Outer lip produced and flared basally, inner extremity infolded to almost contact base of inner lip; profile opisthocline below a shallow, U-shaped posterior siphonal notch. Inner lip very thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Animal unavailable.

Type locality. Angourie, northern New South Wales.

Holotype. AMS C.103095 (4.40 [est.] × 1.90 mm; 12.50 whorls [est.]).

Other material examined (2 specimens). *New South Wales*: Off W side of South West Solitary I., 12–18 m, 18 May 1972, P. Hutchings & P. Weate (AMS); Little Coogee Bay, Sydney, July 1895, J. Brazier (AMS).

Remarks. *N. tricolor* is immediately separable from known southern Australian triphorids by its striking colour pattern. A species with identical teleoconch facies is not uncommon at Lord Howe Island, and one of these is illustrated here (Fig. 32E, F) to show the teleoconch. Obviously it will be necessary to compare specimens with perfect protoconchs to be absolutely certain of their conspecificity. Kosuge (1962b, 1963) recorded a similar species from Japan as *Notosinister cingulifera* (Pease, 1861) but without seeing specimens, I cannot confirm the identification. Compared with *N. tricolor*, Hawaiian topotypes of *T. cingulifera* differ in being deep reddish brown on spirals 3–5, and uniformly yellowish brown elsewhere on the teleoconch.

Cheirodonta n.gen.

Type species: *Cerithium perversum* var. *pallescens* Jeffreys, 1867; Recent, Atlantic.

Diagnosis. Triphorines with hemispherical granules on 1st whorl, and 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spiral 2 commencing later than spirals 1 and 3, sculpture evenly reticulate, intersections nodular. Radula with the formula 6–8 + 1 + 1 + 1 + 8–6. Central and lateral teeth short and broad, central with 7–9 cusps, laterals with 8–9 cusps. Marginal teeth with 7–13 cusps, all teeth or outermost teeth hand-like with elongate basal shafts.

Description. Shell 2.7–8 mm high, narrowly cyrtoconoid, spire rather short, several times higher than aperture plus canal.

Protoconch: Planktotrophic larval protoconch with hemispherical granules on 1st whorl. Subsequent whorls encircled by 2 similar median spiral threads that surmount weak angulations, and entirely traversed by axial riblets. Lecithotrophic larval protoconch with 2 spiral cords.

Teleoconch of up to 8 flat-sided whorls, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical protoconch spiral; spiral 2 appearing on 5th–9th whorl, gradually enlarging to resemble adjacent spirals. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 weakly nodular or smooth, spirals 5 and 6 smooth. Axial costae strong, straight, orthocline or slightly opisthocline, evenly traversing whorls, evanescent against spiral 4. Base evenly contracted. Outer lip produced and flared basally, inner extremity rather deeply infolded; posterior siphonal notch open, U-shaped. Anterior siphonal canal oblique, subtubular, short or of moderate length.

Operculum (as in Fig. 1I; Bouchet, 1983, fig. 3) rather thin, flat, subcircular, nucleus subcentral, of 2½–4 whorls; periphery thinner, not or distinctly projecting from suture externally. Muscle attachment scar minutely pitted, with or without a small, comma-shaped accessory boss behind nucleus.

Radula (Fig. 8C; Bouchet & Guillemot, 1978, fig. 19; Bouchet, 1983, figs 10, 11) with the formula 6–8 + 1 + 1 + 1 + 8–6. Central and lateral teeth short and broad. Central tooth with 6–8 cusps, with or without a small median cusp. Lateral teeth with 7–9 cusps. Marginal teeth with 7–13 cusps, all teeth hand-like, with long, narrow cusps and elongate basal shafts, or innermost teeth short and outer teeth elongate.

Remarks. *Cheirodonta* is based primarily on extremely distinctive radular morphology. The broad central and lateral teeth resemble those in *Bouchetriphora* n.gen., but in *Cheirodonta* elongation of the marginal teeth has been accomplished by elongation of entire teeth instead of cusps alone, and the protoconch has two median threads instead of one. *Nanaphora*(?) *albogemmata* (Laseron, 1958) (Fig. 5I) has similar marginal teeth, but its lateral teeth are elongate as well, and the central tooth is greatly reduced in size. I strongly doubt that *N. albogemmata* belongs in *Cheirodonta*—or even in *Nanaphora*—because its shell and opercular facies are entirely different (Figs 1F, 32J, K). As a broad group, *C. labiata, C. pallescens* and *N. albogemmata* demonstrate progressive inward elongation of the marginal teeth, which has extended into the lateral teeth in *N. albogemmata* with an

associated virtual redundancy of the central tooth. The difference between the radulae of *C. labiata* and *C. pallescens* could be a simple matter of degree, and *C. labiata* is tentatively referred to *Cheirodonta*. Their teleoconchs are certainly very similar and the two spiral cords on the lecithotrophic protoconch of *C. labiata* are probably accordant with the number on the planktotrophic protoconch of a *C. pallescens*-like ancestor.

Cheirodonta labiata (A. Adams, 1851)
Figs 8C, 32A-C, Table 43

Triphoris labiatus A. Adams, 1851:279.
Triphora labiata.—Hedley, 1903:617, pl.33, figs 42, 44.
Cautor labiata.—Cotton & Godfrey, 1931:55.
Notosinister conferta Laseron, 1954:145, fig. 3. New synonym.
Notosinister labiata.—Laseron, 1954:147, fig. 6.

Description. Shell 2.70–4.95 mm x 1.10–1.55 mm, of 7½–10½ whorls, stout, narrowly cyrtoconoid, spire up to 4 x higher than aperture plus canal.

Colour deep reddish brown, spiral 1 a darker or lighter shade.

Protoconch of lecithotrophic larval type, short and broad, of 2½ convex whorls, diameter 420–500 μm, diameter of first whorl 300–400 μm. Sculptured throughout with 2 similar, smooth spiral threads.

Teleoconch whorls flat-sided, reticulately sculptured with prominent spiral cords and axial costae, intersections nodular, suture shallow, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire; a secondary spiral between spirals 2 and 3 on body whorl behind outer lip, sometimes another appears later between spirals 3 and 4. Spirals 1 and 3 commencing immediately, spiral 3 continuing from abapical protoconch spiral; spiral 2 appearing as a thread on 5th–6th shell whorl, gradually enlarging to resemble adjacent spirals before body whorl. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 weakly nodular, spirals 5 and 6 smooth. Axial costae straight, orthocline or gently opisthocline, evenly traversing whorls, evanescent against spiral 4, numbering 19–23 on penultimate whorl. Base evenly contracted. Aperture ovate to subquadrate. Outer lip produced and flared basally, inner extremity rather deeply infolded to almost contact base of inner lip, profile prosocyrt below a U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, subtubular, rather short.

Operculum (as in Fig. 1I) rather thin, flat, subcircular, nucleus subcentral, of about 2½ whorls; periphery thinner, upturned, not projecting from suture externally. Muscle attachment scar minutely pitted, with a small comma-shaped accessory boss behind nucleus.

Radula (Fig. 8C) with the formula 8 + 1 + 1 + 1 + 8. Central tooth 6.8 μm wide, with 7–9 short cusps (7 apparently normal); lateral teeth each 6.8 μm wide, with 8–9 cusps (8 normal). Marginal teeth in 2 series: Marginals 1–3 similar, each about 5.0 μm wide, with 8–9 narrow cusps of moderate length; marginals 4–8 each about 2.3 μm wide, hand-like, longer than broad, tips divided into 7 or 8 long, narrow cusps.

Type localities. *T. labiatus*: Sydney, New South Wales, under stones at low water; *N. conferta*: Pittwater, New South Wales.

Types. *T. labiatus*: LECTOTYPE (here selected from 3 syntypes) BMNH 196569. *N. conferta*: HOLOTYPE AMS C.65856.

Other material examined (135 specimens). *New South Wales*: Warriewood Beach, N of Sydney, J. Kerslake (AMS); Long Reef, Collaroy, Sydney, 1950-60, J. Voorwinde (AMS); Long Reef, rock washings, 1950-60, J. Voorwinde (AMS); Long Reef, alive under intertidal rocks, 26 May 1979 (MPM); Collaroy Beach, 1950-60, J. Voorwinde (AMS); Cronulla Beach, 31 May 1893, J. Brazier (AMS); North Harbour, Sydney, alive among worm tubes (AMS); Middle Harbour, Sydney, 5 m, T.A. Garrard (AMS); Middle Harbour, 13 July 1886, J. Brazier (AMS); Middle Harbour, C. Hedley (AMS); off Doll's Point, Sydney, 18 m (AMS); Little Coogee Bay, Sydney, 13 July 1895, J. Brazier (AMS); Sydney Harbour, H.L. Kesteven (2 lots AMS); exposed side of Wimbie Beach, Bateman's Bay, Sydney, washed from large brown algae, 6 Jan. 1970, W.F. Ponder & P.H. Colman (AMS); Botany Bay, 5 m, T.A. Garrard (AMS); Ocean Beach, Kurnell, 1950-60, J. Voorwinde (AMS); Merimbula Jetty, Sydney, stone washings, 7 Jan. 1970, W.F. Ponder & P.H. Colman (AMS); off Bottle and Glass Rocks, Port Jackson, 9 m, 1878, J. Brazier (AMS); Shell Harbour, J. Voorwinde (AMS); Jervis Bay, alive under intertidal rocks, 26 May 1979 (MPM); Ulladulla, shell sand, 1950-60, J. Voorwinde (AMS).

Remarks. *C. labiata* is well characterized by its dark coloration, small size and blunt-tipped protoconch. The holotype of *N. conferta* is a specimen of *C. labiata* that has grown abnormally following severe damage at the protoconch-teleoconch junction.

Table 43. *Cheirodonta labiata.* Shell measurements (mm) and countings.

Character	Number	Mean	Range	S.D.
Height	17	3.46	2.70–4.95	0.64
Diameter	17	1.28	1.05–1.55	0.14
Height/diameter	17	2.69	2.41–3.19	0.22
Diameter 1st whorl	17	0.34	0.30–0.40	0.03
No. whorls	17	8.54	7.50–10.50	0.85

Genus *Talophora* Gründel

Talophora Gründel, 1975: 157. Type species (original designation): *Notosinister subulata* Laseron, 1958; Recent, Queensland.

Diagnosis. Triphorines with hemispherical granules on the 1st whorl, and with 2 spiral threads and uninterrupted axial riblets on subsequent whorls of planktotrophic larval protoconch. Teleoconch spirals 1–3 commencing simultaneously, spiral 3 continuing from adapical protoconch spiral.

Description. Shell 3.90–9.50 mm high, of 13–18 whorls, narrowly conical or weakly cyrtoconoid, spire long, several times higher than aperture plus canal.

Protoconch: First whorl of planktotrophic larval protoconch sculptured with hemispherical granules. Subsequent whorls entirely traversed by axial riblets and encircled by 2 median spiral threads, adapical spiral more prominent than abapical spiral on last whorl. Lecithotropic protoconch unknown.

Teleoconch whorls shallowly convex, reticulately sculptured with spiral cords and axial costae, intersections nodular, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–3 commencing immediately, spiral 3 continuing from *adapical* protoconch spiral; spiral 2 weaker than adjacent spirals at first, rapidly enlarging. Spirals 1–4 rather similar. Axial costae straight, opisthocline, evenly traversing whorls, evanescent below spiral 4. Base evenly contracted. Inner extremity of outer lip rather shallowly infolded, distant from base of inner lip, posterior siphonal notch open. Anterior siphonal canal open, of moderate length.

Animal unavailable.

Remarks. Gründel (1975, p.157) proposed *Talophora* as a subgenus of *Norephora* Gründel, 1975 (type species *T. granulata* Strauch, 1967), separating it primarily because the axial protoconch riblets in *T. subulata* are not interrupted by a smooth zone as in *N. granulata*. *T. subulata* differs further from *N. granulata* in that teleoconch spiral 3 continues from the adapical instead of abapical median protoconch spiral. *Talophora* is allocated generic status because I consider that the differences between *T. subulata* and *N. granulata* are of sufficient magnitude to indicate that it is not closely related to *Norephora*. *Norephora* is probably closely related to *Inella* Bayle. Establishment of the phylogenetic relationships of *Talophora* must await knowledge of the radula.

Talophora subulata (Laseron, 1958)

Fig. 33D–F, Table 44

Notosinister subulata Laseron, 1958: 634, figs 206, 207.
Norephora (Talophora) subulata.—Gründel, 1975: 157.

Description. Shell 3.90–9.50 mm x 1.15–2.40 mm, of 13–18 whorls, rather thin, narrowly conical or cyrtoconoid, spire up to 4.9 x higher than aperture plus canal.

Colour of protoconch pale yellowish brown. Teleoconch pale yellowish brown, spirals 1 and 4 yellowish to reddish brown between nodules, nodules on spiral 1 white.

Protoconch of planktotophic larval type, narrowly conical, of 6–7 convex whorls, diameter 430–530 μm, diameter of first whorl 125–140 μm. First whorl sculptured with minute, spirally aligned, hemispherical granules. Subsequent whorls entirely traversed by fine crisp axial riblets, and encircled by 2 fine, crisp, similar angulating spiral threads; adapical spiral surmounting a prominent carina on last whorl. A suprasutural thread is exposed on last whorl.

Table 44. *Talophora subulata.* Shell measurements (mm) and countings.

Height	Diameter	Height/ diameter	Diameter 1st whorl	No. whorls	No. axials
3.90	1.20	3.25	0.13	13.00	18
4.45	1.15	3.86	0.13	14.50	—
9.50	2.40	3.95	0.13	18.00	21

Teleoconch whorls flat-sided at first then shallowly convex, reticulately sculptured with well-defined spiral cords and axial costae, intersections nodular, no microsculpture. Spiral cords numbering 4 on body whorl and 2 on base, spiral 4 partly exposed at suture on spire. Spirals 1–3 commencing immediately, spiral 3 continuing from *adapical* protoconch spiral; spiral 2 commencing weaker than adjacent spirals, enlarging to resemble spiral 3 after about 1 whorl. Spirals 1–4 of similar size, spirals 1–3 strongly nodular, spiral 4 more weakly nodular; spirals 5 and 6 weaker, similar, smooth. Axial costae straight, opisthocline, evenly traversing whorls, evanescent below spiral 4, numbering 18–21 on penultimate whorl. Base evenly contracted. Aperture ovate. Outer lip produced and flared basally, inner extremity rather shallowly infolded and distant from base of inner lip, profile prosocyrt below a deep, open U-shaped posterior siphonal notch. Inner lip thick. Parietal glaze thin. Anterior siphonal canal oblique, open, of moderate length.

Animal unavailable.

Type locality. Off Endeavour Reef, near Cooktown, Queensland 36.5 m.

Holotype. AMS C.103072.

Other material examined (6 specimens). *Queensland*: Off Endeavour Reef, 36.5 m (paratypes AMS). *New South Wales*: Little Coogee Bay, Sydney, 9 July 1895, J. Brazier (AMS); off Green Point, Watsons Bay, Port Jackson, 9–14.5 m, June 1865, J. Brazier (AMS).

Remarks. *T. subulata* is rendered extremely distinctive by the colour pattern, simultaneous appearance of teleoconch spirals 1–3, and the unique origin of teleoconch spiral 3 from the adapical protoconch spiral. New South Wales specimens and one of the Queensland paratypes are slightly more conical than the holotype, but otherwise there are no significant differences.

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APPENDIX

List of Triphorid Genus-group Taxa

Valid taxa are shown in bold, homonyms and synonyms in ordinary italic type. Orthographic variants are excluded. References to the best (or only) descriptions and/or illustrations of type species are given in parentheses.

Aclophora Laseron, 1958:627 — *Aclophora robusta* Laseron, 1958; Recent, Queensland (Laseron, 1958, p.627; Fig. 30H herein).

Aclophoropsis n.gen. (p.75) — *Triphoris festivus* A. Adams, 1851; Recent, southern Australia (p.75, Figs 5K, 31G-I herein).

Adelacerithium Ludbrook, 1941:90 — *Adelacerithium merulatum* Ludbrook, 1941; Pliocene, South Australia (Ludbrook, 1941, p.90; Marshall, 1983, in press.).

Biforina Bucquoy, Dautzenberg & Dolfuss, 1884:209 — *Trochus perversus* Linné, 1758. Absolute synonym of *Monophorus* Grillo.

Callitriphora Cotton, 1947:669 — *Triforis wilkinsoni* T. Woods, 1879; Middle Miocene, Australia (T. Woods, 1879, p.233, pl.20, fig. 9).

Cautor Finlay, 1927:384 — *Triphora lutea* Suter, 1908; Recent, New Zealand (Suter, 1908, p.39, pl.3, fig. 50).

Cautotriphora Laws, 1940:51 — *Cautotriphora simulans* Laws, 1940; Lower Pleistocene, New Zealand (Laws, 1940, p.51, fig.24).

Cheirodonta n.gen. (p.79) — *Cerithium perversum* var. *pallescens* Jeffreys, 1867; Recent, Atlantic (Bouchet & Guillemot, 1978, p.346, figs 9, 12, 19; Bouchet, 1983, in press, figs 3, 10, 11, 34).

Cinctriphora Olsson & Harbison, 1953: 296 — *Triphoris bartschi* Olsson, 1916; Yorktown and Duplin Miocene, North Carolina and Virginia (Olsson & Harbison, 1953, p.297, pl.43, figs 7, 7a).

Contraforis Laseron, 1958: 638 — *Contraforis insulana* Laseron, 1958; Recent, Indo-Pacific (Laseron, 1958, p.638, fig. 226). Synonymized with *Mastoniaeforis* Jousseaume, 1884 herein.

Coriophora Laseron, 1958: 602 — *Coriopora negrita* Laseron, 1958; Recent, western Pacific (Laseron, 1958, p.602; Figs 4K, 19H herein). Synonymized with *Mesophora* Laseron, 1958 herein.

Cosmotriphora Olsson & Harbison, 1953: 295 — *Cerithium melanura* C.B. Adams, 1850; Recent, West Indies (Bouchet, 1983, figs 2, 27; Fig. 27D-F herein).

Distophora Laseron, 1958: 613 — *Distophora distorta* Laseron 1958; Recent, Queensland (Laseron, 1958, p.613; Fig. 15J-L herein). Synonymized with *Teretriphora* Finlay, 1927 herein.

Eocautor Eames, 1951: 47 — *Triphora (Eocautor) soriensis* Eames, 1951; Upper Eocene, Pakistan (Eames, 1951, p.47, pl.2, fig. 65).

Epetrium Harris & Burrows, 1891: 112 — *Triforis grignonensis* Deshayes, 1866; Eocene, Paris Basin (Deshayes, 1866, p.238, pl.82, figs 6, 7; Gougerot & Le Renard, 1979, figs 20, 21). New name for *Stylia* Jousseaume, 1884, not Robineau-Desvoidy, 1830.

Epiforis Laseron, 1958: 582 — *Epiforis australis* Laseron, 1958; Recent, Queensland (Laseron, 1958, p.582, fig. 14). Synonymized with *Mastoniaeforis* Jousseaume, 1884, herein.

Euthymella Thiele, 1929: 219 — *Euthymia regalis* Jousseaume, 1884; Recent, New Caledonia (Jousseaume, 1884, p.265, fig. 18; Fig. 5A herein). New name for *Euthymia* Jousseaume, 1884, not Stal, 1876.

Euthymia Jousseaume, 1884: 237 (not Stal, 1876) — *Euthymia regalis* Jousseaume, 1884; Recent, New Caledonia. = *Euthymella* Thiele, 1929.

Eutriphora Cotton & Godfrey, 1931—*Triphora cana* Verco, 1909; Recent, southern Australia (p.53, Figs 5B, 8D, 22D-F herein).

Hedleytriphora n.gen. (p.36) — *Triforis fasciata* T. Woods, 1879; Recent, southern Australia (p.37, Figs 6G, 17A-C herein).

Hypotriphora Cotton & Godfrey, 1931: 56 — *Triphora subula* Verco, 1909; Recent, southern Australia (p.23, Fig. 12E-G herein).

Inella Bayle, 1879: 27 — *Triphoris (Ino) gigas* Hinds, 1843; Recent, tropical western Pacific (Fig. 10H herein). New name for *Ino* Hinds, 1843, not Samsuelle, 1817.

Iniforis Jousseaume, 1884: 235 — *Iniforis malvaceous* Jousseaume, 1884; Recent, New Caledonia (Jousseaume, 1884, p.239; Figs 4G, 20A herein).

Ino Hinds, 1843: 18 (not Samsuelle, 1817) — *Triforis (Ino) gigas* Hinds, 1843; Recent, tropical western Pacific. = *Inella* Bayle, 1879.

Isotriphora Cotton & Godfrey, 1931: 52 — *Triforis tasmanica* T. Woods, 1875; Recent, southern Australia (p.56, Figs 5F, 23H-K herein).

Latitriphora n.gen. (p.42) — *Triphora latilirata* Verco, 1909; Recent, southern Australia, (p.43, Fig. 18G-J herein).

Liniphora Laseron, 1958: 638 — *Liniphora restis* Laseron, 1958; Recent, Christmas I., Indian Ocean (Laseron, 1958, p.639, figs 227, 228).

Liometaxia Le Renard, 1980: 18 — *Liometaxia laevigata* Le Renard, 1980; Eocene, Paris Basin (Le Renard, 1980, p.18, fig. 8a-c; Dolin *et al.*, 1980, pl.3, fig. 36a-d). Doubtfully referable to Triphoridae.

Litharium Dall, 1924: 89 — *Triphora (Litharium) oceanida* Dall, 1924; Recent, Hawaii (Kay, 1979, p.138, fig. 49J).

Magnosinister Laseron, 1954: 157 — *Magnosinister hedleyi* Laseron, 1954; Recent, New South Wales (p.25, Fig. 13A-C herein).

Marshallora Bouchet, 1983: in press — *Murex adversus* Montagu, 1803; Recent, Europe (Bouchet, 1983, in press, figs 12, 31).

Mastonia Hinds, 1843: 18 — *Triphoris (Mastonia) ruber* Hinds, 1843; Recent, Indo-Pacific (Figs 4J, 20B-D herein).

Mastoniaeforis Jousseaume, 1884: 236 — *Mastoniaeforis chaperi* Jousseaume, 1884; Indo-Pacific (Jousseaume, 1884, p.243; Fig. 20E, F herein).

Mesophora Laseron, 1958: 592 — *Mesophora bowenensis* Laseron, 1958 (= *Triforis fusca* Dunker,1860); Recent, western Pacific (p.46, Figs 4I, 19I-K herein).

Metalepsis Jousseaume, 1884: 236 (not Grote, 1875) — *Triforis singularis* Deshayes, 1834; Eocene, Paris Basin. = *Ogivia* Harris & Burrows, 1891.

Metaxia Monterosato, 1884: 125 — *Cerithium rugulosum* C.B. Adams, 1850; Recent, West Indies (Clench & Turner, 1950, pl.38, fig.10).

Monophorus Grillo, 1877: 58 — *Trochus perversus* Linné, 1758; Recent, Mediterranean (Bouchet, 1983, in press, figs 5-7, 20, 21, 37).

Nanaphora Laseron, 1958: 614 — *Nanaphora torquesa* Laseron, 1958; Recent, Queensland (Laseron, 1958, p.614; Fig. 32H,I herein).

Norephora Gründel, 1975: 155 — *Norephora (Norephora) granulata* Strauch, 1967; Upper Oligocene, Europe (Gründel, 1975, p.155, text fig. 6, pl.1, figs 10-13).

Notosinister Finlay, 1927: 384 — *Triphora fascelina* Suter, 1908: Recent, New Zealand (Suter, 1908, p. 38; Figs 6C, 13H herein). Synonymized with *Monophorus* Grillo, 1877 herein.

Nototriphora n.gen. (p.65) — *Notosinister aupouria* Powell, 1937; Recent, New Zealand (Powell, 1937, p.206, pl.54, fig. 2; Fig. 5H herein).

Obesula Jousseaume, 1898:75 — *Mastonia obesula* Jousseaume, 1884; Recent, New Caledonia (Jousseaume, 1884, p.255; Figs 26H-J, 33G herein).

Ogivia Harris & Burrows, 1891: 112 — *Triforis singularis* Deshayes, 1866; Eocene, Paris Basin (Deshayes, 1866, p.244, pl.82, figs 1-5; Gougerot & Le Renard, 1979, figs 38, 39). New name for *Metalepsis* Jousseaume, 1884, not Grote, 1875.

Opimaphora Laseron, 1958: 619 — *Opimaphora sarcira* Laseron, 1958; Recent, Queensland (Laseron, 1958, p.619; Fig. 32D herein).

Orbitriphora Laseron, 1958: 582 — *Orbitriphora iredalei* Laseron, 1958 (= *Triphoris cancellatus* Hinds, 1843); Recent, Indo-Pacific (Laseron, 1958, p.583; Kosuge, 1961b, pl.22, fig. 1). Synonym of *Viriola* Jousseaume (Kosuge, 1965 and herein).

Oriforina Gründel, 1975: 152 — *Biforina (Oriforina) praeversa* Gründel, 1975; Upper Oligocene, Europe (Gründel, 1975, p.152, text figs 3, 4, pl.1, figs 8,9).

Risbecia Kosuge, 1966:314 — *Triphora montrouzieri* Hervier, 1897; Recent, New Caledonia (Hervier, 1898, p.281, pl.16, figs 1, 1a; Risbec, 1943, p.102, pl.4, figs 46, 57-59).

Sagenotriphora n.gen. (p.29) — *Triphora ampulla* Hedley, 1903; Recent, southern Australia and northern New Zealand (p.30, Figs 1B, 6D, 14E-G herein).

Seilarex Iredale, 1924: 246 — *Seila attenuata* Hedley, 1900 (= *Bittium turritelliformis* Angas, 1877), Recent, Australia. (p.17, Fig. 9G-I herein).

Sinistroseila Oliver, 1915: 523 — *Triforis incisus* Pease, 1861; Recent, tropical Pacific (Kay, 1965, p.54, pl.6, figs 19, 20). Synonym of *Viriola* Jousseaume, 1884 (Cernohorsky, 1977, and herein).

Solosinister Laseron, 1954: 157 — *Solosinister pagoda* Laseron, 1954 (= *Triphoris* cf. *corrugatus* Hinds, 1843); Recent, New South Wales (Laseron, 1954, p.157, figs 27, 27a). Synonymized with *Viriola* Jousseaume, 1884 herein.

Strobiligera Dall, 1924: 89 — *Triphora ibex* Dall, 1881; Recent, Atlantic (Dall, 1881, p.86; Dall, 1889, pl.20, fig. 12b).

Subulophora Laseron, 1958: 610 — *Subulophora exporrecta* Laseron, 1958 (= *Triforis rutilans* Hervier, 1897); Recent, Indo-Pacific (p.24, Figs 6B, 12H-J herein).

Stylia Jousseaume, 1884: 236 (not Robineau-Desvoidy, 1830) — *Triforis grignonensis* Deshayes, 1866; Eocene, Paris Basin. = *Epetrium* Harris & Burrows, 1891.

Sychar Hinds, 1843: 19 — *Triphoris (Sychar) vitreus* Hinds, 1843; Recent, Straits of Malacca (Fig. 15G herein).

Talophora Gründel, 1975: 157 — *Norephora (Talophora) subulata* Laseron, 1958; Recent, eastern Australia (p.81, Fig. 33D-F herein).

Teretriphora Finlay, 1927: 384 — *Triphora huttoni* Suter, 1908; Recent, New Zealand (Suter, 1908, p.38; Fig. 15H herein).

Tetraphora Laseron, 1958: 625 — *Tetraphora mapoonensis* Laseron, 1958; Recent, Queensland (Laseron, 1958; p.625; Fig. 14D,H herein).

Torresophora Laseron, 1958: 585 — *Torresophora elongata* Laseron, 1958; Recent, Queensland (Laseron, 1958, p.585, figs 22, 23). Synonymized with *Euthymella* Thiele, 1929 herein.

Triphora Blainville, 1828: 344 — *Triphora gemmatum* Blainville, 1828; Recent, Mauritius (Blainville, 1827, pl.20, fig. 3; Fig. 28K herein).

Tristoma "Deshayes" Menke, 1830: 57 (listed in synonymy of *Cerithium*). Nomen nudum.

Viriola Jousseaume, 1884: 238 — *Viriola bayani* Jousseaume, 1884; Recent, New Caledonia (Jousseaume, 1884, p.267, pl.4, fig. 20).

Viriolopsis n. gen. (p.49)—*Viriolopsis occidua* n.sp.; Recent, southern Australia (p.50, Figs 4M, 21D-F herein).

References

Adams, A., 1851. Descriptions of new species of *Eulima, Triphoris,* etc., from the collection of Hugh Cuming, esq. Proceedings of the Zoological Society of London 19: 276-279.

———& L. Reeve, 1850 (1848-1850). Mollusca (Part 3). In 'The zoology of the voyage of H.M. "Samarang"; under the command of Sir Edward Belcher . . .' Reeve, Benham and Reeve, London. 87 pp.

Angas, G.F., 1877. Descriptions of one genus and twenty-five species of marine shells from New South Wales. Proceedings of the Zoological Society of London (1877): 171-177.

Baker, F., & V.D.P. Spicer, 1935. New species of molluscs of the genus *Triphora.* Transactions of the San Diego Society of Natural History 8(7): 35-44.

Bayle, E., 1879. Liste rectificative de quelques noms de genres. Journal de Conchyliologie 27: 34-35.

Blainville, H.M.D. de, 1827. Manuel de Malacologie et de Conchyliologie. Levrault, Paris.

——— 1828. In 'Dictionnaire des sciences naturelles,' (ed. F.G. Levrault) 55. Le Normant, Paris.

Bloom, S.A., 1976. Morphological correlations between dorid nudibranch predators and sponge prey. The Veliger 18(3): 289-301.

Bouchet, P., 1983. Les Triphoridae de Mediterranée et de Proche Atlantique. (in press).

——— & H. Guillemot, 1978. The *Triphora perversa*-complex in Western Europe. Journal of Molluscan Studies 44: 344-356.

Brazier, J., in A.U. Henn, 1894. List of Mollusca found at Green Point, Watson's Bay, Sydney: With a few remarks upon some of the most interesting species, and descriptions of new species, by John Brazier. Proceedings of the Linnean Society of New South Wales 9: 165–182.

Bucquoy, E., P. Dautzenberg & G. Dollfus, 1884. Les mollusques marins de Roussillon. 1. Gastropodes. Baillière, Paris.

Cernohorsky, W.O., 1977. The taxonomy of some Indo-Pacific Mollusca, part 5, with descriptions of new taxa and remarks on *Nassarius albus* (Say). Records of the Auckland Institute and Museum 14: 121–132.

——— 1978. Tropical Pacific marine shells. Pacific Publications, Sydney, New York.

Clench, W.J., & R.D. Turner, 1950. The western Atlantic marine molluscs described by C.B. Adams. Occasional Papers on Mollusks 1(15): 233–403.

Cotton, B.C., 1951. Australian Recent and Tertiary Mollusca, family Cerithiopsidae. Records of the South Australian Museum 9: 383–395.

——— 1953. New species and records of Mollusca from South Australia. Transactions of the Royal Society of South Australia 76: 21–26.

Cotton, B.C., & F.K. Godfrey, 1931. South Australian shells. Part 1. The South Australian Naturalist 12(4): 51–63.

Cox, L.R., 1960. Gastropoda—general characteristics of Gastropoda. Pp. I84–I169 in 'Treatise on Invertebrate Paleontology' (ed. R.C. Moore), Part I, Mollusca 1. Geological Society of America and University of Kansas Press.

Crosse, H., & P. Fischer, 1865. Description d'éspèces nouvelles de l'Australie méridionale. Journal de Conchyliologie 13: 38–55.

Dall, W.H., 1881. Preliminary report on the Mollusca. Reports on the results of dredging . . . in the Gulf of Mexico, and in the Caribbean Sea, 1877-1879, by the United States Coast Survey steamer "Blake" . . . Bulletin of the Museum of Comparative Zoology 9: 33–144.

——— 1889. Reports on the results of dredging . . . in the Gulf of Mexico (1877-78) and in the Caribbean Sea (1879-80), by the U.S. Coast Survey Steamer "Blake" . . . 29. Report on the Mollusca. Part 2: Gastropoda and Scaphopoda. Bulletin of the Museum of Comparative Zoology, Harvard 18: 1–492.

——— 1924. Notes on molluscan nomenclature. Proceedings of the Biological Society of Washington 37: 87–90.

Dartnall, A.J., 1974. Littoral Biogeography. Part 7, pp.171–194 in 'Biogeography and Ecology in Tasmania' (ed. W.D. Williams). Junk, The Hague.

Deshayes, G.P., 1832. Encyclopédie Méthodique. Histoire Naturelle des Vers 3, Paris.

——— 1834 (1824-1837). Description des Coquilles Fossiles des Environs de Paris (2 vols). Paris.

——— 1863. Catalogue des Mollusques de l'Ile de la Réunion (Bourbon). Paris.

——— 1866. Description des Animaux sans Vertèbres découverts dans le Bassin de Paris . . .3. Baillière, Paris.

Dolin, C., L. Dolin & J. Le Renard, 1980. Inventaire systématique des mollusques de l'Auversien "A Faciès Charrié" de Baron (Oise), et remarques paléontologiques. Bulletin d'Information des Geologues du Bassin de Paris 17(2): 26–48.

Dunker, W., 1860. Neue Japanische Mollusken. Malakozoologische Blätter 6: 221–240.

——— 1861. Mollusca Japonica descripta et tabulis iconum illustrata. Schweizerbart, Stuttgart.

Eames, F.E., 1951. A contribution to the study of the Eocene in Western Pakistan and western India. C. The description of the Scaphopoda and Gastropoda from standard sections in the Rakhi Nala and Zinda Pir areas of the western Punjab and in the Kohat district. Philosophical Transactions of the Royal Society B236: 1–168.

Finlay, H.J., 1927. A further commentary on New Zealand molluscan systematics. Transactions of the New Zealand Institute 57: 320–485.

Fretter, V., 1951. Observations on the life history and functional morphology of *Cerithiopsis tubercularis* (Montagu) and *Triphora perversa* (L). Journal of the Marine Biological Association of the United Kingdom 29: 567–586.

Gabriel, C.J., 1956. Mollusca from southeast of King Island, Bass Strait. Memoirs of the National Museum of Victoria 22(4): 1–16.

Gill, E.D., 1970. Current Quaternary shoreline research in Australasia. Australian Journal of Science 32: 426–430.

Golikov, A.N. & Y.I. Starobogatov, 1975. Systematics of prosobranch gastropods. Malacologia 15(1): 185–232.

Gougerot, L. & J. Le Renard, 1979. Clefs de détermination des petites espèces de gastéropodes de l'Éocène du Bassin Parisien. Cahiers des Naturalistes: Bulletin des Naturalistes Parisiens (NS) 35(3): 41–59.

Gray, J.E. 1847. A list of the genera of Recent Mollusca, their synonyms and types. Proceedings of the Zoological Society of London 15:129-206.

Grillo, G.G., 1877. Sul *Cirropteron semilunare* Sars & del nuovo sottogenere *Monophorus*. Bullettino della Societa Malacologica Italiana 3: 54–60.

Gründel, J., 1975. Bemerkungen zur Familie Triforidae Jousseaume, 1884, mit Beschreibungen einiger Arten dieser Familie. Malakologische Abhandlungen 4(16): 145-158.

——— 1980. Bemerkungen zur Überfamilie Cerithiopsacea H & A. Adams, 1854 (Gastropoda) sowie zur Fassung einiger ihrer Gattungen. Zoologischer Anzeiger 204(3/4): 209–264.

Habe, T., 1961. Coloured illustrations of the shells of Japan, 2. Hoikusha, Osaka, (1st edn.).

——— 1962. Coloured illustrations of the shells of Japan, 2. Hoikusha, Osaka. (2nd edn.)

——— 1964. Shells of the western Pacific in colour, 2. Hoikusha, Osaka.

——— & S. Kosuge, 1966. Shells of the World in colour, 2. Hoikusha, Osaka.

Hamon, B.V., 1970. Western Boundary currents in the South Pacific. Pp 50–59 in 'Scientific Exploration of the South Pacific' (ed. W.S. Wooster). National Academy of Sciences, Washington D.C.

Harris, G.F., & H.W. Burrows, 1891. The Eocene and Oligocene Beds of the Paris Basin. Geological Association, London.

Heath, R.A., 1973. Present knowledge of the oceanic circulation and hydrology around New Zealand—1971. Tuatara 20(2): 125–140.

——— 1980. Eastwards oceanic flow past northern New Zealand. New Zealand Journal of Marine and Freshwater Research 14(2):169–182.

Hedley, C., 1899. The Mollusca of Funafuti. Part 1, Gasteropoda. Memoirs of the Australian Museum 3(7): 397–488.

——— 1900. Studies on Australian Mollusca, Part 1. Proceedings of the Linnean Society of New South Wales 25: 87–100.

——— 1903. Studies on Australian Mollusca, Part 7. Proceedings of the Linnean Society of New South Wales 27: 596–619.
——— 1904. The effect of the Bassian isthmus upon the existing marine fauna: A study in ancient geography. Proceedings of the Linnean Society of New South Wales 28: 876–883.
——— 1909. Mollusca from the Hope Islands, North Queensland. Proceedings of the Linnean Society of New South Wales 34: 420–466.
Hervier, J., 1897. Diagnoses d'éspèces nouvelles de *Triforis*, provenant de l'Archipel de la Nouvelle-Calédonie. Journal de Conchyliologie 45: 249–266.
——— 1898. Descriptions d'éspèces nouvelles de mollusques, provenant de l'Archipel de la Nouvelle-Calédonie. Journal de Conchyliologie 46: 270–313.
Hinds, R.B., 1843. Description of new shells from the collection of Captain Belcher. Annals and Magazine of Natural History (ser. 1)11: 16–21.
Inaba, T., & K. Oyama, 1977. Catalogue of molluscan taxa described by Tadashige Habe during 1939-1975, with illustrations of hitherto unfigured species. Tokyo.
Iredale, T., 1924. Results from Roy Bell's molluscan collections. Proceedings of the Linnean Society of New South Wales 49(3): 179–278.
Johnson, R.I., 1964. The Recent Mollusca of Augustus Addison Gould. United States National Museum Bulletin 239: 1–172.
Jousseaume, F., 1884. Monographie des Triforidae. Bulletin de la Société Malacologique de France 1(3): 218–270.
——— 1898. Triphoridae de la Mer Rouge. Bulletin de la Société Philomathique de Paris (ser. 8) 9: 71–77.
Kay, E.A., 1965. Marine molluscs in the Cuming collection, British Museum (Natural History), described by William Harper Pease. Bulletin of the British Museum (Natural History), Zoology, Supplement 1.
——— 1979. Hawaiian Marine Shells. Reef and shore fauna of Hawaii 4: Mollusca. Bernice P. Bishop Museum Special Publication 64(4).
Kosuge, S., 1961a. On the family Triphoridae (Gastropoda) from Amami Islands (1). Venus 21(3): 308-316.
——— 1961b. On the family Triphoridae (Gastropoda) from Amami Islands (2). Venus 21(4): 413–415.
——— 1962a. On the family Triphoridae (Gastropoda) from Amami Islands (3). Venus 22(2): 119–129.
——— 1962b. Descriptions of 10 new species and 1 new subspecies of the family Triphoridae (Mollusca) from Shino-misaki, Kii Peninsula, central Japan, with a list of hitherto known species. Bulletin of the National Science Museum, Tokyo 6(2) 51: 78–89.
——— 1963. On the family Triphoridae (Gastropoda) from Amami Islands (4). Venus 22(3): 240–257.
——— 1965. Supplemental notes on the family Triphoridae of Japan. Venus 23(4): 210–217.
——— 1966. The family Triphoridae and its systematic position. Malacologia 4(2): 297–324.
——— 1974. Descriptions of six new species of the family Triphoridae (Gastropoda: Mollusca) in the collection of the Smithsonian Institution, U.S. National Museum of Natural History. Pavona 1: 1–4.
Laseron, C.F., 1951a. Revision of the New South Wales Cerithiopsidae. The Australian Zoologist 11(4): 351–368.
——— 1951b. The New South Wales Pyramidellidae and the genus *Mathilda*. Records of the Australian Museum 22(4): 298–334.
——— 1954. Revision of the New South Wales Triphoridae. Records of the Australian Museum 23: 139–158.
——— 1958. The family Triphoridae (Mollusca) from Northern Australia; also Triphoridae from Christmas Island (Indian Ocean). Australian Journal of Marine and Freshwater Research 9(4): 569–658.
Laws, C.R., 1940. Palaeontological study of Nukumaruan and Waitotaran rocks near Wanganui. Transactions of the Royal Society of New Zealand 70: 34–56.
Le Renard, J., 1980. Nouvelles éspèces de gastéropodes de l'Auversian "A Faciès Charrié" de Baron (Oise). Bulletin d'Information des Geologues du Bassin de Paris 17(2): 17–25.
Ludbrook, N.H., 1941. Gastropoda from the abbatoirs bore, South Australia, together with a list of miscellaneous fossils from the bore. Transactions of the Royal Society of South Australia 65(1): 79–102.
Marshall, B.A., 1977a. The Recent New Zealand species of *Triforis* (Gastropoda:Triforidae). New Zealand Journal of Zoology 4: 101–110.
——— 1977b. The dextral triforid genus *Metaxia* (Mollusca: Gastropoda) in the south-west Pacific. New Zealand Journal of Zoology 4: 111–117.
——— 1978. Cerithiopsidae (Mollusca: Gastropoda) of New Zealand and a provisional classification of the family. New Zealand Journal of Zoology 5: 47–120.
——— 1979. Additional dextral triphorids (Mollusca: Gastropoda) from New Zealand. New Zealand Journal of Zoology 6: 397–404.
——— 1980. The systematic position of *Triforis* Deshayes (Mollusca: Gastropoda). New Zealand Journal of Zoology 7: 85–88.
——— 1983. Adelacerithiinae: A new subfamily of the Triphoridae. Journal of Molluscan Studies (in press).
May, W.L., 1903. On Tenison-Woods' types in the Tasmanian Museum, Hobart. Papers and Proceedings of the Royal Society of Tasmania (1902): 106–114.
——— 1910. Additions to the catalogue of the marine shells of Tasmania. Papers and Proceedings of the Royal Society of Tasmania (1910): 306–313.
——— 1915. Additions to the Tasmanian marine Mollusca, with descriptions of new species. Papers and Proceedings of the Royal Society of Tasmania (1915): 75–99.
——— 1921. A check-list of the Mollusca of Tasmania. Government Printer, Hobart.
——— 1923. An illustrated index of Tasmanian shells. Government Printer, Hobart.
Menke, C.T., 1830. Synopsis methodica molluscorum generum omnium et specierum, quae in museo Menkeano adservantur cum synonymia critica et novarum specierum diagnosibus (edn 2). Pyrmont.
Mileikovsky, S.A., 1971. Types of larval development in marine bottom invertebrates, their distribution and ecological significance: a re-evaluation. Marine Biology 10(3): 193–213.
Monterosato, M.A. di, 1884. Nomenclatura generica e specifica di alcune conchiglie Mediterranee. Palermo.
Nybakken, J., & G. McDonald, 1981. Feeding mechanisms of west American nudibranchs, feeding on Bryozoa, Cnidaria and Ascidiacea, with special respect to the radula. Malacologia 20(2): 439–449.
Oliver, W.R.B., 1915. The Mollusca of the Kermadec Islands. Transactions of the New Zealand Institute 47: 509–556.
Olsson, A.A., & A. Harbison, 1953. Pliocene Mollusca of southern Florida, with special reference to those from

North Saint Petersburg. Academy of Natural Sciences, Philadelphia, Monograph 8: 1-361.

Pease, W.H., 1870. Remarks on the genus *Triphoris* (Desh.), with descriptions of new species. Proceedings of the Scientific Meetings of the Zoological Society of London (1870): 773-777.

Powell, A.W.B., 1979. New Zealand Mollusca: Marine, land and freshwater shells. Collins, Auckland.

Risbec, J., 1943. Recherches anatomiques sur les prosobranches de Nouvelle-Calédonie. Annales des Sciences Naturelles. Zoologie (ser. 11) 5:89-107.

Sowerby, G.B., 1894. Descriptions of new species of marine shells from the neighbourhood of Hong Kong. Proceedings of the Malacological Society of London 1: 153-159.

——— 1901. Descriptions of new species of marine Mollusca collected by the late Otto Koch at the Island of Cebu, Philippines. Proceedings of the Malacological Society of London 4: 208-211.

——— 1914. Descriptions of new Mollusca from New Caledonia, Japan, Philippines, China, and West Africa. Annals and Magazine of Natural History (ser. 8) 14: 475-480.

Spight, T.M., 1976. Ecology of hatching size of marine snails. Oecologia 24: 283-294.

Suter, H., 1908. The marine Mollusca of New Zealand. Proceedings of the Malacological Society, London 8: 22-42.

——— 1913. Manual of the New Zealand Mollusca, with (1915) atlas of plates. Government Printer, Wellington.

Tapparone Canefri, C., 1877. Contribuzioni per una fauna malacologica delle isole Papuane, 4. Annali del Museo Civico di storia Naturale di Genova 9: 278-293.

Tate, R., & W.L. May, 1901. A revised census of the marine Mollusca of Tasmania. Proceedings of the Linnean Society of New South Wales (1901): 344-471.

Thiele, J., 1929 (1929-35). Handbuch der Systematischen Weichtierkunde. Fischer, Jena.

——— 1930. Gastropoda und Bivalvia. Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise 1905, herausgegeben von Prof. Dr W. Michaelsen und Prof. Dr R. Hartmeyer 5(8): 561-596.

Thorson, G., 1950. Reproduction and larval ecology of marine bottom invertebrates. Biological Reviews (Cambridge) 25: 1-45.

Vance, R.R., 1973. On reproductive strategies in marine benthic invertebrates. American Naturalist 107: 339-352.

Verco, J.C., 1909. Notes on south Australian marine Mollusca, with descriptions of new species, Part 2. Transactions of the Royal Society of South Australia 33: 277-292.

——— 1910. Notes on South Australian marine Mollusca, with descriptions of new species, Part 13. Transactions of the Royal Society of South Australia 34: 115-145.

Webster, W.H., 1906. Results of dredging on the continental shelf of New Zealand. Transactions of the New Zealand Institute 38: 305-308.

Whitley, G.P., 1932. Marine zoogeographical regions of Australasia. The Australian Naturalist 8: 166-167.

Woods, J.E. Tenison, 1876. On some new species of Tasmanian marine shells. Papers and Proceedings of the Royal Society of Tasmania (1875): 27-29.

——— 1877. On some new Tasmanian marine shells. Papers and Proceedings of the Royal Society of Tasmania (1876): 131-159.

——— 1878. Census; with brief descriptions of the marine shells of Tasmania and the adjacent Islands. Papers and Proceedings of the Royal Society of Tasmania (1877): 26-57.

——— 1879. On some new Tasmanian marine shells. Papers and Proceedings of the Royal Society of Tasmania (1878): 32-40.

——— 1880. On some Tertiary fossils from Muddy Creek, western Victoria. Proceedings of the Linnean Society of New South Wales 3(3): 222-240.

Yen, T., 1942. A review of the Chinese gastropods in the British Museum. Proceedings of the Malacological Society of London 24: 170-289.

Zinsmeister, W.J. & W.K. Emerson, 1979. The role of passive dispersal in the distribution of hemipelagic invertebrates, with examples from the tropical Pacific Ocean. The Veliger 22(1): 32-40.

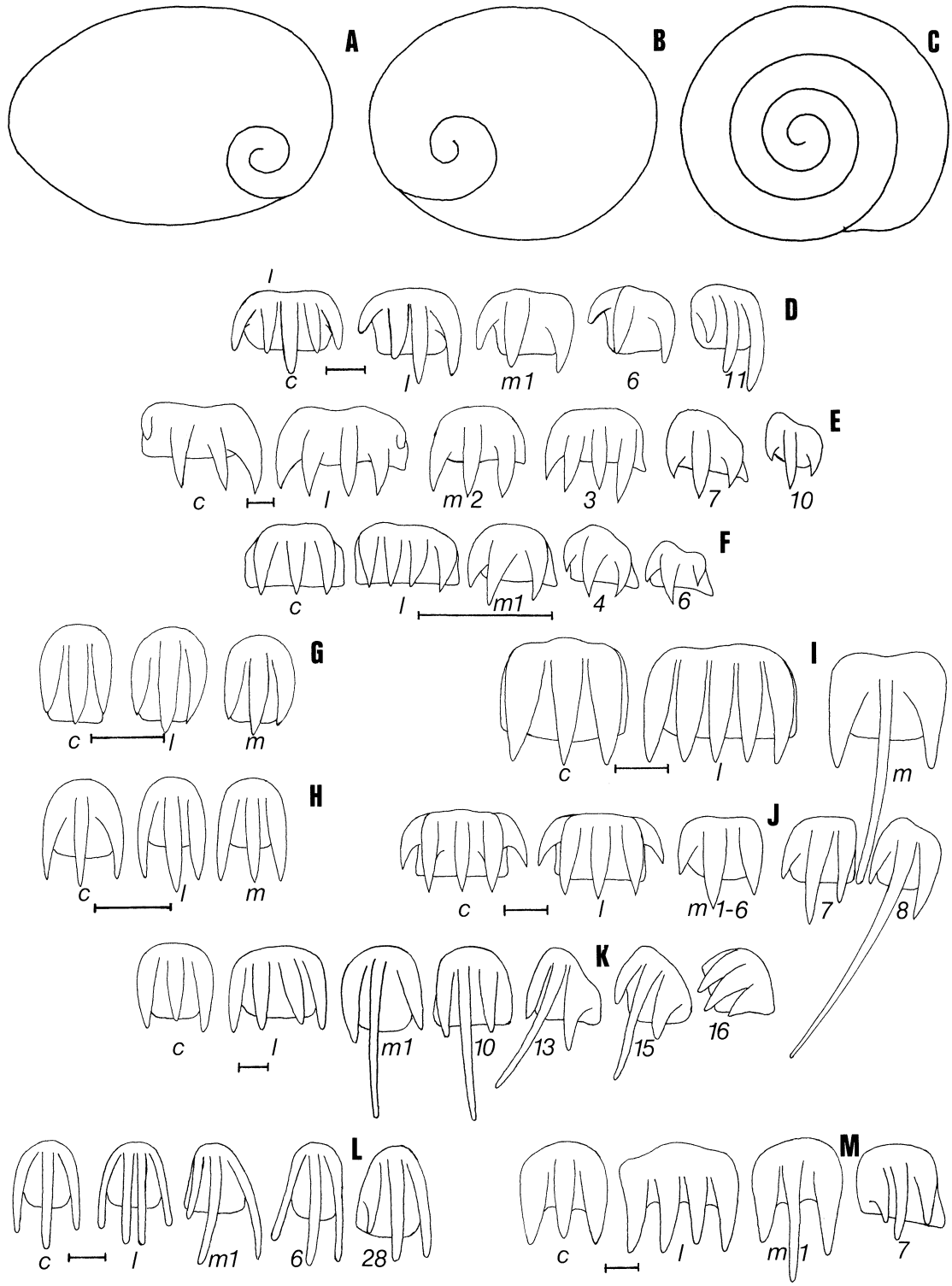


Fig. 4. **A–C,** exteriors of opercula: **A,** *Seilarex verconis* Cotton, "South Australia", SAM; **B,** *Aclophoropsis univitta* (Laseron), Port Jackson, New South Wales, C.113678; **C,** *Isotriphora amethystina* new name, Two Peoples Bay, Western Australia, C.111419. **D–M,** radulae (*c, l, m* = central, lateral, marginal teeth; scale line F = 10 μm, others = 1 μm): **D,** *Inella obliqua* (May), "Great Australian Bight", 146–220 m, SAM; **E,** *Monophorus angasi* (Crosse & Fischer), off Fluted Cape, Tasmania, AMS; **F,** *Monophorus nigrofusca* (A. Adams), off Fluted Cape, AMS; **G,** *Iniforis malvaceous* Jousseaume, Ouen I., New Caledonia, P. Bouchet, MNHN; **H,** *Iniforis* cf. *violaceus* (Quoy & Gaimard), Marau Sound, Solomon Is, MF.27314; **I,** *Mesophora fusca* (Dunker), Port Hacking, New South Wales, C.111388; **J,** *Mastonia rubra* (Hinds), Lauvie I., Solomon Is, MF. 30830; **K,** *Mesophora negrita* (Laseron), Monéo, New Caledonia, P. Bouchet, MNHN; **L,** *Viriola* cf. *corrugata* (Hinds) (broad, dark, intertidal form), Bowen, Queensland, C.110879; **M,** *Viriolopsis occidua* n.sp., Exmouth, Western Australia, C.110862.

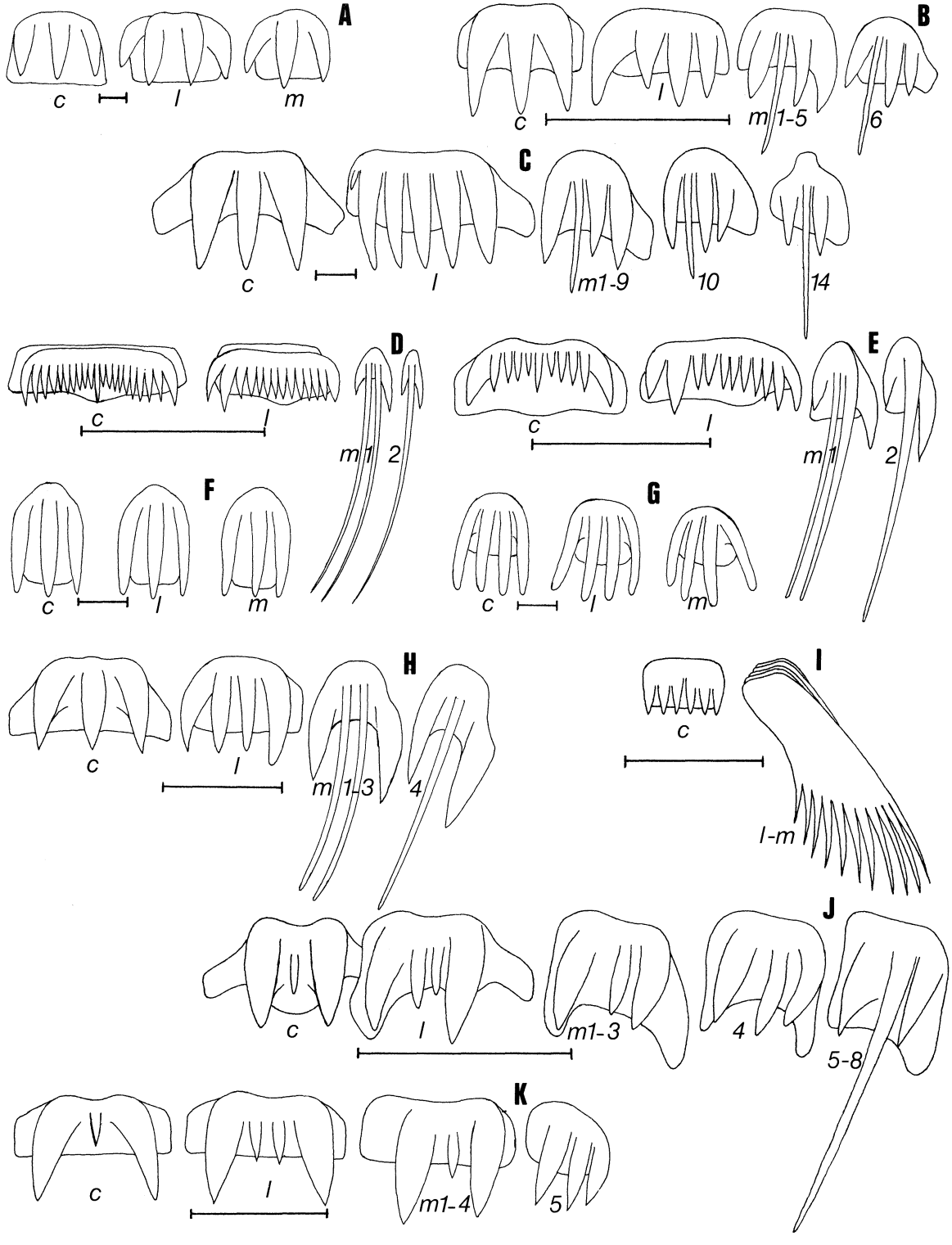


Fig. 5. Radulae (*c, l, m*—central, lateral, marginal teeth; scales B, D, E, I–K = 10 μm, others = 1 μm). **A,** *Euthymella regalis* (Jousseame), Ricaudy Reef, Nouméa. New Caledonia, P. Bouchet, MNHN; **B,***Eutriphora cana* (Verco), Gulf St.Vincent, South Australia, D.16363; **C,** *Eutriphora armillata* (Verco), Gulf St. Vincent, D.16364; **D,** *Bouchetriphora aspergata*, Wilson I., Queensland, C.134642; **E,** *Bouchetriphora marrowi* n.sp., Long Reef, New South Wales, M.P. Marrow; **F,** *Isotriphora tasmanica* (T. Woods), off Cronulla, New South Wales, 24 m, C.116206; **G,** *Isotriphora amethystina* new name, Two Peoples Bay, Western Australia, C.111419; **H,** *Nototriphora aupouria* (Powell), Leigh, New Zealand, M.72078; **I,** *Nanaphora albogemmata* (Laseron), Mangalia Reef, New Caledonia, P. Bouchet, MNHN; **J,** *Aclophoropsis univitta* (Laseron), Port Jackson, New South Wales, C.113678; **K,** *Aclophoropsis festiva* (A. Adams), off Edithberg, South Australia, 9 m, C.111425.

[At the request of the author the following figures were reprinted with lighter inking soon after publication. In this PDF the original figures are not given—Sub-Editor, May, 2009]

RECORDS OF THE AUSTRALIAN MUSEUM

Triphoridae of Southern Australia

B.A. MARSHALL

SUPPLEMENT 2 FIGS 6-33 (inclusive) 15 DECEMBER 1983

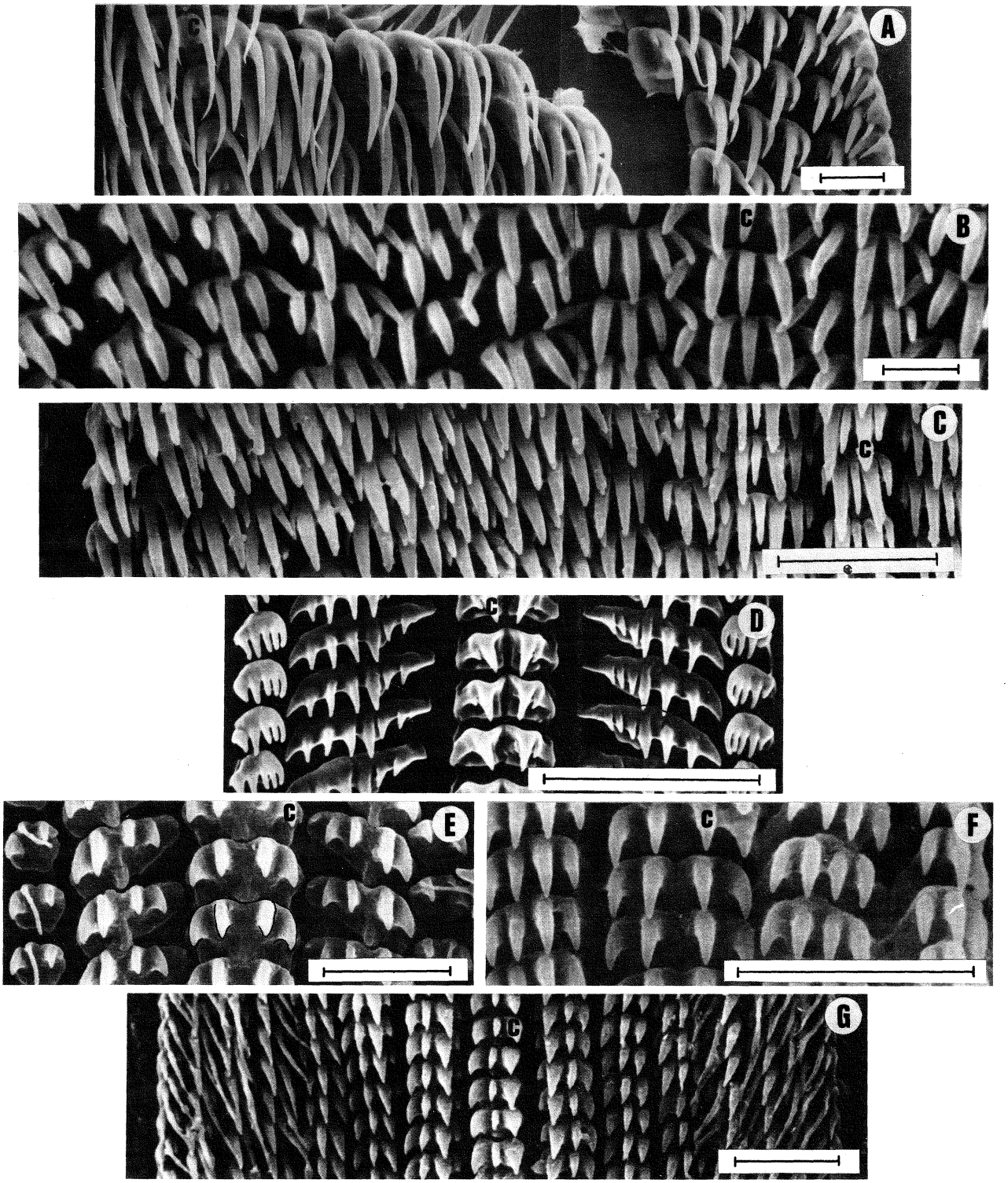


Fig. 6. Radulae (scale line B = 1 μm, others = 10 μm). **A,** *Seilarex verconis* Cotton, "South Australia", Verco Coll., SAM; **B,** *Subulophora rutilans* (Hervier), Moyotte, Mozambique Channel, 23–35 m, MNHN; **C,** *Monophorus fascelina* (Suter), off Nugget Point, New Zealand, 140 m, M.65985; **D,** *Sagenotriphora ampulla* (Hedley), Port Phillip Heads, Victoria, MF. 34173; **E,** *Tetraphora granifera* (Brazier), off Fluted Cape, Tasmania, AMS; **F,** *Tetraphora iniqua* (Jousseaume), Maitre I. Channel, off Nouméa, New Caledonia, 24 m, MNHN; **G,** *Hedleytriphora fasciata* (T. Woods), off Fluted Cape, Tasmania, AMS.

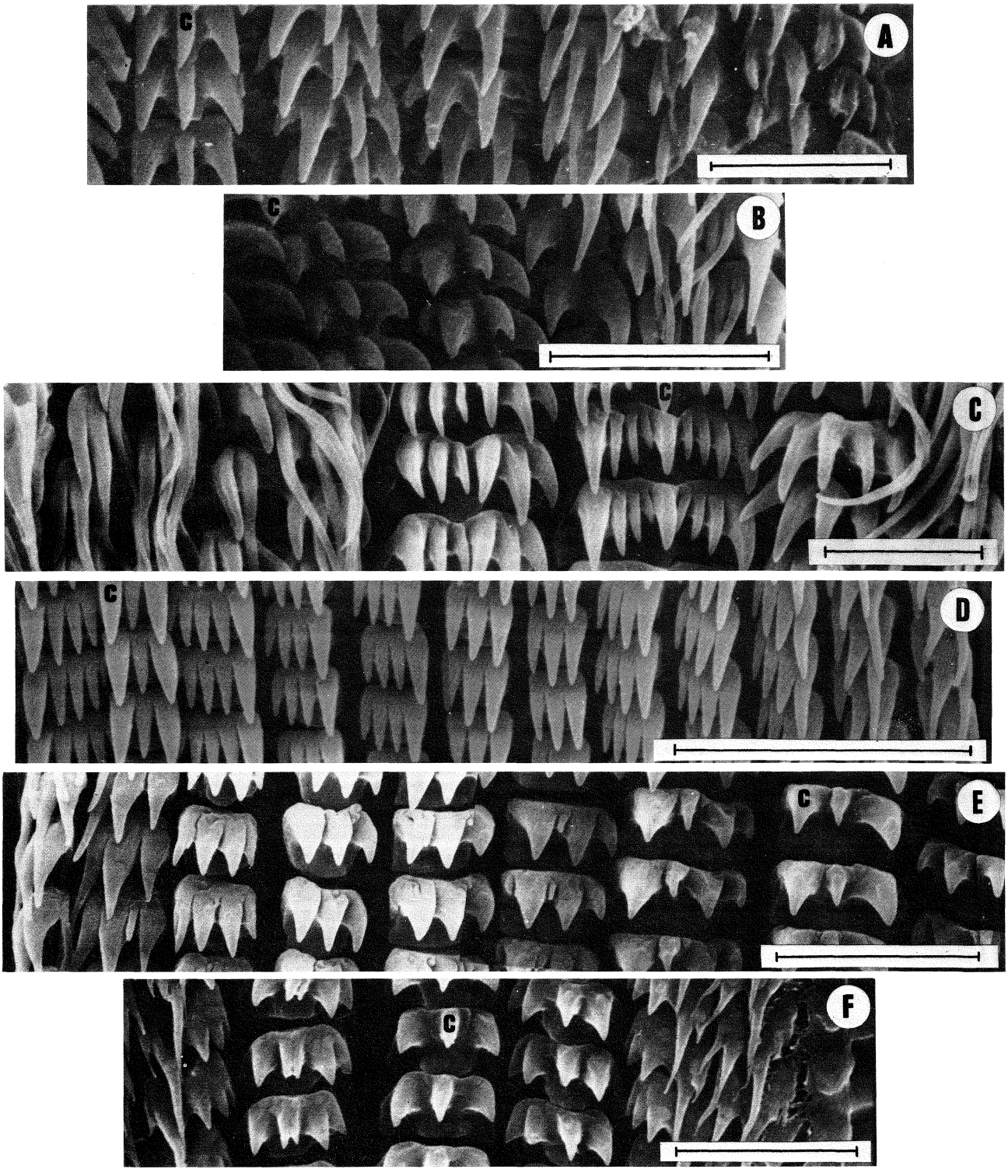


Fig. 7. Radulae (scale lines = 10 μm). **A,** *Hedleytriphora innotabilis* (Hedley), Long Reef, New South Wales, C.116222; **B,** *Hedleytriphora basimacula* n.sp., Knobs Bluff, South Australia, C.113408; **C,** *Bouchetriphora pallida* (Pease), Leigh, New Zealand, M.72077; **D,** *Triphora taeniolata* Hervier, Ouen I., New Caledonia, P. Bouchet, MNHN; **E,** *Triphora nivea* (Verco), Backstairs Passage, South Australia, 37 m, D.16365; **F,** *Obesula mamillata* (Verco), Port Arlington, Victoria, M.P. Marrow, MF.34175.

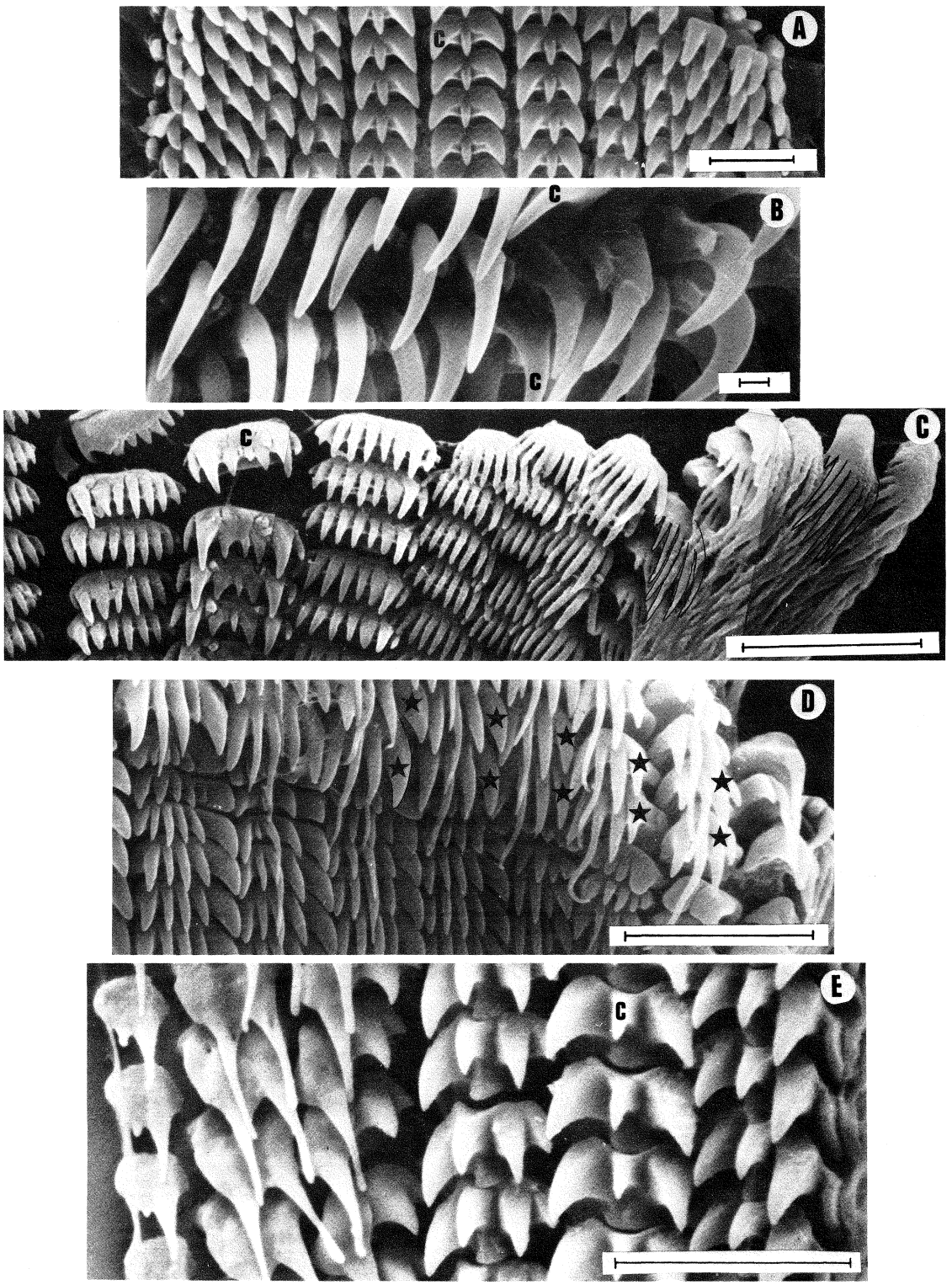


Fig. 8. Radulae (scale line B = 1 μm, others = 10 μm). **A,** *Aclophora hedleyi* n.sp., Wyadup, Western Australia, C.111416; **B,** *Aclophora xystica* (Jousseaume), Wilson I., Queensland, C.132708 (marginals); **C,** *Cheirodonta labiata* (A. Adams), Jervis Bay, New South Wales, M.P. Marrow; **D,** *Eutriphora cana* (Verco), marginal teeth showing normal (*) and abnormal teeth—note that 'program error' has been transmitted across the transverse rows as well as along them. **E,** *Obesula Obesula* (Jousseaume), Croissant Reef, off Nouméa, New Caledonia, low tide, P.H. Colman.

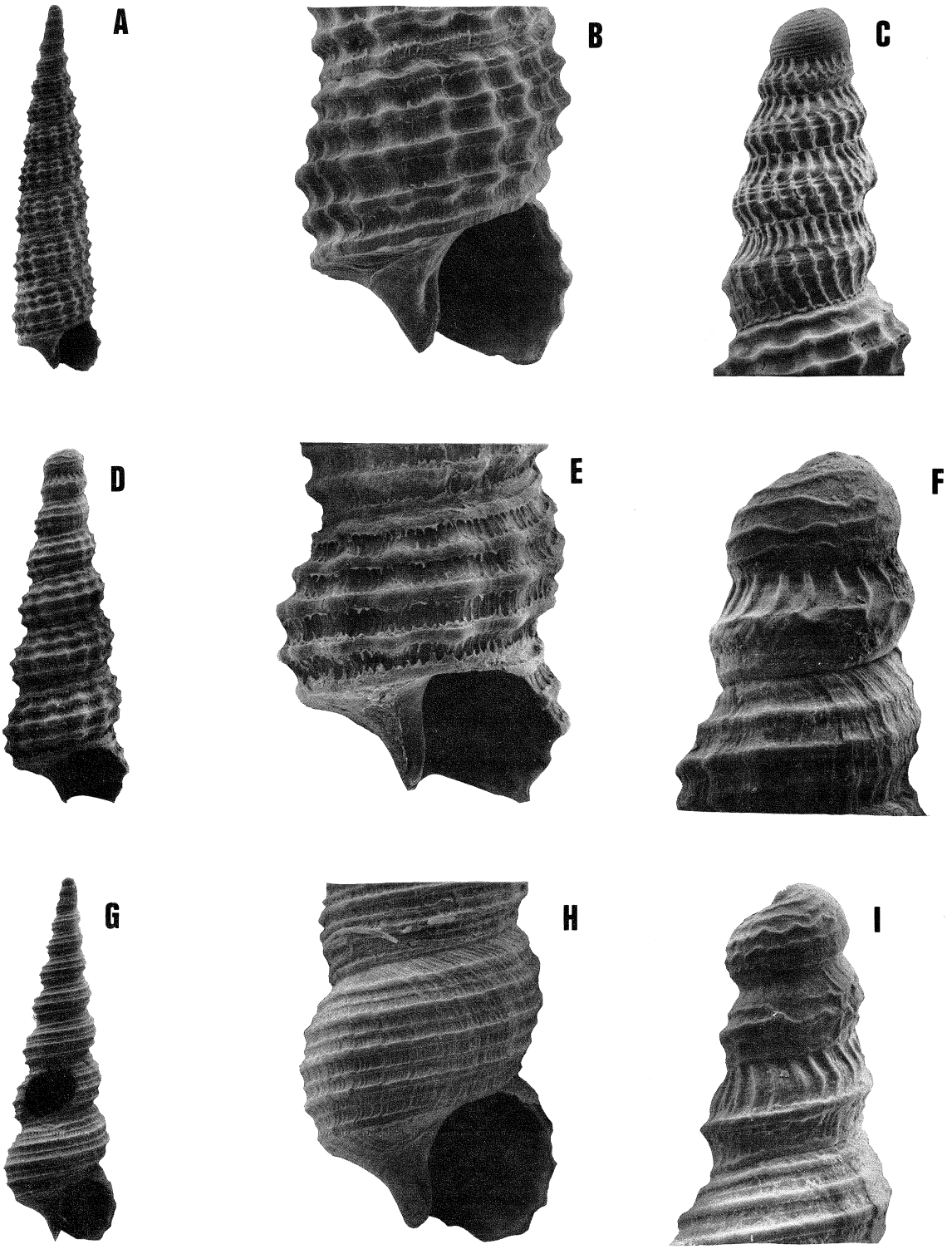


Fig. 9. **A–C,** *Metaxia fuscoapicata* Thiele: **A, B,** Carnac I., off Fremantle, Western Australia, C.123447 (4.10 x 0.90 mm). **C,** Point Quobba, Western Australia, C.123441. **D–F,** *Metaxia protolineata* (Laseron), off Cape Borda, South Australia, 101 m, D.16245 (2.55 x 0.85 mm). **G–I,** *Seilarex turritelliformis* (Angas): **G,** Facing I., Queensland, C.123407 (5.55 x 1.60 mm); **H,** Twofold Bay, New South Wales, C.7787. **I,** off Lakes Entrance, Victoria, 37–46 m, C.123409.

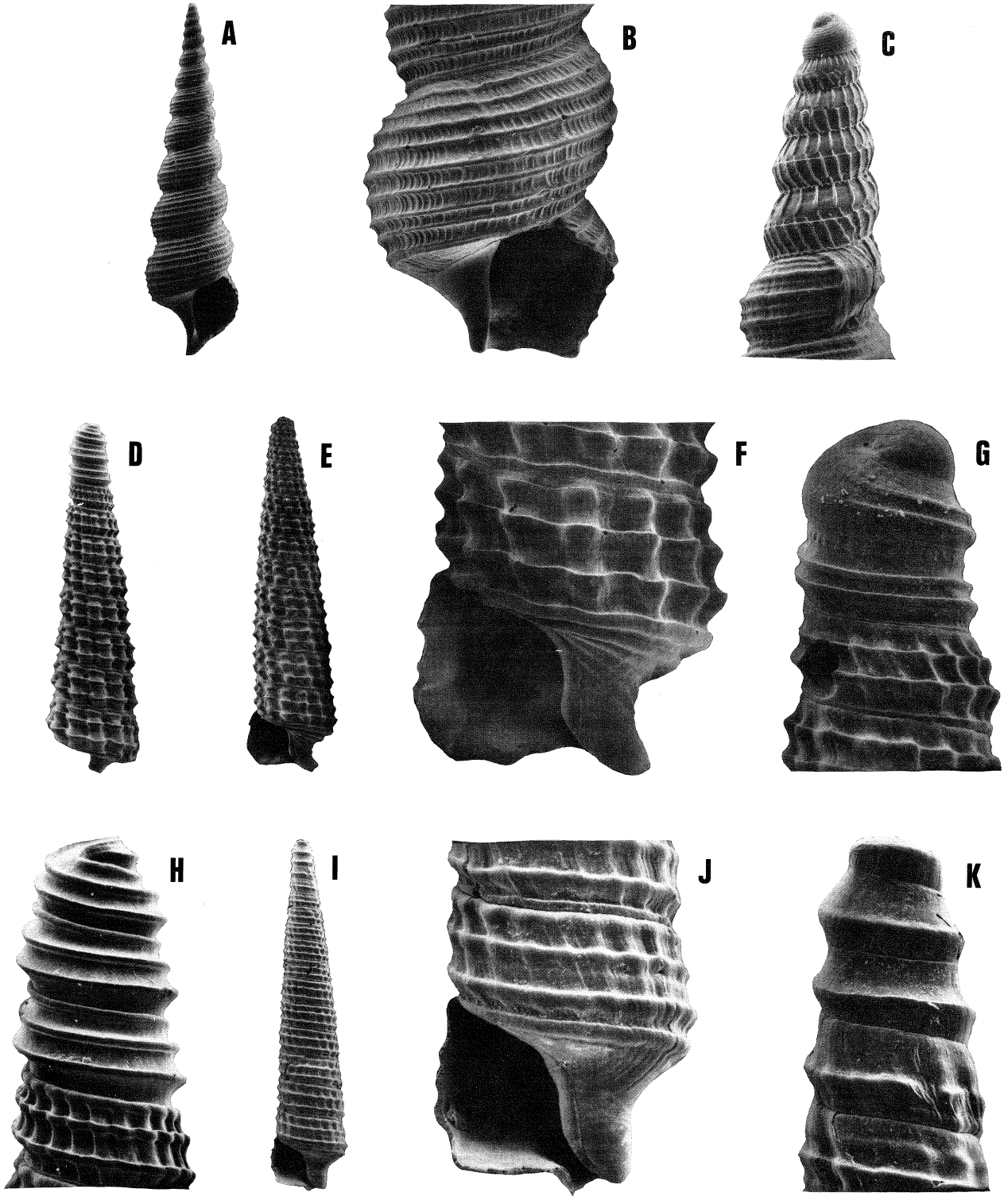


Fig.10. **A–C,** *Seilarex verconis* Cotton, off Eucla, Western Australia, 79–140 mm, C.123408 (5.05 x 1.30 mm). **D–H,** *Inella* cf. *gigas* (Hinds), off Point Charles, Darwin, Northern Territory, 15–17 m, C.132699 (5.00 x 1.45 mm); **E–G,** *Inella obliqua* (May): **E, F,** off Salisbury I., Western Australia, 123–125 m, C.116177 (11.5 x 2.70 mm); **G,** off Schouten I., Tasmania, 146 m, C.39503. **I–K,** *Inella spina* (Verco), off Beachport, South Australia, 201 m, D.15964 (7.35 x 1.50 mm).

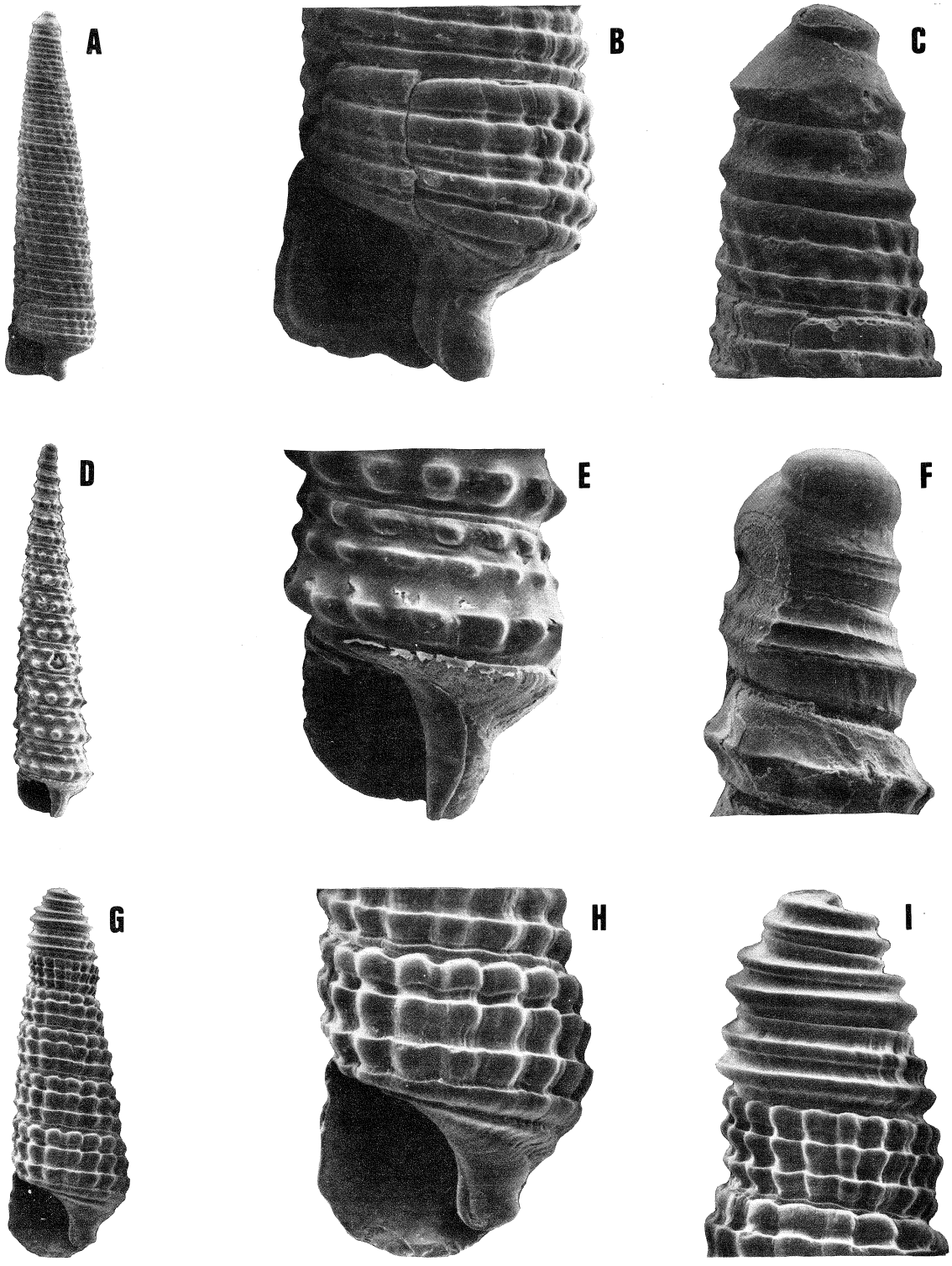


Fig. 11. **A–C,** *Inella obtusa* n.sp., holotype, off Sydney, New South Wales, 53 m, C.116240 (7.00 x 1.60 mm). **D–F,** *Inella kimblae* n.sp., holotype, off Sydney, New South Wales, 384 m, C.130014 (8.00 x 1.70 mm). **G–I,** *Inella carinata* n.sp., holotype, Gulf St. Vincent, South Australia, 26 m, D.16239 (3.90 x 1.25 mm).

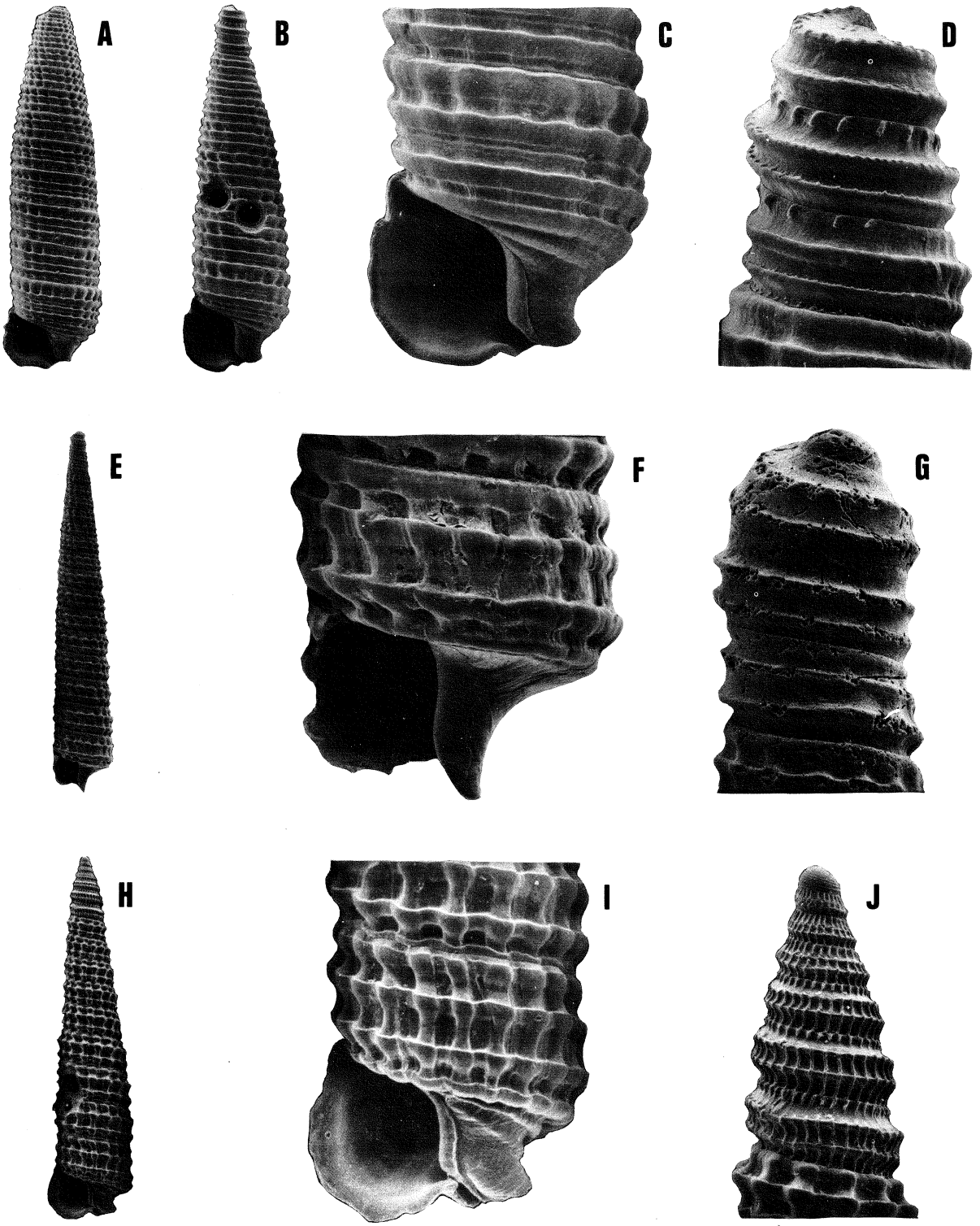


Fig. 12. **A–D,** *Inella intercalaris* n.sp: **A,** paratype, Gulf St. Vincent, South Australia, 46 m, D.16308 (8.50 x 2.10 mm); **B–D,** holotype, off Eucla, Western Australia, 148 m, D.16240 (5.00 x 1.40 mm). **E–G,** *Hypotriphora subula* (Verco): **E, F,** off Point Brown, South Australia, 40 m, M.P. Marrow coll. (10.5 x 1.65 mm); **G,** off Cape Borda, South Australia, 101 m, D.16309. **H–J,** *Subulophora rutilans* (Hervier), off Euston Reef, Queensland, 21 m, C.132700 (4.20 x 1.00 mm).

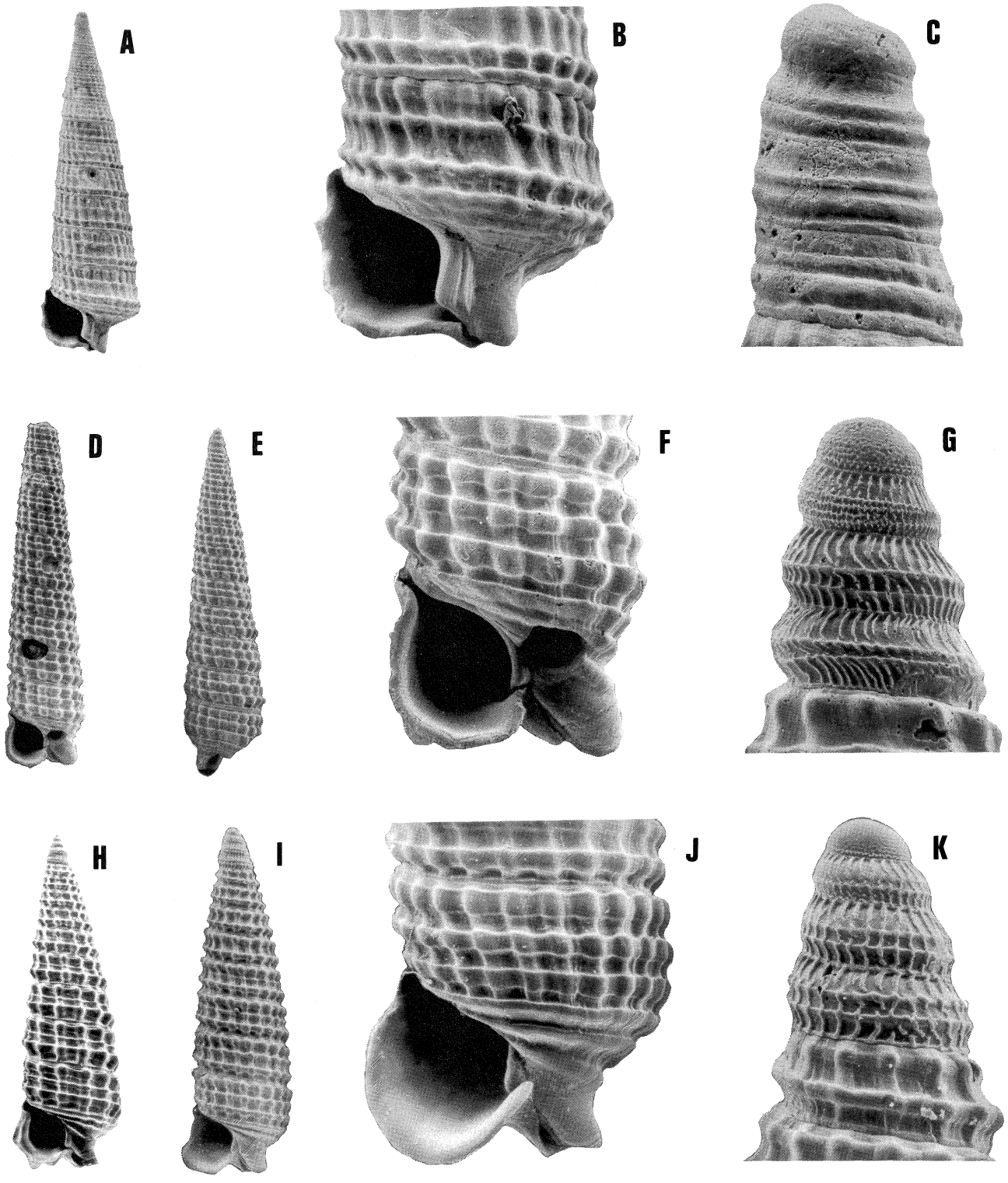


Fig. 13. **A–C,** *Magnosinister hedleyi* Laseron, off Sydney, New South Wales, 37–40 m, C.116243 (14.0 x 4.10 mm). **D–G,** *Monophorus australica* n.sp., off Neptune I., South Australia, 190 m; **D, F,** paratype, D.16252 (7.90 x 1.85 mm); **E, G,** holotype, D.16241 (7.05 x 1.65 mm). **H,** *Monophorus fascelina* (Suter), off Three Kings Is, New Zealand, 102 m, M.33114. (5.20 x 1.60 mm). **I–K,** *Monophorus angasi* (Crosse & Fischer): **I, K,** off Eucla, Western Australia, 75 m, C.116160 (3.30 x 1.00 mm); **J,** off Twofold Bay, New South Wales, 18 m, C.65956.

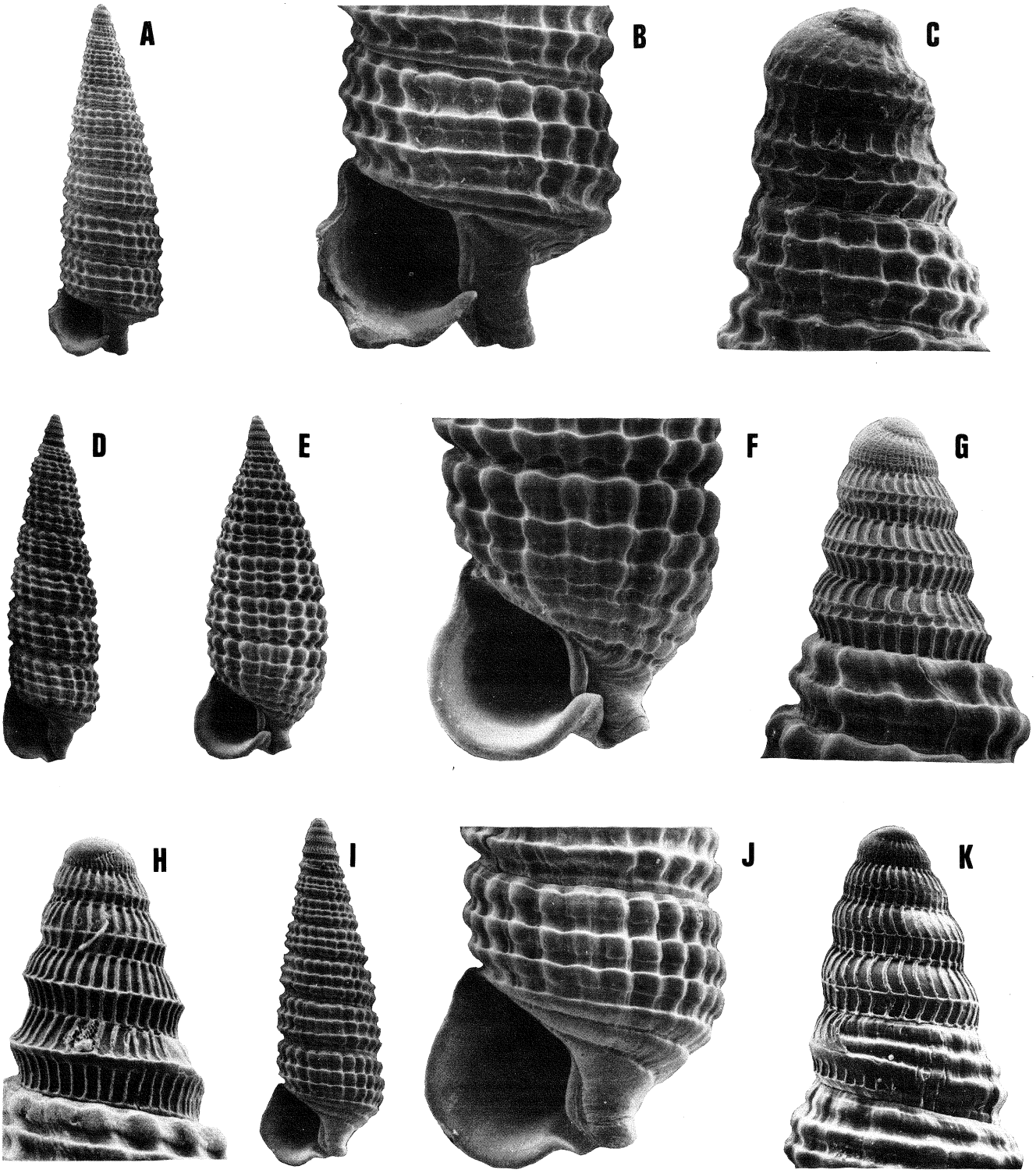


Fig. 14. **A–C,** *Monophorus nigrofusca* (A. Adams): **A, B,**Crookhaven Heads, New South Wales, C.113741 (8.40 × 2.60 mm). **C,** Balmoral, Sydney, New South Wales, C.13521. **D, H,** *Tetraphora mapoonensis* Laseron, Cape York Peninsula, Queensland, C.110708 (5.00 × 1.40 mm). **E–G,** *Sagenotriphora ampulla* (Hedley), Port Phillip Heads, Victoria, MF.34173 (4.80 × 1.75 mm). **I–K,** *Tetraphora granifera* (Brazier): **J,** Sydney Harbour, New South Wales, C.32586, (3.75 × 1.30 mm); **K,** Kangaroo I., South Australia, 18 m, C.132701.

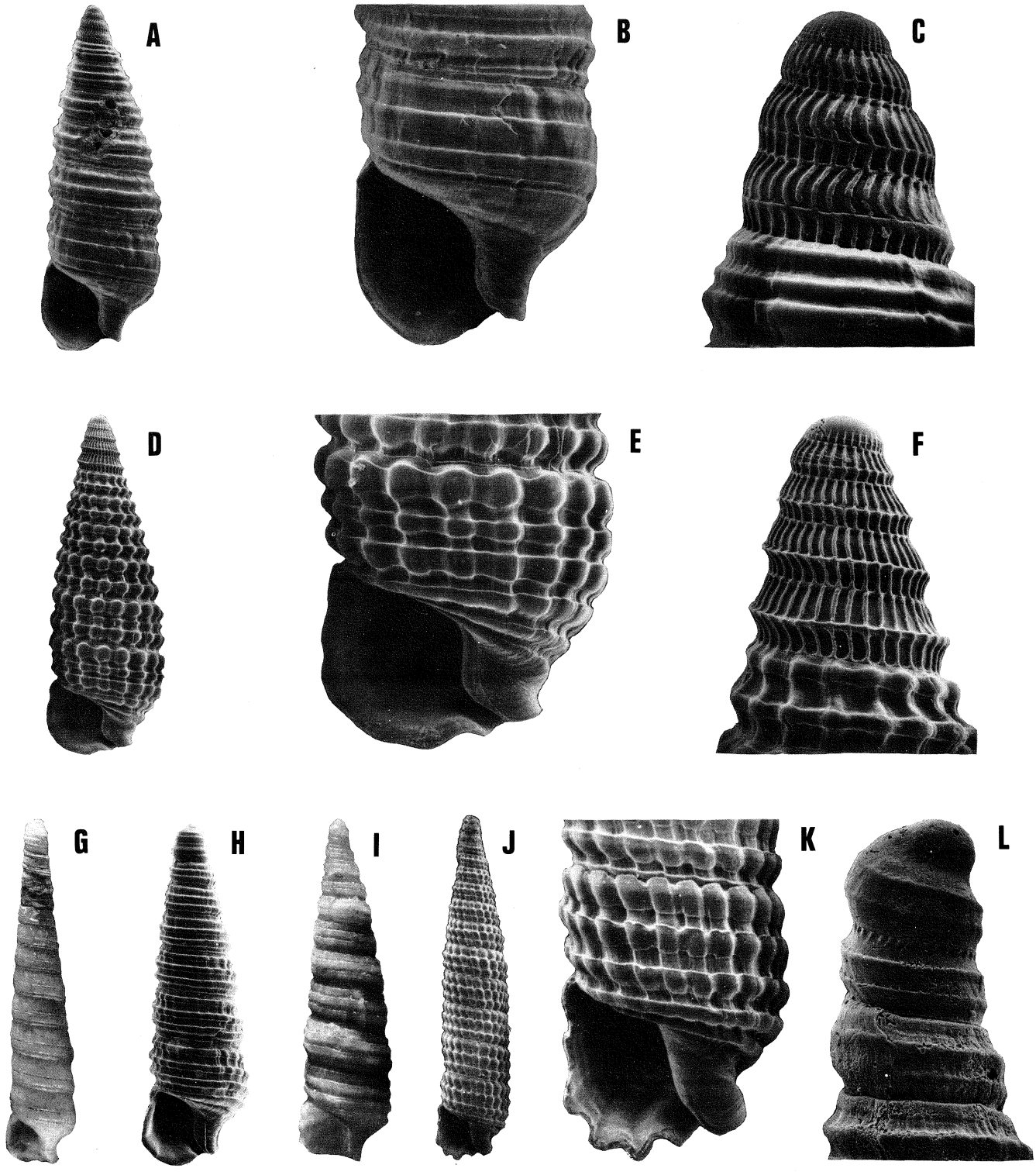


Fig. 15. **A–C,** *Tetraphora mcgilpi* (Cotton), Glenelg, South Australia, C.116189 (3.10 × 1.00 mm); **D–F,** *Tetraphora iniqua* (Jousseaume), Mangalia Reef, New Caledonia, P. Bouchet, MNHN (2.60 × 0.90 mm); **G,** *Sychar vitreus* (Hinds), holotype, Malacca Straits, BMNH (10.0 × 2.10 mm); **H,** *Teretriphora huttoni* (Suter), Stewart I., New Zealand, M.20027 (3.50 × 1.20 mm); **I,** *Teretriphora gemmegens* (Verco), holotype, off Beachport, South Australia, 73 m, D.13451 (7.20 × 2.00 mm); **J–L,** *Teretriphora distorta* (Laseron): **J, K,** Great Barrier Reef, off Cairns, Queensland, C.46206 (6.00 × 1.35 mm); **L,** Michaelmas Cay, Queensland, C.64420.

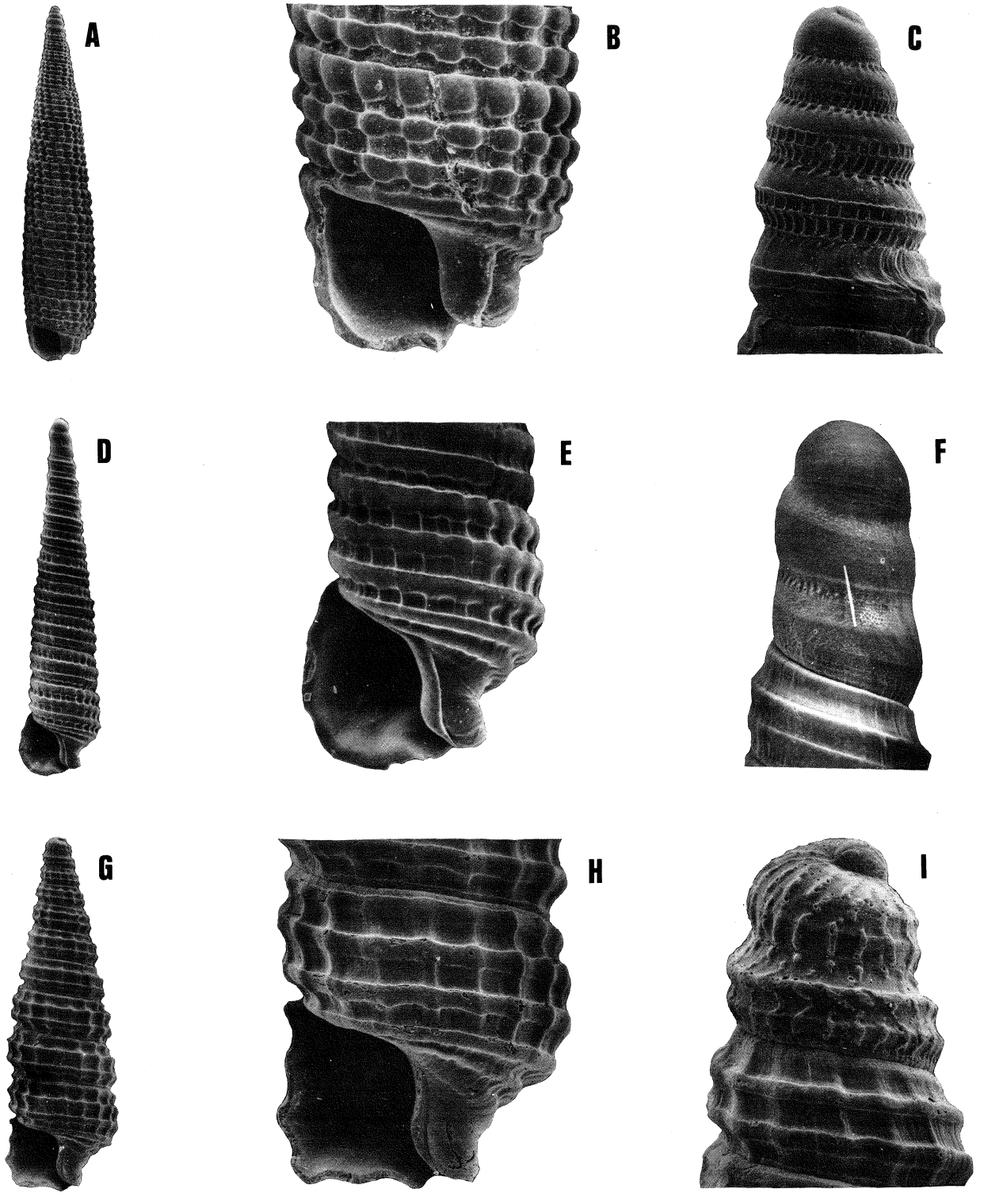


Fig. 16. **A–C,** *Teretriphora spica* (Verco), off Cape Borda, South Australia, 101 m, D.16311 (7.60 × 1.50 mm). **D–F,** *Teretriphora ponderorum* n.sp., holotype, off Peppermint Grove Beach, Western Australia, 4.6–7.6 m, C.130023 (4.70 × 1.10 mm). **G–I,** *Teretriphora novapostrema* (Verco), off Neptune I., South Australia, 190 m, D.16312 (4.20 × 1.25 mm).

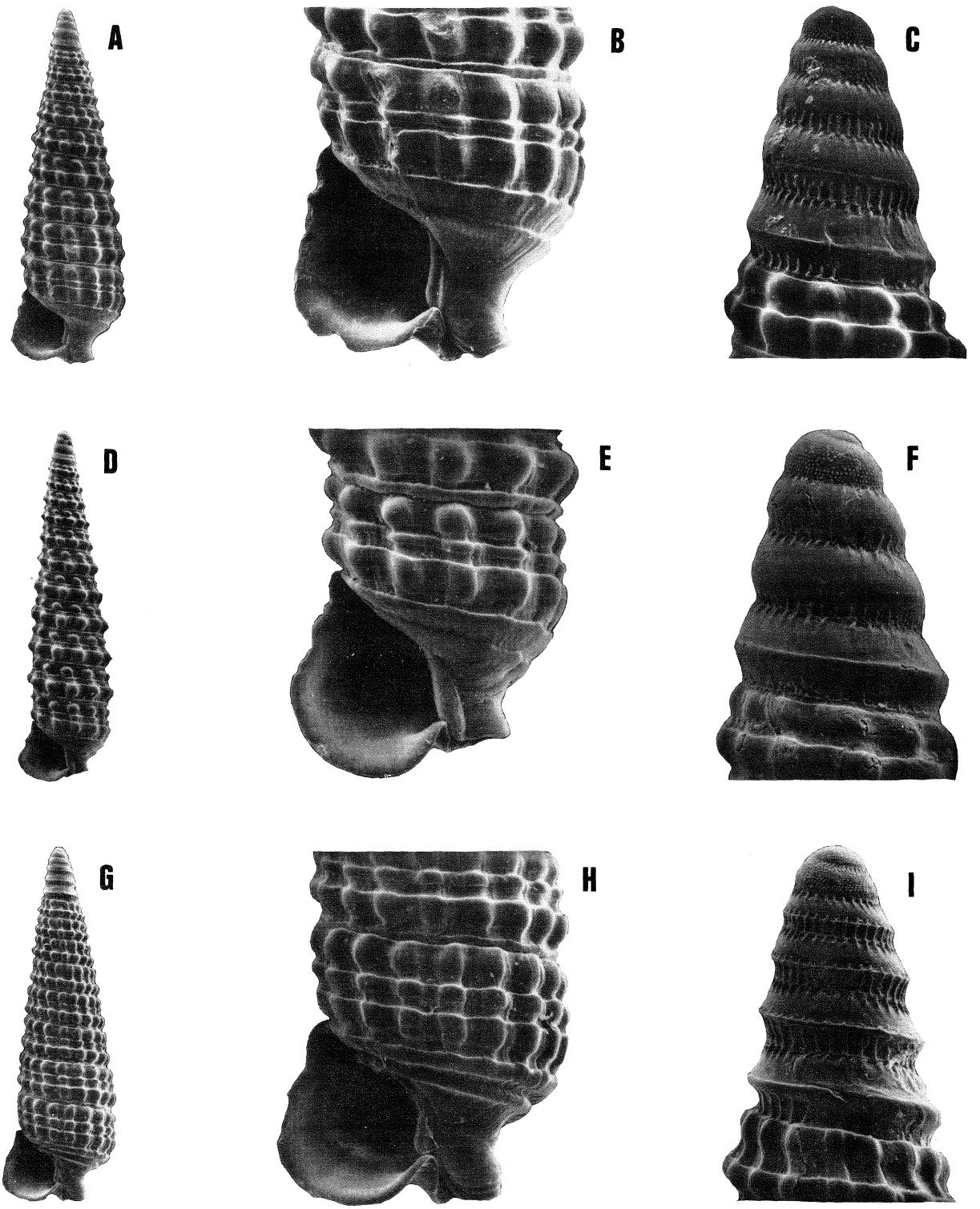


Fig. 17. **A–C,** *Hedleytriphora fasciata* (T. Woods), off Lakes Entrance, Victoria, 37–46 m, C.113424 (5.20 × 1.55 mm). **D–F,** *Hedleytriphora scitula* (A. Adams): **D, E,** Gulf St. Vincent, South Australia, C.113410 (4.95 × 1.20 mm); **F,** off Kangaroo I., South Australia, 18 m, C.132702. **G–I,** *Hedleytriphora innotabilis* (Hedley), Port Hacking, New South Wales, C.132703 (4.00 × 1.25 mm).

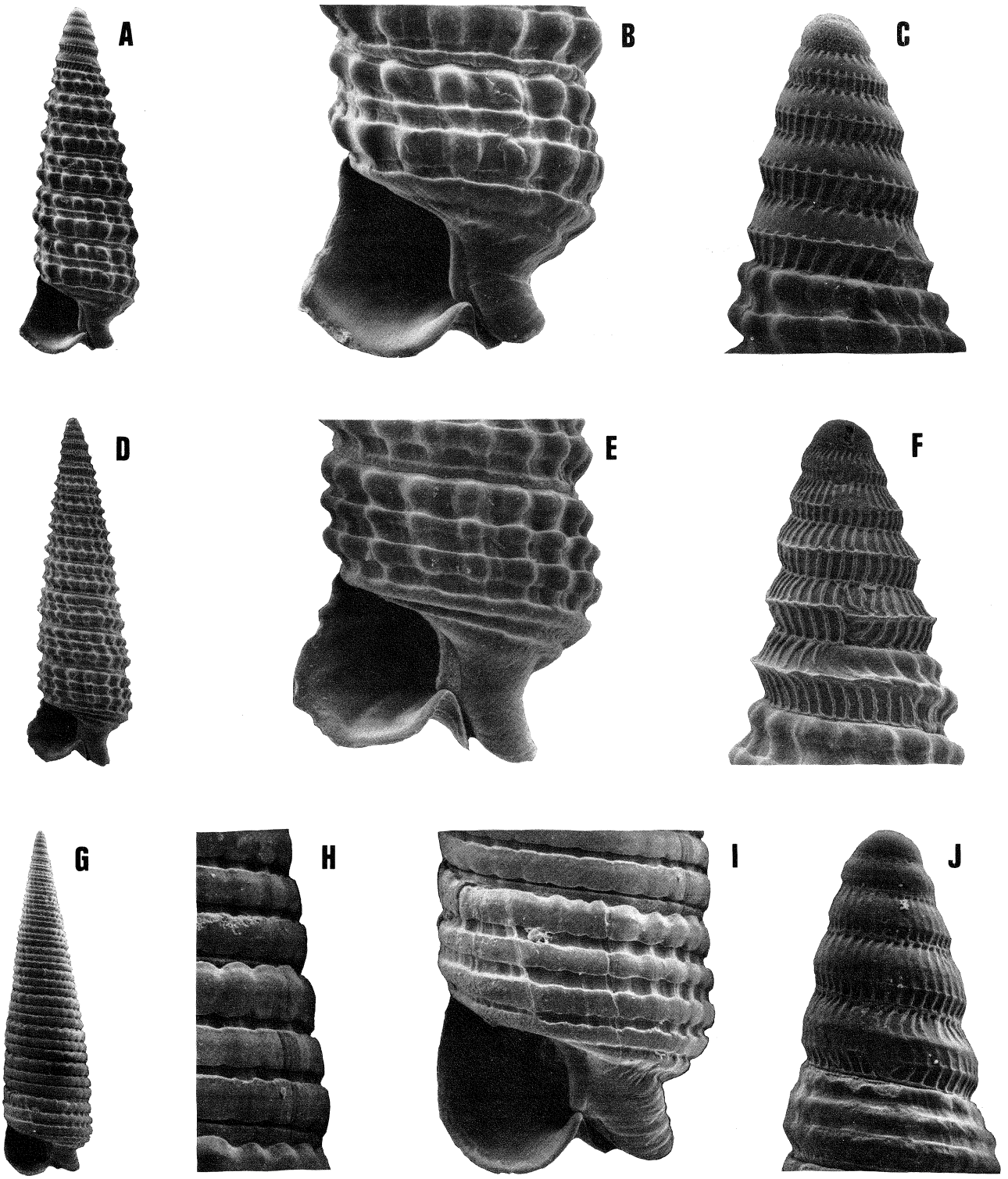


Fig. 18. **A–C,** *Hedleytriphora basimacula* n.sp., holotype, Dunsborough, Western Australia, C.113388 (2.90 × 0.90 mm). **D–F,** *Hedleytriphora elata* (Thiele), off Eucla, Western Australia, 148 m, D.16254 (3.90 × 1.15 mm). **G–J,** *Latitriphora latilirata* (Verco), off Eucla, Western Australia, 75 m, C.116164, (8.90 × 2.25 mm).

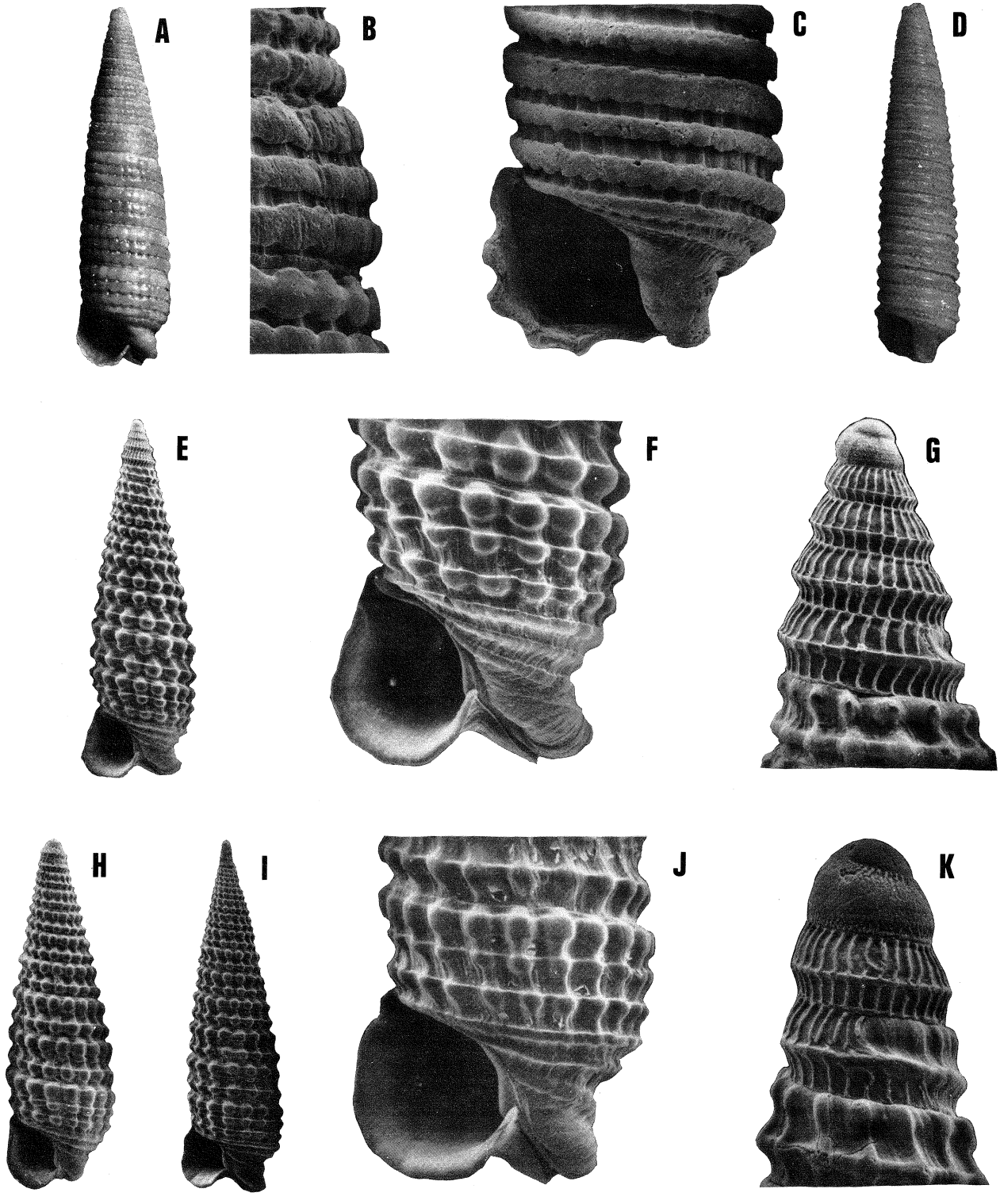


Fig. 19. **A,B,** *Latitriphora conferta* (Laseron): **A,** holotype, Angourie, New South Wales, C.103108 (9.20 × 2.50 mm); **B,** Shelley Beach, near Angourie, M.P. Marrow coll. **C, D,** *Latitriphora kesteveni* (Hedley): **C,** holotype, Sydney, New South Wales, C.13505 (6.70 × 1.65 mm); **D,** Sydney, C.21231. **E–G,** *Mesophora granosa* (Pease), off Euston Reef, Queensland, 21 m, C.132704 (3.40 × 1.10 mm). **H,** *Mesophora negrita* (Laseron), Masthead Reef, Queensland, C.64429 (4.40 × 1.55 mm). **I–K,** *Mesophora fusca* (Dunker): **I,** Proserpine, Queensland, C.110786 (9.70 × 2.85 mm); **J, K,** Hervey Bay, Queensland, C.110796.

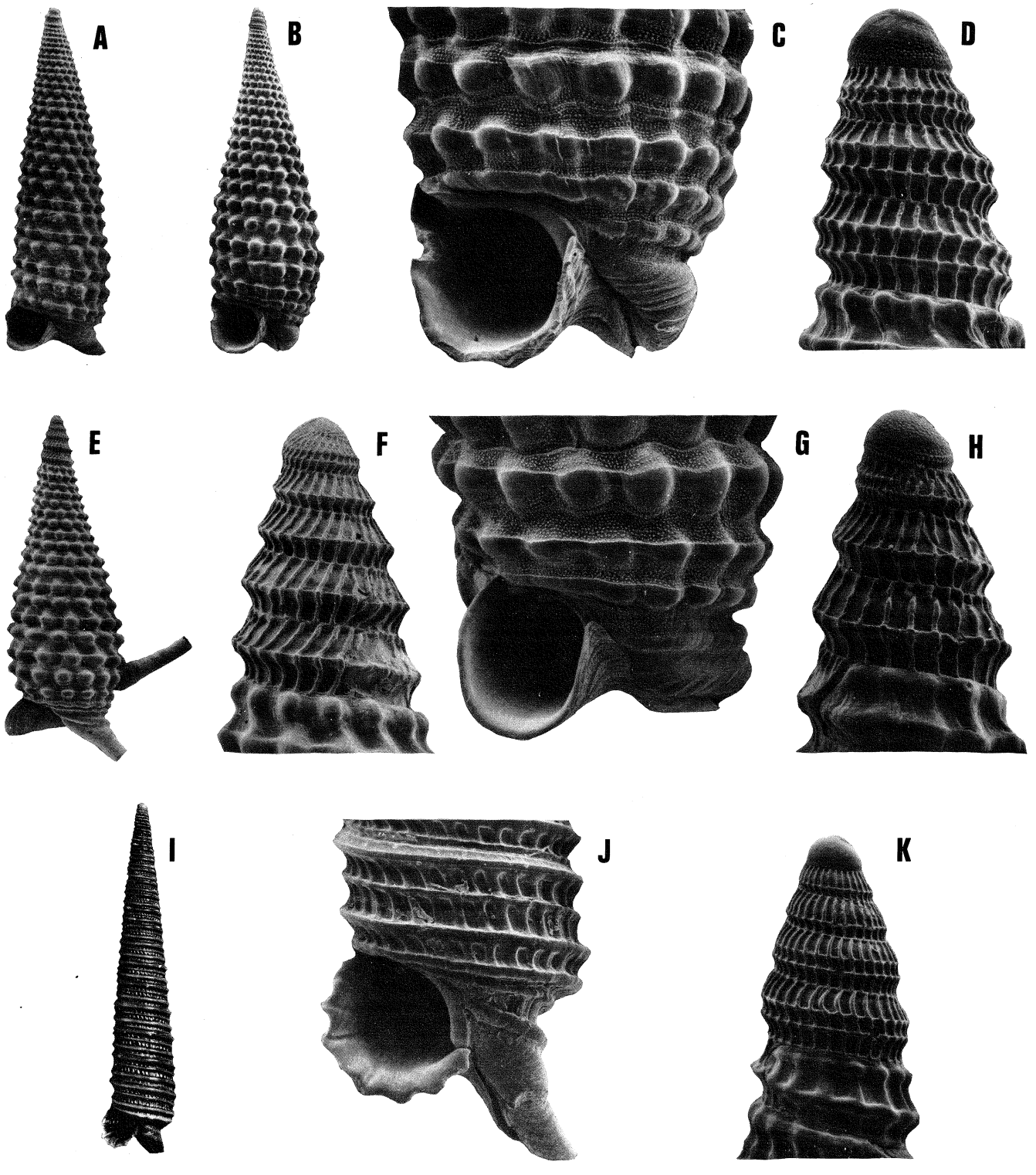


Fig. 20. **A,** *Iniforis malvaceous* (Jousseaume), Prony Bay, New Caledonia, P. Bouchet, MNHN (7.25 × 2.15 mm). **B–D,** *Mastonia rubra* (Hinds), Marau Sound, Solomon Is, MF.30830 (5.30 × 2.30 mm). **E, F,** *Mastoniaeforis* cf. *chaperi* Jousseaume, off Euston Reef, Queensland, 21 m, C.132705 (3.90 × 2.10 mm), **G,H,** *Iniforis* cf. *violaceus* (Quoy & Gaimard), Marau Sound, Solomon Is, MF.27314 (4.50 × 1.45 mm). **I–K,** *Viriola* cf. *corrugata* (Hinds): **I,** Bowen, Queensland, C.64185 (16.7 × 3.70 mm); **J,** off Melville I., Northern Territory, C.110875; **K,** off Point Charles, Darwin, Northern Territory, 15–17 m, C.132706.

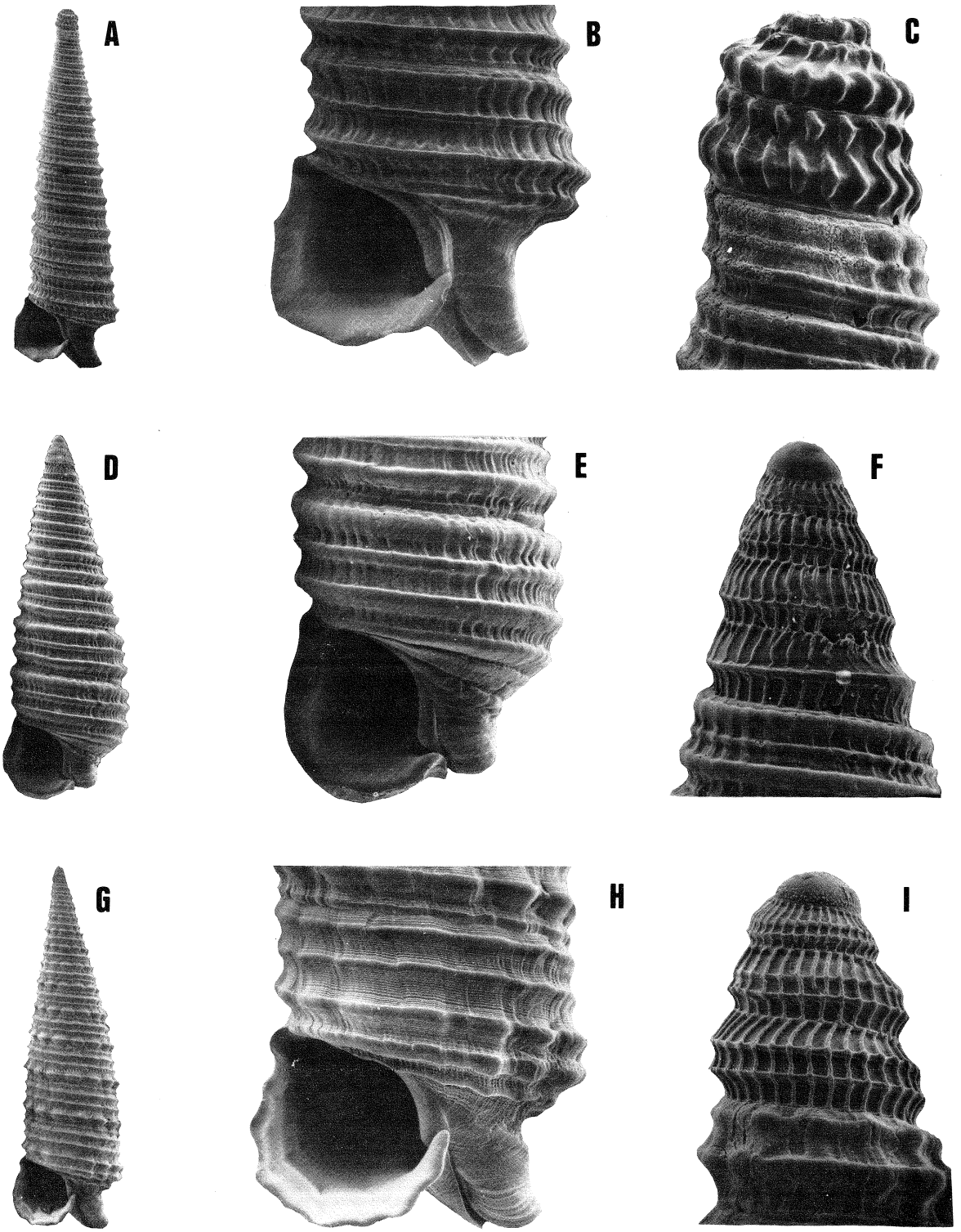


Fig. 21. **A–C,** *Viriola truncata* n.sp., holotype, Port Hedland, Western Australia, C.130019 (10.3 × 2.90 mm). **D–F,** *Viriolopsis occidua* n.sp., holotype, off Carnac I., Western Australia, 4–8 m, C.130018 (4.05 × 1.40 mm). **G–I,** *Euthymella elegans,* Papeete, Tahiti, H. & J. Trondle, MF.34174 (9.00 × 2.70 mm).

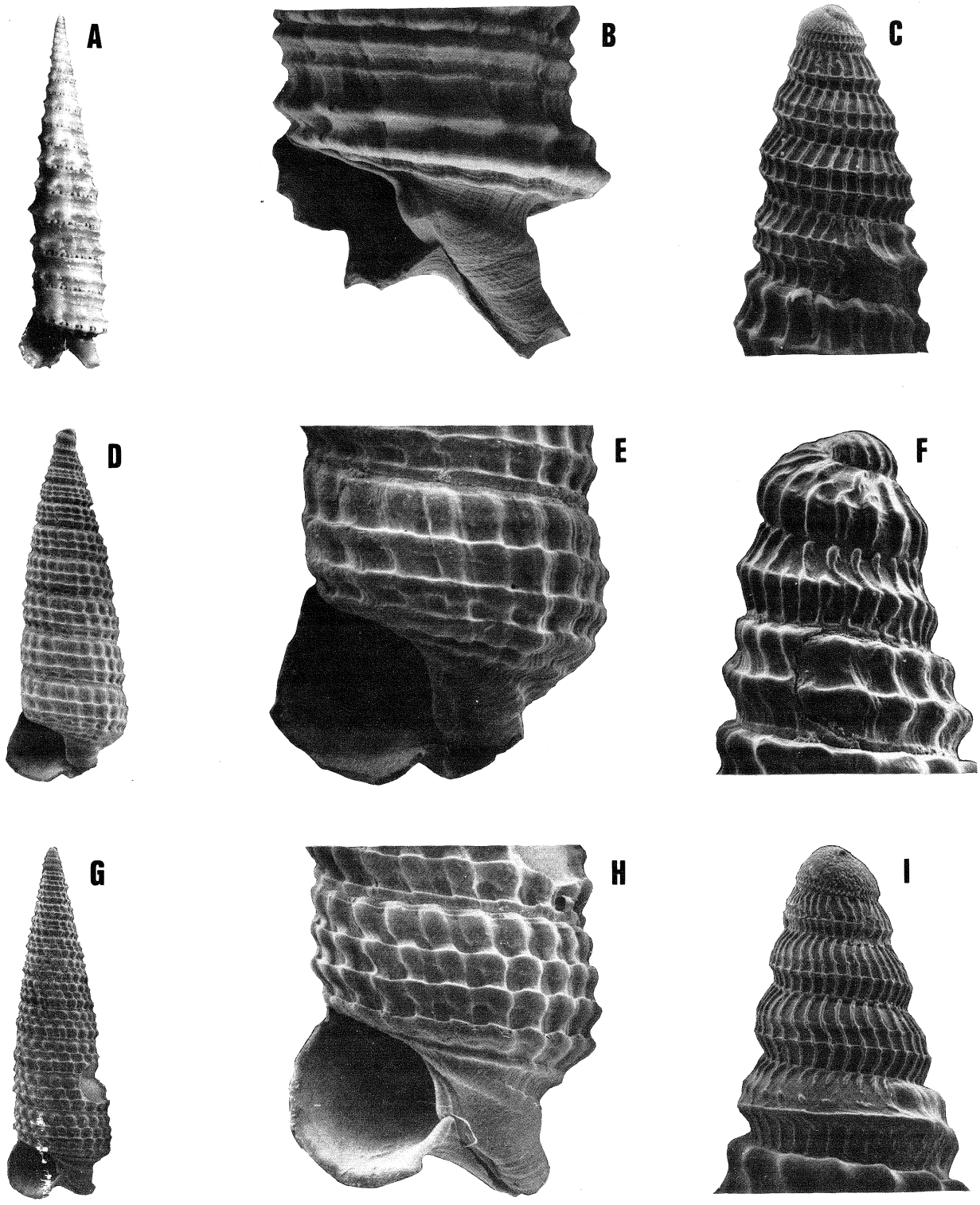


Fig. 22. **A–C,** *Euthymella kosugei* n.sp.: **A,** holotype, off Malaita I., Solomon Is, 3–7.5 m, C.110711 (16.0 × 3.85 mm); **B,** paratype, Geyser Bank, Comoro Is, Mozambique Channel, MNHN; **C,** paratype, Madang Harbour, New Guinea, C.110853. **D–F,** *Eutriphora cana* (Verco): **D, E,** Gulf St. Vincent, South Australia, D.16363 (7.75 × 2.45 mm); **F,** off Cape Borda, South Australia, 101 m, D.15881. **G–I,** *Eutriphora armillata* (Verco): **G, H,** off Eucla, Western Australia, 132 m, D.16313 (7.55 × 2.10 mm); **I,** off Eucla, 148 m, D.16314.

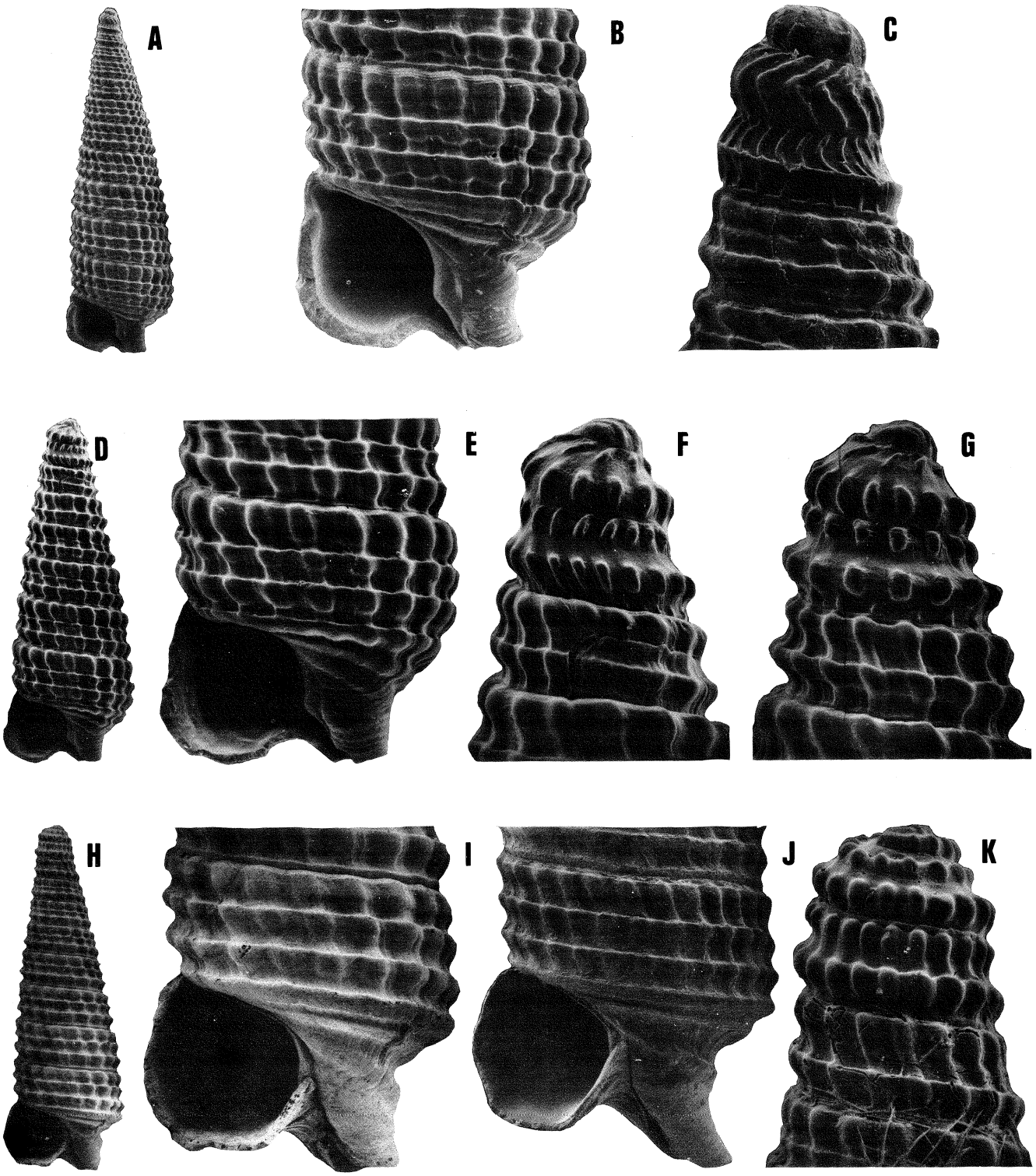


Fig. 23. **A–C,** *Eutriphora tricolor* (Laseron), off Deal I., Tasmania, 6–15 m, C.113463 (7.50 × 2.30 mm). **D–G,** *Eutriphora pseudocana* n.sp.: **D–F,** holotype off Cape Carnot, South Australia, 150–178 m, C.130021 (3.10 × 1.15 mm); **G,** paratype, off Cape Borda, South Australia, 101 m, D.16315. **H–K,** *Isotriphora tasmanica* (T. Woods): **H,I,K,** off Cape Wiles, South Australia, C.113668 (5.60 × 1.80 mm); **J,** *echina* form, off Little Bay, Sydney, New South Wales, 183–192 m, C.116242.

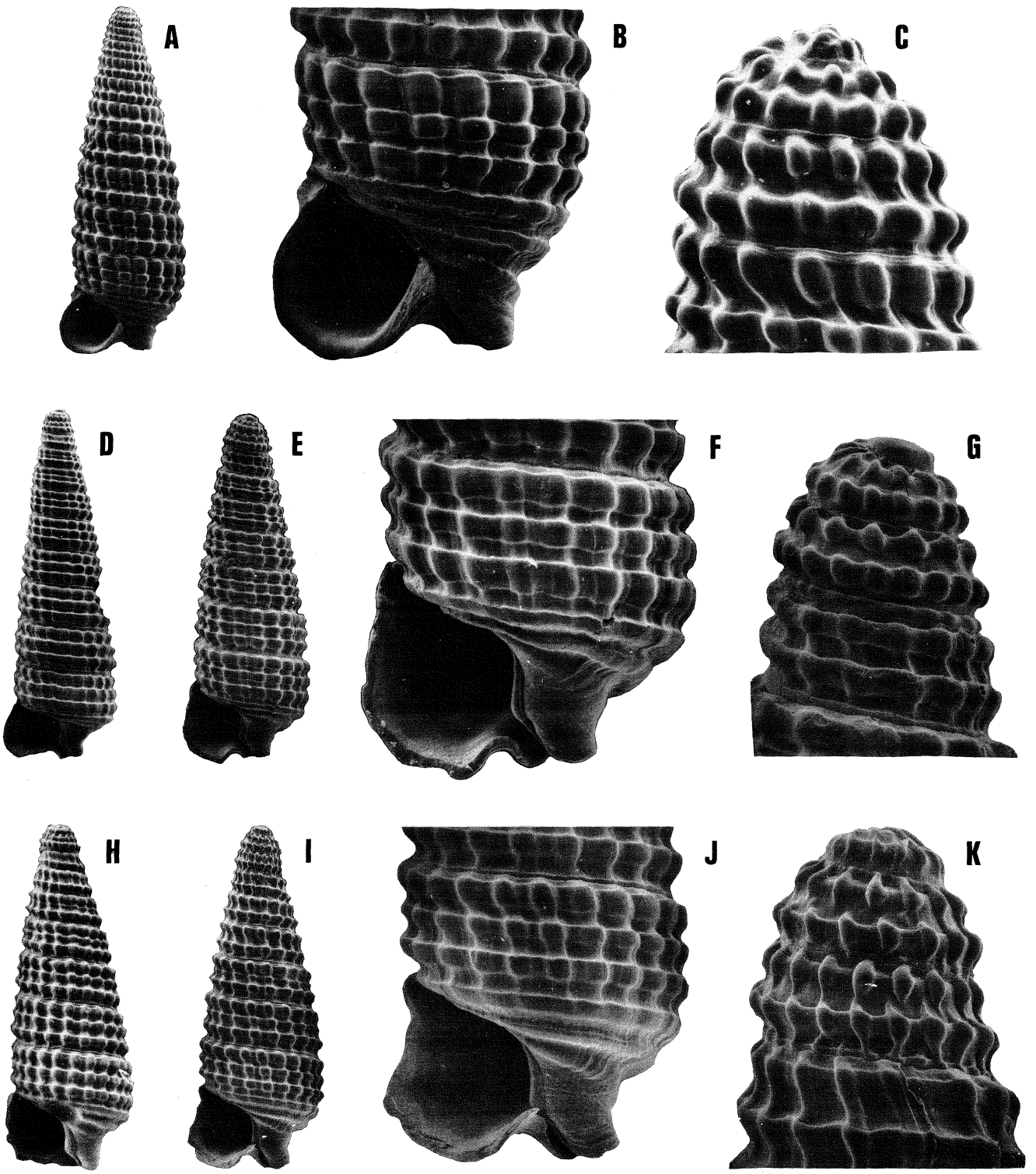


Fig. 24. **A–C,** *Isotriphora amethystina* new name, Two Peoples Bay, Western Australia, C.111419 (5.80 × 2.05 mm). **D–G,** *Isotriphora disjuncta* (Verco): **D,** off Cape Wiles, South Australia, 183 m, C.31899 (6.10 × 1.90 mm); **E–G,** off Cape Borda, South Australia, 101 m, D.16384 (4.60 × 1.60 mm). **H,** *Isotriphora* cf. *simulata* n.sp., Sydney, New South Wales, C.113345 (3.60 × 1.30 mm). **I–K,** *Isotriphora simulata* n.sp., holotype, off Cape Borda, 101 m, D.16243 (3.65 × 1.40 mm).

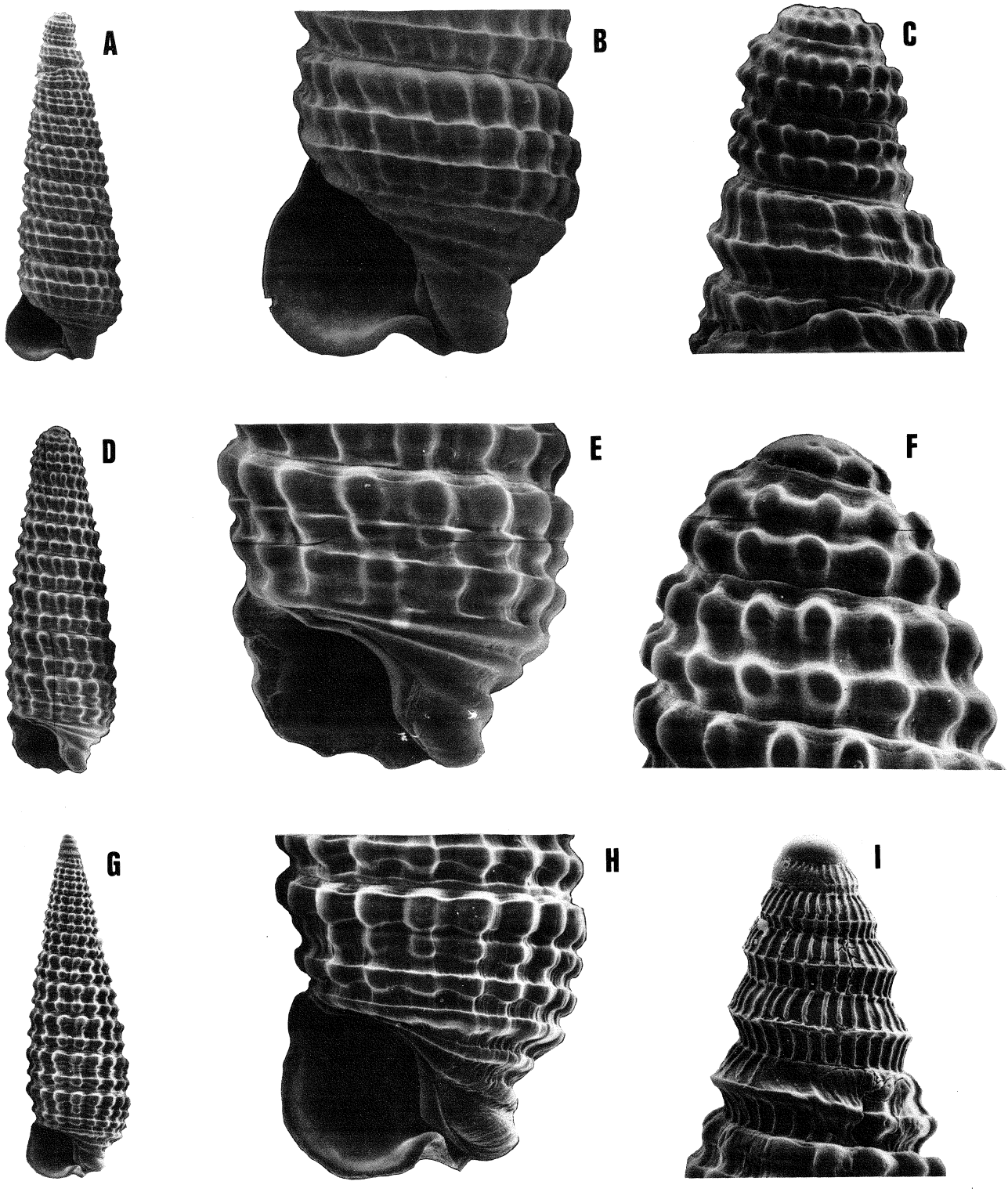
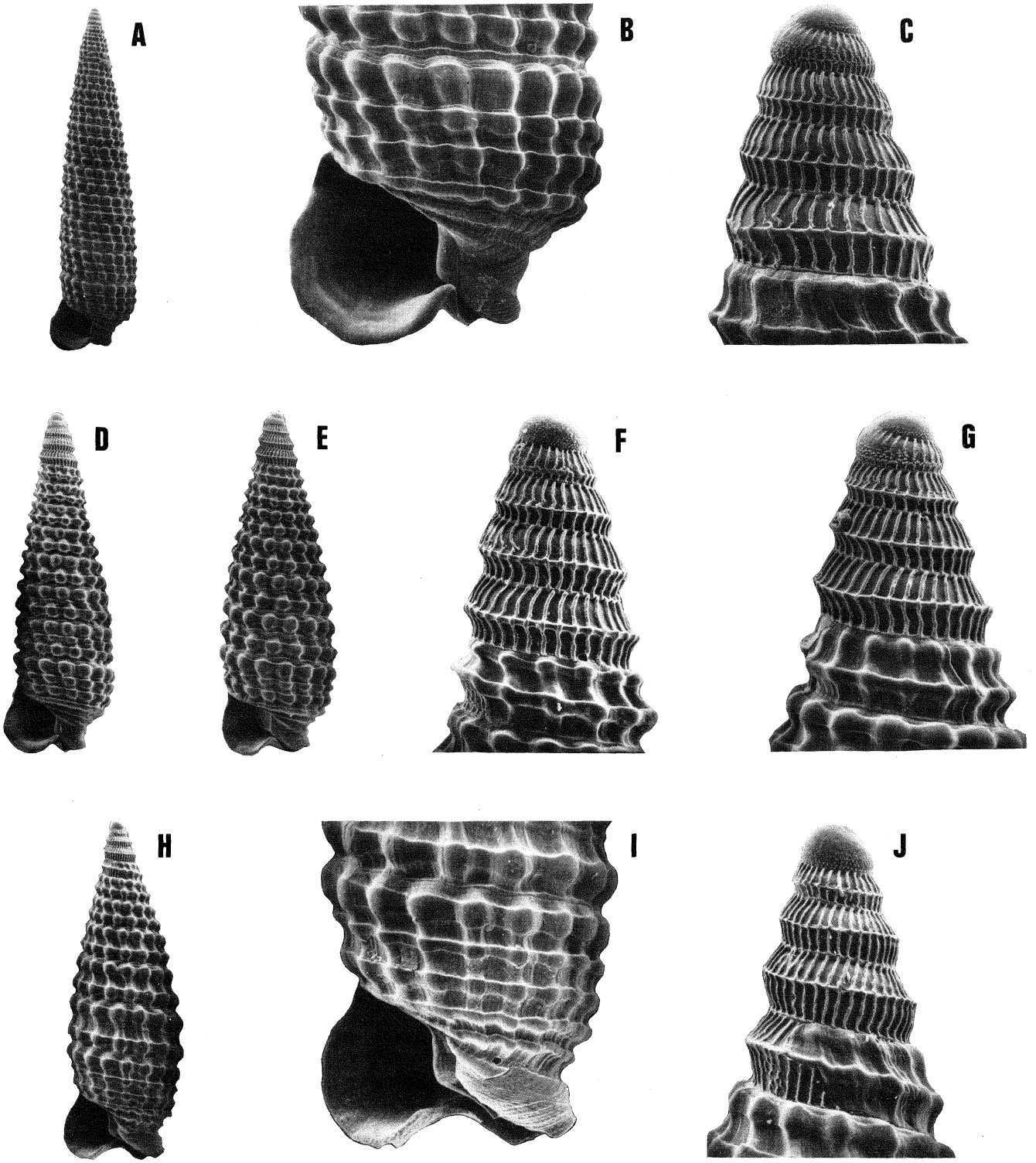


Fig. 25. **A–C,** *Isotriphora vercoi* n.sp., holotype, off Cape Pillar, Tasmania, 183 m, C.130022 (5.10 × 1.60 mm). **D–F,** *Isotriphora aureovincta* (Verco), Rottnest I., Western Australia, D.16316 (3.70 × 1.20 mm). **G–I,** *Bouchetriphora aspergata* (Laseron): **G, H,** Long Reef, New South Wales, C.116223 (5.45 × 1.60 mm); **I,** Iluka Bluff, New South Wales, C.113484.



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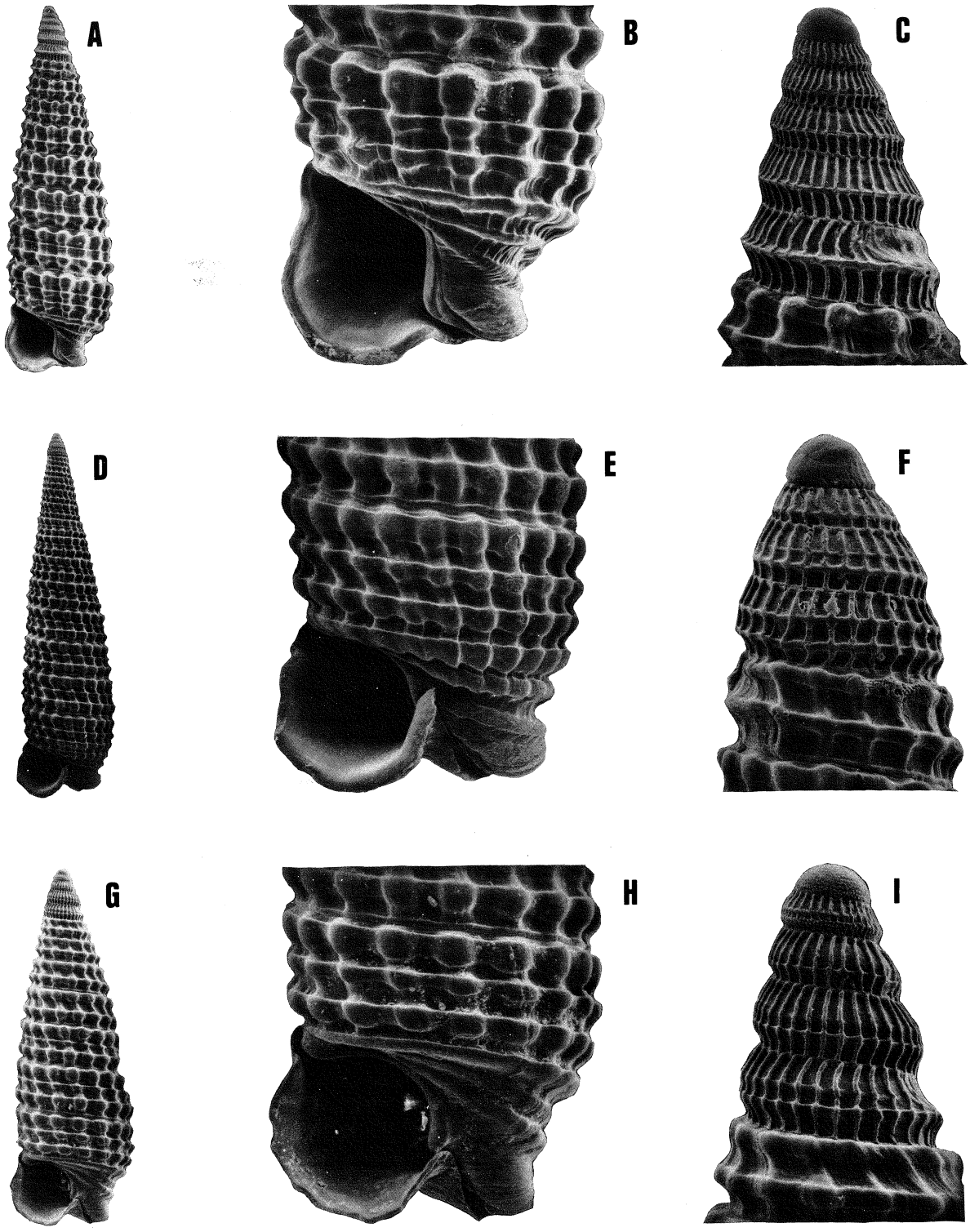


Fig. 27. **A–C,** *Bouchetriphora marrowi* n.sp., holotype, Long Reef, New South Wales, C.130020 (4.25 × 1.30 mm). **D–F,** *Cosmotriphora melanura* (C.B. Adams), St. Thomas, West Indies, D.16249 (7.60 × 2.00 mm). **G–I,** *Nototriphora regina* (Hedley), off Cape Wiles, South Australia, 183 m, C.31897 (3.45 × 1.10 mm).

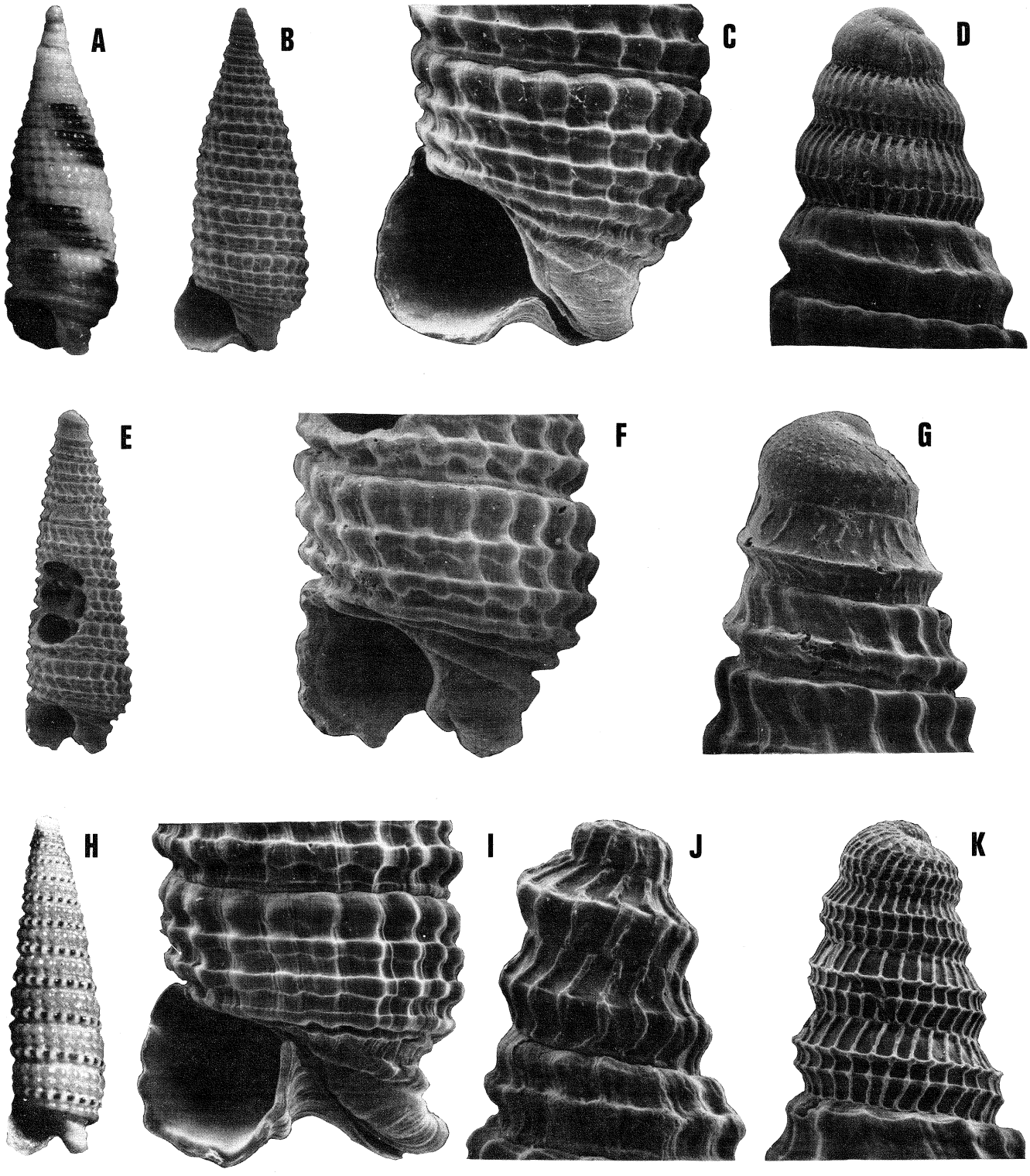
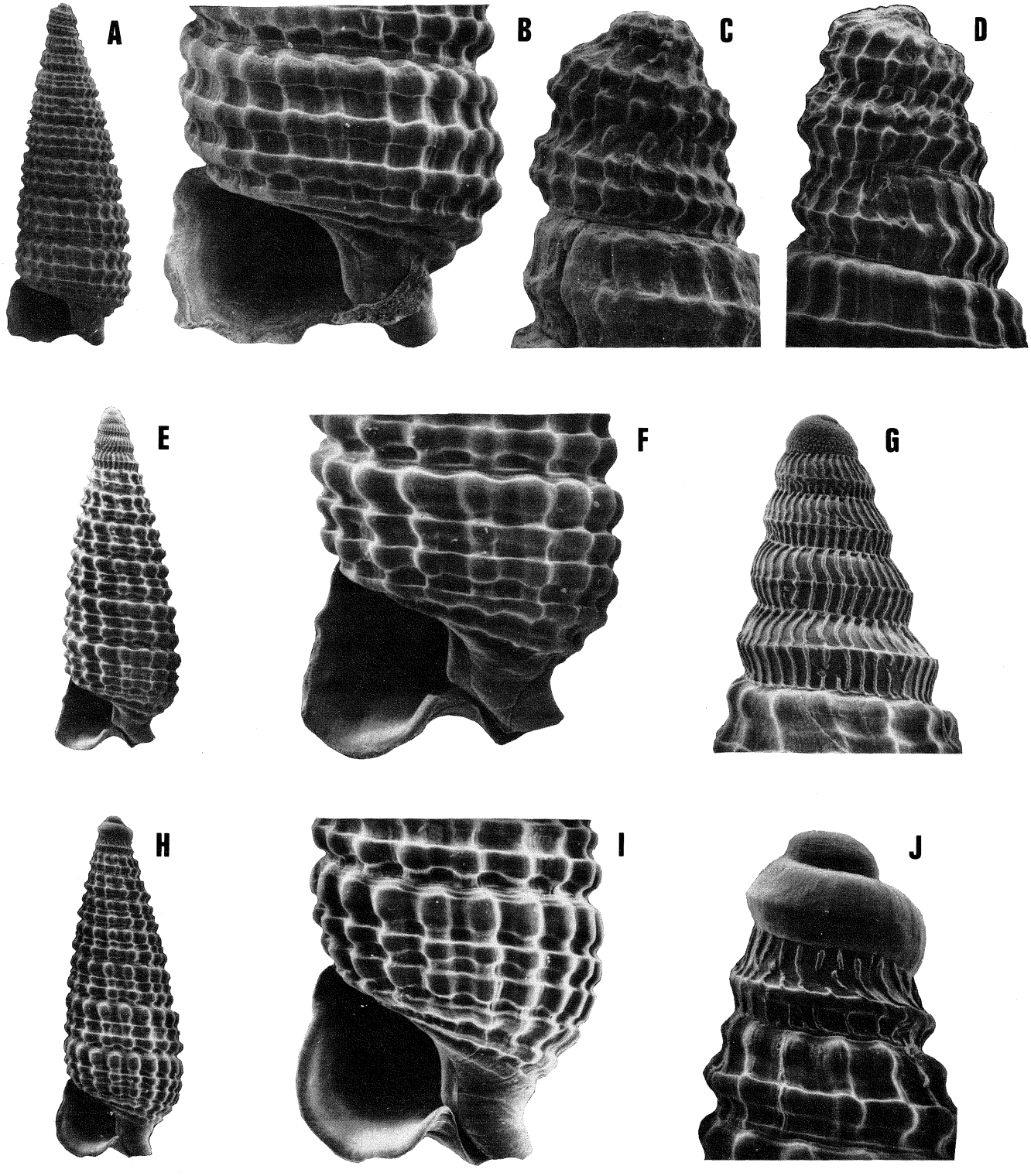


Fig. 28. **A,** *Nototriphora sarcira* (Laseron), holotype, off Long Reef, New South Wales, 26 m, C.65855 (5.80 × 1.95 mm). **B–D,** *Nototriphora vestita* n.sp., holotype, Gulf St. Vincent, South Australia, 26 m, D.16242 (4.70 × 1.70 mm). **E–G,** *Nototriphora unicarinata* n.sp., holotype, off Narrabeen, New South Wales, 146 m, C.130015 (4.15 × 1.20 mm). **H–J,** *Triphora taeniolata* Hervier: **H,** Capricorn Group, Queensland, C.103080 (8.50 × 2.25 mm) (*Coriophora monovitta* Laseron, holotype); **I, J,** Wilson I., Queensland, C.132707. **K,** *Triphora* cf. *gemmata* Blainville, Mayotte, Comoro Is, Mozambique Channel, 15–20 m, MNHN.



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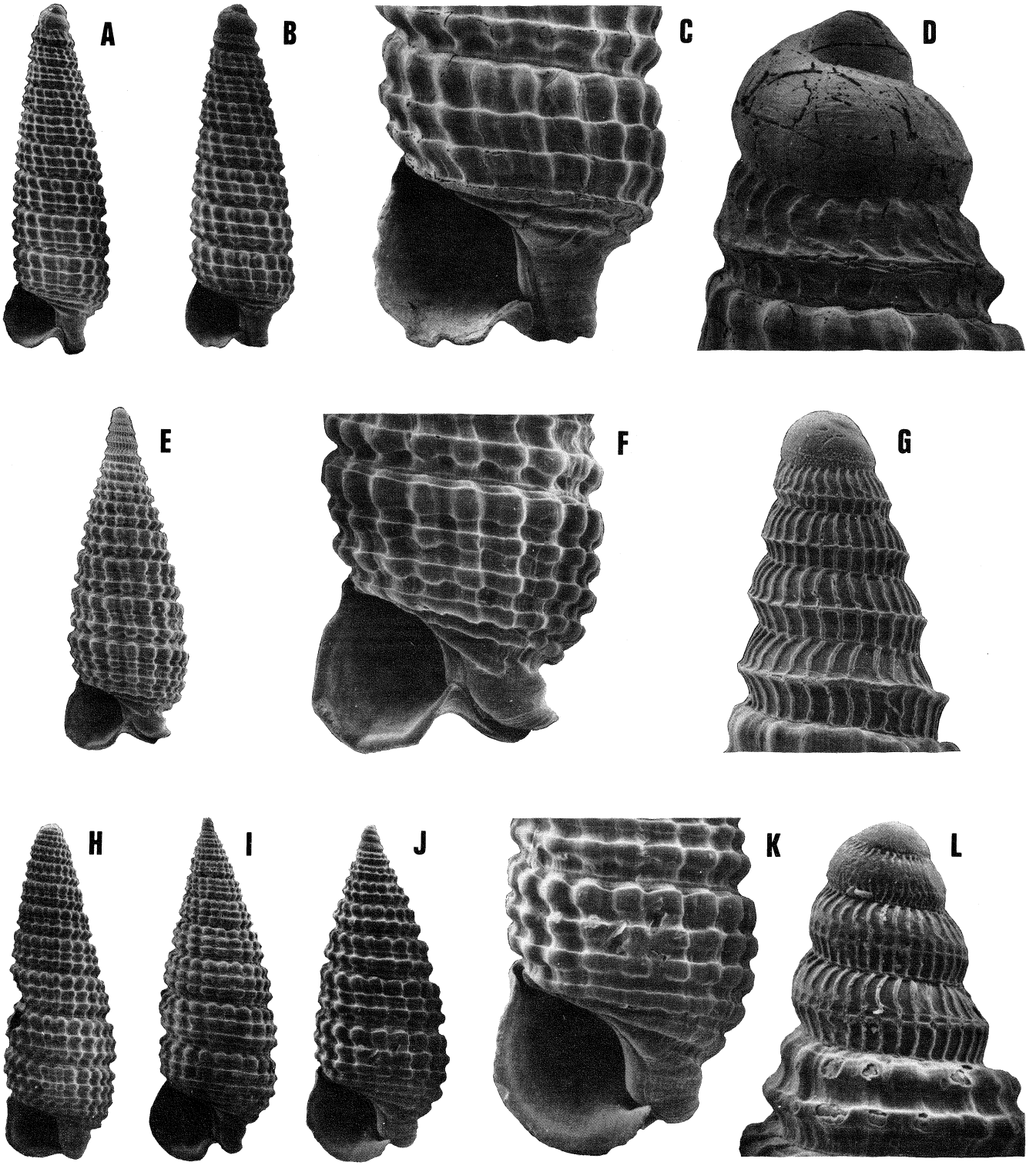

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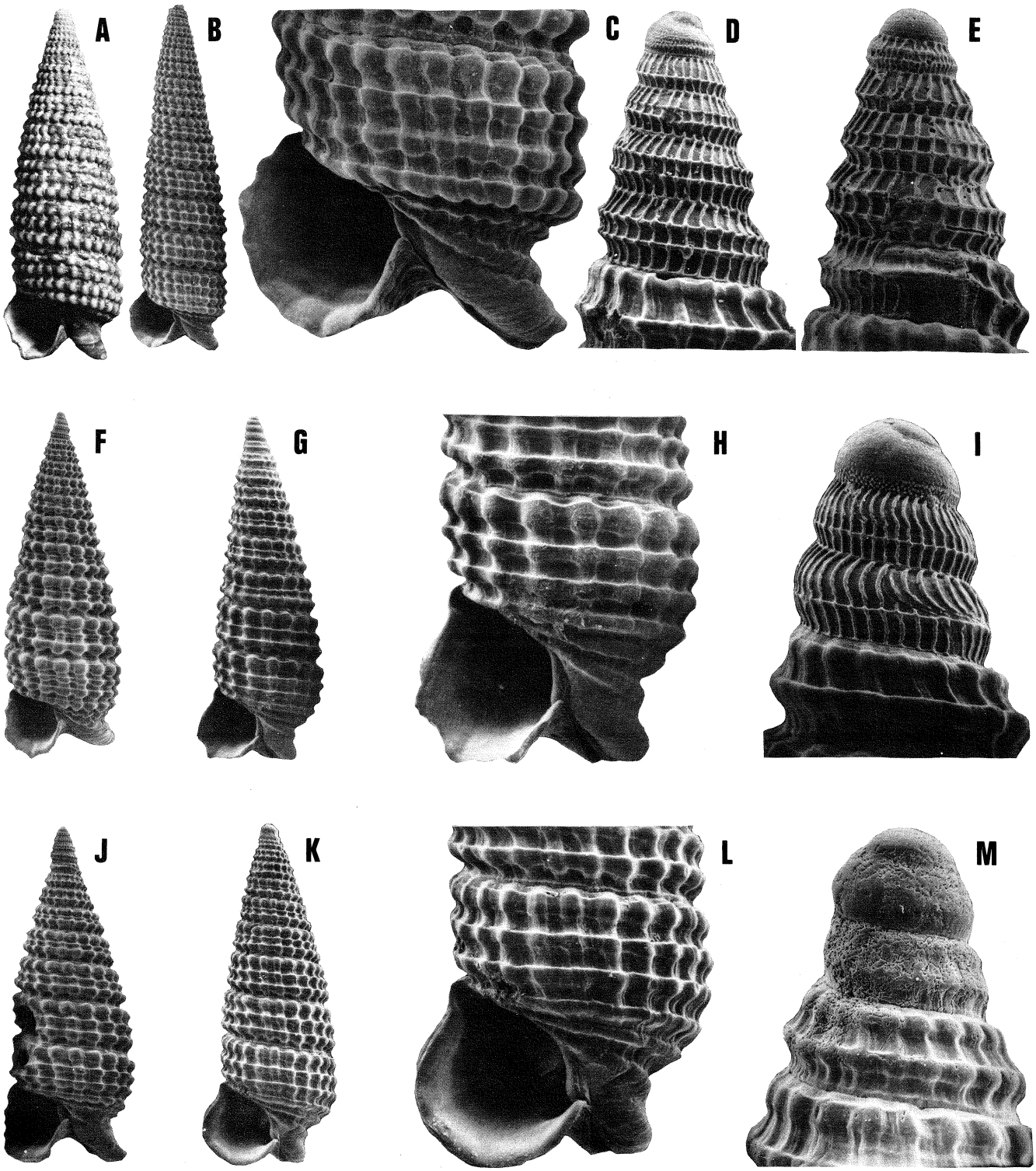

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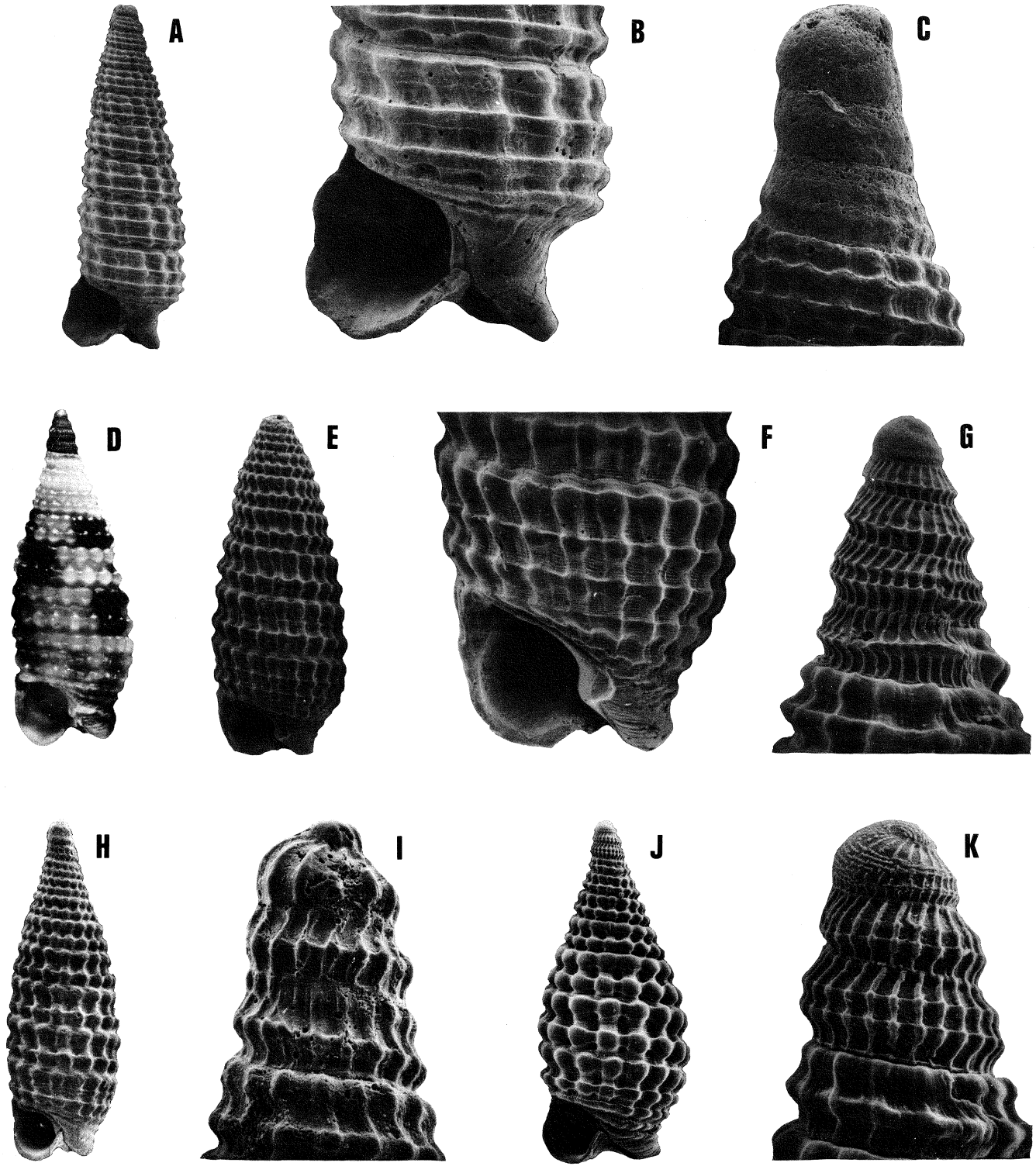

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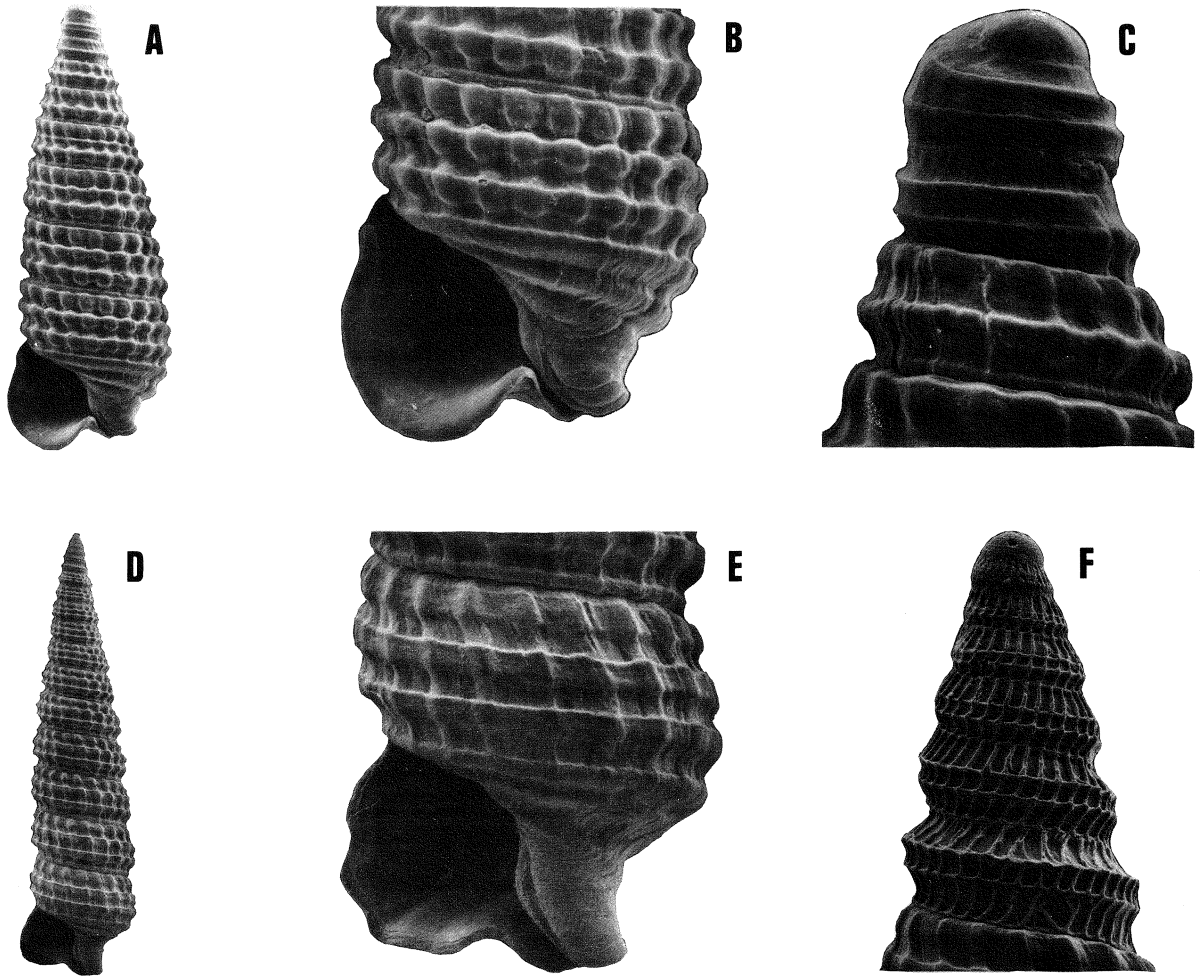

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