Ponder, Winston F., and E. K. Yoo, 1976. A revision of the Australian and tropical Indo-Pacific Tertiary and Recent species of *Pisinna (=Estea)* (Mollusca: Gastropoda: Rissoidae). *Records of the Australian Museum* 30(10): 150–247. [26 July 1976].

doi:10.3853/j.0067-1975.30.1976.190

ISSN 0067-1975

Published by the Australian Museum, Sydney

A REVISION OF THE AUSTRALIAN AND TROPICAL INDO-PACIFIC TERTIARY AND RECENT SPECIES OF *PISINNA* (=*ESTEA*) (MOLLUSCA: GASTROPODA: RISSOIDAE)

W. F. PONDER AND E. K. YOO

The Australian Museum, Sydney.

SUMMARY

The Recent and Tertiary species of *Pisinna* Monterosato (=*Estea* Iredale) from Australia and the tropical Indo-Pacific are reviewed. 26 species are recognised from temperate Australia and 11 from tropical Australia and the Indo-Pacific. The extralimital species, with the exception of those from New Zealand, are also briefly reviewed. 10 new species and 2 new subspecies are described and radulae and opercula of some species are illustrated.

CONTENTS

Introduction 150
Techniques 152
Availability of material 152
Abbreviations 153
Taxonomy 154
  Keys to species 158
  Temperate Australian species 164
  Tropical Australian and Indo-Pacific species 202
  Temperate Indian Ocean and Mediterranean species 210
Acknowledgements 212
References 213

INTRODUCTION

The genus *Pisinna* Monterosato (=*Estea* Iredale) is richly represented in temperate Australasia, where many species live in the lower intertidal zone and on the continental shelf.

The first species described from Australia were collected by the *Novara* Expedition in the Sydney area in 1858 and the results were published by Frauenfeld in 1867. Early Tasmanian workers such as J. E. Tenison Woods, W. F. Petterd and W. L. May described several species. A few additional species were added by C. Hedley, J. H. Gatliff, C. J. Gabriel, and B. C. Cotton. The most important recent revision was that of C. F. Laseron (1950) when he revised the New South Wales Rissoidae and described several new species. Worthy of record is the fact that an early amateur conchologist, Mr. A. U. Henn, had recognised several

Records of the Australian Museum, 1976, **30**, 150-247, Figures 1-20.

of Laseron's species as new and illustrated them (the drawings are now in the Western Australian Museum, and the figured specimen lots in the Australian Museum). Laseron later (1956), in a review of the northern Australian Rissoidae, described new species of *Estea* and *Scrobs*, some of which are here recognised as *Pisinna*.

Ponder (1965c) reviewed the Recent and Tertiary species of *Estea* in New Zealand, and later (1968b) added 3 new species and subspecies. The genus is one of the most diverse of the family Rissoidae in temperate Australasia, there being 23 Recent species and subspecies known from New Zealand and 28 from temperate Australia. Tropical species are fewer, only 7 Recent species being known from tropical Australia, one of these (*tropica* Laseron) being distributed widely in the south west Pacific.

The familial and subfamilial location of the genus (as *Estea)* has been discussed by Ponder (1967).

BIOLOGY AND ANATOMY: Ponder (1968a) has described the anatomy of two New Zealand species, and earlier (1965c), the external features of several species. Risbec (1942) described the gross anatomy of *"Barleia rosea* Hutton" (=*Pisinna* sp.) from New Caledonia. *Pisinna* species are probably diatom scrapers (micro-herbivores) but no positive information is available and nothing is known of their life histories.

The two species examined by Ponder (1968a) were *P. semiplicata* (Powell) and *P. zosterophila* (Webster). These species are probably typical of the genus *Pisinna* in the main features of their anatomy. The head bears a pair of setose, club-shaped cephalic tentacles, and a broad bilobed snout, the foot has a large, internally massive posterior pedal gland which opens into a median slit in the posterior half of the ciliated sole. There are no accessory tentacles and the propodium is very indistinct, the anterior pedal gland being poorly developed. Most species and genera of the Anabathroninae have a similar external appearance except that the smaller genera tend to lose the posterior mucous slit in the sole.

The mantle cavity is like that of most small prosobranchs in having a long osphradium and a row of finger shaped ctenidial filaments. The osphradium, however, of *Pisinna* and other Anabathroninae is bordered by glandular, not ciliated ridges, and thus they differ from most other rissoaceans. The alimentary canal is unusual in that there is both an oesophageal gland and a crystalline style present. There are no jaws and the salivary glands are a pair of simple tubes. The other members of the Anabathroninae that have been examined (Ponder, 1968a) have a similar alimentary canal. The other subfamilies of the Rissoidae differ from the Anabathroninae in not having an oesophageal gland.

The reproductive system is fairly typical of the family Rissoidae. The penis of *Pisinna* and other Anabathroninae is unusual in being attached mid-dorsally behind the head instead of on the right side of the head, as it is in most other rissoaceans.

The female reproductive system has been examined only in *P. semiplicata* which has large yolky eggs in the ovary. The upper oviduct is a simple, narrow tube which expands to form a glandular pouch at its junction with the seminal receptacle and the duct of the albumen gland. Another duct leads to a muscular tube which terminates blindly as a muscular bulb (?bursa copulatrix) in one direction and in the other it narrows to connect with the ventral channel of the capsule gland. The only other species of the Anabathroninae whose reproductive system has been described is *Scrobs hedleyi* (Suter) (Ponder, 1968a) which shows a similar arrangement of organs and a bursa copulatrix occupies the position of the blind muscular bulb of *P. semiplicata*. This muscular bulb was not observed to store sperm and consequently its function is in doubt.

HABITAT: Many species of *Pisinna* live on algae in the lower littoral zone, and in the sublittoral, whereas others prefer the under surface of rock or coral blocks. Often the same

species are found in a variety of microhabitats (e.g. pools, exposed rock faces) on varying substrates (e.g. under stones, on algae) in the one geographic location. Species found on the continental shelf supposedly on soft substrate are probably occupying small patches of hard substrate (such as accumulations of dead shell) rather than moving about on the soft sediments.

GEOLOGICAL HISTORY: The genus first appears in the Duntroonian (Middle Oligocene) of New Zealand and there are 8 species known only as fossils although one Recent species *olivacea*, subspecies *impressa* (Hutton, 1885), extends back to the Duntroonian. Only one extinct Australian fossil subspecies is here recognised which is known from the Lower Miocene. However the number of available samples is not great and undoubtedly additional species will be located. *Pisinna bikiniensis* (Ladd) from the Lower Miocene of Bikini Atoll, Marshall Islands is the only known fossil species in the tropical Indo-Pacific. Unfortunately no material has been available for checking fossil occurrences in the Mediterranean area, although a probable Miocene species has been named (see under *P. punctulum* (Philippi) below).

Thus, from the rather flimsy evidence it could be suggested that the genus had its origins in the temperate Australian area (probably New Zealand) and then spread widely through the Indo-Pacific and to the Mediterranean via the Tethys Sea. It is, however, also possible that *Pisinna* evolved in the early Tertiary Tethys Sea and then migrated southwards followed by a spectacular speciation in the temperate waters of Australasia.

TECHNIQUES

Material was obtained from several types of sample which were hand-sorted beneath a low-power binocular microscope. The samples included debris washed from littoral and sublittoral algae (algae washings), debris washed from beneath littoral or sublittoral stones, rocks or coral blocks (stone (etc.) washings) and benthos samples obtained by dredging. These samples were usually fixed in 10% neutral formaldehyde.

The specimens obtained were generally split into two fractions, one fraction being preserved in 5% neutral formaldehyde and the other dried.

Radulae were mounted after dissolving the animal tissue in NaOH, washing in distilled water and drying on a fragment of a microscope-slide coverslip. The mount was coated with gold and examined with the scanning electron microscope (SEM). Opercula were simply removed from the animal, washed in distilled water, and mounted for examination with the SEM.

All shell drawings were done by using a "Wild" M5 microscope and drawing apparatus.

AVAILABILITY OF MATERIAL

Much of the material examined, apart from that already housed in museums, was sorted from samples during the course of this study. Samples have been made available from several sources and as a result the southern, south-eastern and northern continental shelves of Australia have been moderately well covered. The western shelf has been barely sampled for micro-Mollusca, although several small samples have been available from the N.W. Australian shelf. Little material was available from the Torres Strait region although "Chevert" and "Challenger" stations were made in this area and one species (*Pisinna eurychades* (Watson)) was described from the latter expedition.

Good series of littoral and shallow sublittoral samples have been available from parts of most states, except South Australia and Northern Territory. In addition, some littoral and shallow sublittoral material has been examined from New Caledonia, Fiji, Solomon Islands, the New Hebrides and Papua-New Guinea.

Extensive shallow and deep water Philippines, and central Pacific shallow water collections in the U.S. National Museum failed to reveal any species of *Pisinna*, and the Hawaiian collections in the U.S. National Museum and Bishop Museum, Honolulu, also failed to reveal additional species. A small amount of material from Japan and Hong Kong has been examined, but again, no additional species have been found. One species is named from Mauritius (*microthyra* (Martens)), one species (*cazini* (Velain)) was described from the Island of St. Paul, southern Indian Ocean, and one species (*kis* (Winckworth)) is named from Ceylon. What is here believed to be a single species (*punctulum* (Phillipi)), is known from the Mediterranean Sea and one (*crawfordi*, (Smith)) is known from South Africa.

Despite searching collections in many overseas museums, no species referable to *Pisinna* has been found from west Africa, the Red Sea — Persian Gulf nor the whole Atlantic — Caribbean area.

A small collection of Australian fossil material has been available for study but this, for the most part has been inadequate for a proper understanding of the taxonomy of the fossil species.

ABBREVIATIONS

A.M. ..... the Australian Museum, Sydney.

B.M.N.H. ..... British Museum (Natural History), London.

B.M.R. ..... Bureau of Mineral Resources, Canberra.

coll. ..... collected by.

Coll. ..... collection.

N.M.V. ..... National Museum of Victoria, Melbourne.

N.S.W. ..... New South Wales.

Qld ..... Queensland.

S.A. ..... South Australia.

S.A.M. ..... South Australian Museum, Adelaide.

Tasm. ..... Tasmania.

T.M. ..... Tasmanian Museum, Hobart.

Vic. ..... Victoria.

W.A. ..... Western Australia.

W.A.M. ..... Western Australian Museum, Perth.

Note: In the locality data, and sometimes elsewhere, compass points (north, south etc.) are abbreviated to N., S. etc.

TAXONOMY

Family Rissoidae
Subfamily Anabathroninae
Genus *Pisinna* Monterosato, 1878: 86.
Type species: (S.D. Cossmann, 1921: 33) *Rissoa punctulum* Philippi, 1836: 154.
Synonyms: *Estea* Iredale, 1915: 451.
Type species (o.d.) *Rissoa zosterophila* Webster, 1898.
Nodulestea Iredale, 1955: 81.
Type species (o.d.) *Estea castella* Laseron, 1950.
Feldestea Iredale, 1955: 81.
Type species (o.d.) *Rissoa salebrosa* (Frauenfeld, 1867) (=*Alvania salebrosa* Frauenfeld).
Microestea Ponder, 1965c: 156.
Type species (o.d.) *Estea angustata* Powell, 1927.

DESIGNATION OF TYPE SPECIES: Varying interpretations have been placed on the type designation of this genus. The first valid designation appears to be that of Cossmann (1921: 33), but Wenz (1938: 612), Ludbrook (1956: 26) and Ladd (1966: 62) list the type designation as 'monotypy'. When Monterosato introduced *Pisinna* he listed two species, *"Rissoa glabrata* auct" (non v. Mülhfeldt, 1824) = *R. punctulum* Philippi (with two synonyms) and *Rissoa seminulum* Monterosato, 1877. Examination of Monterosato's type material suggests that *seminulum* is not a *Pisinna* and probably belongs near *Barleeia* Clark.

NOTE ON SYNONYMY: Thiele (1929: 162), Wenz (1938: 612), Ludbrook (1956: 26) and Macpherson and Gabriel (1962: 91) correctly regard *Estea* as a synonym of *Pisinna* whereas New Zealand workers and most other Australian workers have used *Estea*. Examination of the type species of *Pisinna* has confirmed that *Estea* and *Pisinna* cannot be separated on shell, radular or opercular characters. The authors have not been able to locate a description of the external features of the animal of *P. punctulum*.

Nodulestea and *Feldestea* were erected for sculptural forms of *Pisinna*. All gradation between smooth, axially ribbed and spirally keeled species occur in the genus and to separate any one of these groups would create an artificial assortment of species sharing only superficial sculptural features. *Microestea* was separated because of its smaller, thinner shell from typical *Estea* (i.e. *Pisinna*) but its recognition seems to be unnecessary in view of the range of size seen in the genus as a whole.

TERMINOLOGY: The descriptive terminology employed for gastropod shells has never been completely stabilised. Recent reviews by Cox (1955, 1960) have put forward non-ambiguous terms for use in directional description, and because these terms are likely to gain general acceptance and are less ambiguous than other terminology, they are employed here (see figure 1).

The descriptive terminology used for the radula and operculum follows Ponder (1965a).

DIAGNOSIS: Shell — Small, more-or-less pupiform, dull or glossy; spire longer than aperture, outline straight to moderately convex. *Protoconch* dome-shaped, usually reddish, 1½ to 2 whorls, surface minutely pitted, the pits usually in close spiral rows. *Teleoconch* with aperture typically almost circular to obliquely oval, slightly angled adapically, peristome continuous, usually thickened within, outer lip sharp-edged. Inner lip distinct, fixed to parietal area in adapical portion, free or partially free in abapical region (i.e. separated from base to some extent). Surface smooth or sculptured with axial ribs or, more rarely, spiral grooves or cords. Umbilicus absent. A distinct, chitinous internal shell layer present (Fig. 12 c-d).

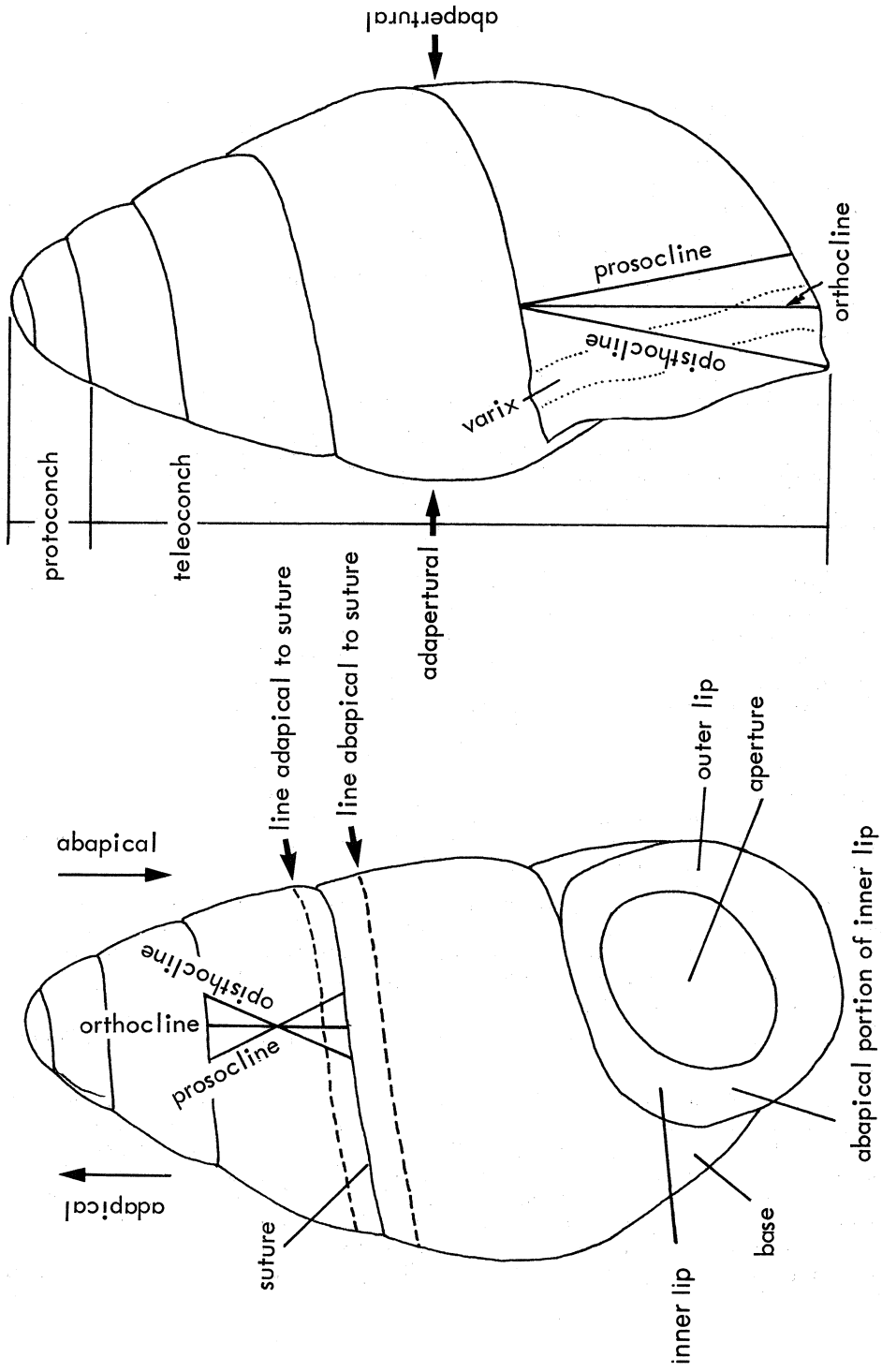


Figure 1. Diagrammatic views of a generalised *Pisinna* shell to illustrate the descriptive terminology employed.

Operculum — Thin, transparent, colourless or pale yellow; oval, nearly flat, nucleus small, indistinct. Marginal areas usually narrow. Muscle insertion area typically distinct, occupying columellar half and up to 2/3 of surface, slightly thickened. Composed of 2 separable layers (Fig. 13b-c).

Head Foot — Cephalic tentacles club shaped, with stationary cilia terminally and a tract of posteriorly directed cilia on ventral surface. Eyes in bulges at outer bases of tentacles. Snout rather large, bilobed, mobile. Foot moderately long, a distinct groove on anterior edge, posterior mucous gland with a slit in posterior half of sole. Opercular lobes simple. No accessory tentacles. Penis coiled, simple, attached to midline some distance behind head.

Radula — Central teeth relatively large, each with a pair of long basal processes and usually a pair of accessory denticles beside each process; cusps 1-3+1+3-1, the middle cusp longest. Lateral teeth rather small, with a long, narrow outer, oblique limb and shorter vertical limb beneath main cusp; cusps large, 2-3+1+2-5. Marginal teeth elongate, approximately parallel-sided, curved distally, denticulate, outer marginal more finely denticulate than inner.

SPECIES RECENTLY REFERRED TO *PISINNA* OR *ESTEA* BUT NOT INCLUDED IN *PISINNA* IN THE PRESENT REVISION.

Generic and family locations are suggested following each name.

alvea Laseron, 1950. Cingulopsidae. Note 2.

amblycorymba Cotton, 1944. *Nozeba* (Rissoidae).

aurantiocincta May, 1915. *Crassitoniella*. (Eatoniellidae). Note 3.

chrysalida Chapman & Gabriel, 1914. *Botelloides* (Rissoidae).

erma Cotton, 1944. *Notoscrobs (Microfossa)* (Rissoidae).

erratica May, 1912. *Crassitoniella* (Eatoniellidae). Note 3.

figula Laseron, 1950. *Peringiella* s.l. (Rissoidae). Note 5.

flammea Frauenfeld, 1867. *Crassitoniella* (Eatoniellidae). Note 3.

gregaria Laseron, 1950. Cingulopsidae. Note 2.

incidata Frauenfeld, 1867. *Notoscrobs (Microfossa)* (Rissoidae). Note 4.

iravadioides Gatliff & Gabriel, 1913. *Microdryas*. (Rissoidae). Note 4.

janjucensis Gatliff & Gabriel, 1913. *Microdryas* (Rissoidae). Note 4.

labrotoma May, 1919. *Notoscrobs (Microfossa)* (Rissoidae).

lunata Laseron, 1956. Genus? Cingulopsidae.

obeliscus May, 1915. Genus? Rastodentidae? Note 8.

perpolita May, 1919. *Powellisetia* s.l. (Rissoidae). Note 6.

pertumida May, 1915. *Powellisetia* s.l. (Rissoidae). Note 6.

praeda Hedley, 1908. *Rissoa (Haurakia)* (Rissoidae).

puer May, 1921 (nom. nov. pro *Rissoa pupoides* May, 1915). Genus? Rastodentidae? Note 8.

pulvilla Hedley, 1906. *Peringiella* s.l. (Rissoidae). Note 5.

pyramidata Hedley, 1903. *Pseudestea* (Rissoidae).

rubicunda Tate & May, 1900. *Peringiella* s.l. (Rissoidae). Note 5.

subbicolor Ludbrook, 1956. *Crassitoniella* (Eatoniellidae). Note 3.

tiara May, 1915. *Powellisetia* s.l. (Rissoidae). Note 6.

xanthias Watson, 1886. Genus? (Rissoidae). Note 7.

TAXONOMIC NOTES ON SPECIES WRONGLY LOCATED IN *PISINNA*.

NOTE 1: Cotton (1944: 292) introduced *Subestea* for 3 species: *seminodosa* May, 1915 (as the type of the genus), *salebrosa* Frauenfeld, and *flindersi* T. Woods. The latter two species are typical *Pisinna* but *seminodosa* is closely related to *Merelina* Iredale, 1915.

NOTE 2: Several minute species closely resembling *Pisinna* in teleoconch characters are known from Australian and Pacific waters. Laseron (1950) described two New South Wales species as *Estea, E. gregaria* and *E. alvea,* but most of the other species are undescribed. The protoconch of these minute species is smooth and the radular, opercular and head-foot characters place them in the Cingulopsidae (see Ponder, 1965b). They probably require a new generic name which will be provided in a forthcoming revision of the Australian species of that family.

NOTE 3: The species listed as Eatoniellidae are to be the subject of a future revision where more definitive generic and subgeneric placements will be made.

The original material of the fossil species *subbicolor* Ludbrook, consists of a mixture of three species, the most abundant being *Notoscrobs (Microfossa)* cf *erma* (Cotton). The holotype, however, is a *Crassitoniella.*

NOTE 4: The genus *Microdryas* Laseron, 1950, was based on a misidentified type species. This is the subject of a submission currently placed before the International Commission on Zoological Nomenclature.

NOTE 5: The systematic position of the species listed as belonging to *Peringiella* s.l. is problematic in that the genus *Peringiella* needs to be clarified. The three names included here appear to represent only one species, *rubicunda* Tate and May.

NOTE 6: The several species listed as *Powellisetia* Ponder, 1967 are only tentatively placed there as only the shells are available for examination.

NOTE 7: *Mucronalia xanthias* Watson was transferred to *Estea* by Laseron (1956) but differs considerably in having a narrow, several-whorled protoconch and a differently sculptured teleoconch. The relationships of this species are obscure, but possibly lie with *Scaliola* rather than the Rissoidae.

NOTE 8: The two species *obeliscus* May and *puer* May are possibly representatives of the Rastodentidae (Ponder, 1966) but only shells have been examined and definite placement in this family must await at least the examination of the radulae and opercula of these species.

SPECIES TAXONOMY

The following descriptive section dealing with the species of *Pisinna* is divided into the following parts:

1. The Tertiary and Recent temperate Australian species.

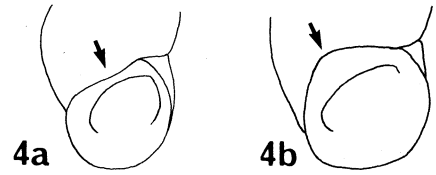
2. The Tertiary and Recent tropical species comprising those Australian species whose distribution is centred north of Moreton Bay on the east coast of Australia, and N.W. Cape on the west coast. It also includes the other species from the tropical Pacific not occurring in Australia.

3. The extralimital species. A brief synopsis of those species occurring in the temperate Indian Ocean and the Mediterranean Sea.

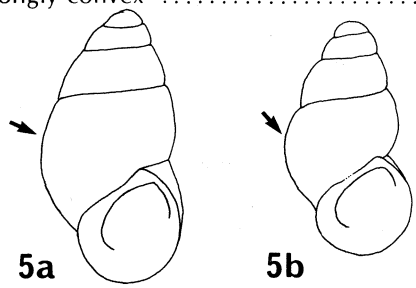
All species are listed in alphabetical order.

KEY TO THE RECENT TEMPERATE AUSTRALIAN SPECIES

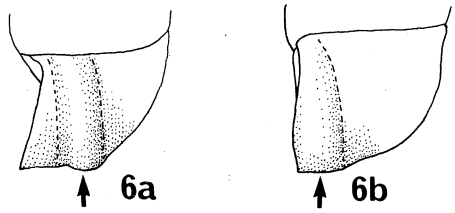
1. a. Teleoconch without axial ribs 2
   b. Teleoconch with axial ribs 20
2. a. Shell less than 3 mm in length 3
   b. Shell greater than 3 mm in length 14
3. a. Spire short (up to 1½ × length of aperture) 4
   b. Spire medium to long (greater than 1¾ × length of aperture) 6
4. a. Shell brown with more or less straight or slightly concave edge to inner lip 5
   b. Shell pinkish with strongly convex edge to inner lip ..... *circumlabra* nov.



5. a. Whorls weakly convex ..... *dubitabilis* (Tate)
   b. Whorls strongly convex ..... *megastoma* nov.

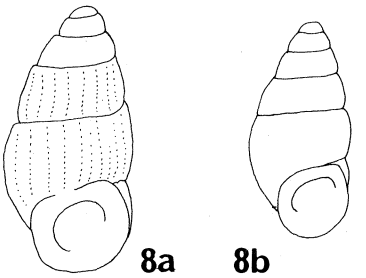


6. a. With very strong varix ..... *laseroni* nov.
   b. With weak varix or none 7



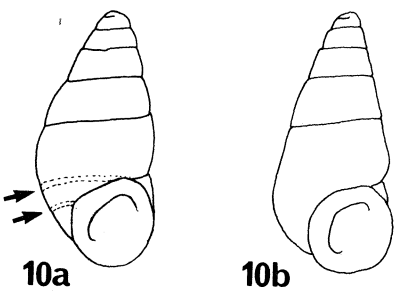
7. a. Shell 2 mm-3 mm in length 8
   b. Shell less than 2 mm in length 11

8. a. Shell very solid, whorls convex, usually sutures deeply impressed, colour mostly greyish, typically with fine axial riblets .... *varicifera relata* (Cotton)
   b. Shell moderately solid, whorls weakly convex, sutures not deeply impressed, colour pinkish or brown 9



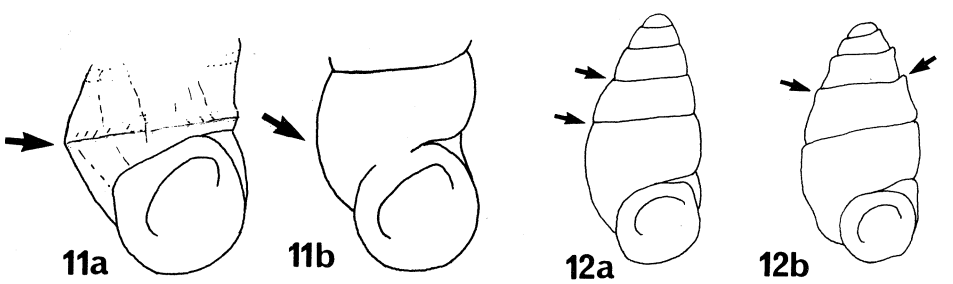
9. a. Brown with whitish band abapical to sutures (sometimes rather strong axial ribs on body whorl) ..... *albizona* (Laseron)
   b. Uniform brown or pinkish, sometimes with darker bands 10

10. a. Brown to yellowish sometimes with 2 brown bands on body whorl, spire outline slightly convex (never strongly axially ribbed) .... *frenchiensis* (Gatliff & Gabriel)
   b. Pinkish to yellowish, spire with straight outlines (sometimes axially ribbed on body whorl) ..... *tasmanica* (T. Woods)



11. a. Body whorl subangled to strongly keeled at periphery and sometimes spirally ribbed abapical to sutures ..... *vincula* (Laseron)
   b. Body whorl rounded 12

12. a. Sutures simple 13
   b. Sutures stepped ..... *gradata* nov.



Operculum — Typical (fig. 13a).

Radula — Central teeth with broad, blunt middle cusp, proximal end narrower than distal end, 1+1+1 (+ denticle on both sides); lateral teeth 2+2+2, middle cusp broad with bluntly rounded cutting edge. Inner marginals with approximately 10-12 small, sharp cusps, outer marginals finely serrate (fig. 10a-b).

LOCATION OF TYPES: A.M. Lectotype here chosen (C. 79208) and 30 paralectotypes (C. 79209).

TYPE LOCALITY: Point Halliday, N.S.W., alive on algae in rock pools.

ADDITIONAL MATERIAL EXAMINED: North Beach, Bellingen, N.S.W., Voorwinde Coll. (A.M.). S.W. of Solitary Is., N.S.W., 15 m on small boulder, 17 May 1972, coll. P. Hutchings & P. Weate (A.M.). Point Halliday, N.S.W., on algae, Voorwinde Coll. (A.M.). Forster, N.S.W., Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Lighthouse, Port Stephens, N.S.W., 73 m, Voorwinde Coll. (A.M.). Seal Rocks, N. of Newcastle, N.S.W., Voorwinde Coll. (A.M.). Woy Woy, Broken Bay, N.S.W., 13 m, Voorwinde Coll. (A.M.). Pittwater, Broken Bay, N.S.W., 16 m, Voorwinde Coll. (A.M.). Narrabeen Beach, Sydney, N.S.W., Voorwinde Coll. (A.M.). Long Reef, Sydney, N.S.W., on short brown algae, 16 June 1969, coll. W. F. Ponder & P. H. Colman, 3 lots (A.M.). N.E. side of Long Reef, N.S.W., on algae, Voorwinde Coll., 2 lots (A.M.). Fairlight, Sydney, at low water, 23 Dec. 1968, coll. W. F. Ponder; on *Zonaris*, Voorwinde Coll. (A.M.). Harbord, Sydney, N.S.W., sublittoral rocks below R.S.L. club, 14 Aug. 1971, coll. P. Hutchings (A.M.). North Harbour, Sydney, N.S.W., Voorwinde Coll. (2 lots); under stones, C. Laseron Coll. (A.M.). Balmoral, Sydney, 11-14 m, Voorwinde Coll., 2 lots (A.M.). Chinamans Beach, Sydney, N.S.W., 4-7 m, Voorwinde Coll., 2 lots (A.M.). Middle Harbour, Sydney, N.S.W., C. Hedley; 5 m, Voorwinde Coll. (A.M.). West Channel, Port Jackson, Sydney, N.S.W., 27 m, Voorwinde Coll. (A.M.). Sow & Pigs Reef, Port Jackson, N.S.W., 1879, coll. J. Brazier; 11-16 m, Voorwinde Coll. (A.M.). Bottle & Glass Rocks, Sydney, N.S.W., Voorwinde Coll.; 9 Oct. 1968, coll. W. F. Ponder (A.M.). Ny-ar-gine Point, Sydney, N.S.W., on small algae, 19 Dec. 1968, coll. A.M. party (A.M.). Port Jackson, N.S.W., Hargraves Coll. (A.M.). Kurnell, Botany Bay, Sydney, N.S.W., Voorwinde Coll. (A.M.). Gunnamatta Bay, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Cronulla, Sydney, N.S.W., Voorwinde Coll., 2 lots (A.M.). Honeymoon Beach, Jervis Bay, N.S.W., under stones; in beach sand, 18 Jan. 1969, coll. W. F. Ponder & N. Coleman (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.). S. side of Ulladulla, N.S.W., outside breakwater on moderately exposed rock platform, on coralline algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Batemans Bay, N.S.W., Voorwinde Coll. (A.M.). Off Gabo Is., Vic., 26 m, coll. R. Bell (A.M.). Cape Everard, Vic., 18 m, 16 Feb. 1973, coll. P. Hutchings (A.M.).

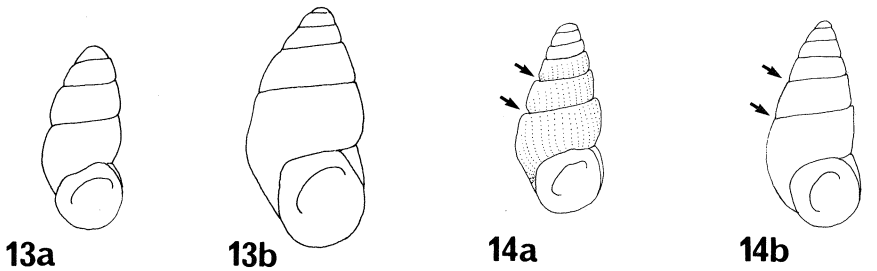
DISTRIBUTION AND HABITAT: Common in N.S.W. at least as far south as Batemans Bay and north to Bellingen on low tidal and shallow sublittoral algae. One specimen from Cape Everard, S.E. Victoria is known but the record needs confirmation (see fig. 18).

REMARKS: Similar to *frenchiensis* (Gatliff & Gabriel) but differs in having a slightly more elongate shell, in often developing axial ribs on the last whorl (*frenchiensis* is always smooth) and in usually having a distinct, rather broad, whitish band abapical to the sutures which is absent or only a narrow line in *frenchiensis*. The radulae show a number of differences, the most obvious being the relative size of the middle cusp on the central teeth (cf. fig. 10a-b and fig. 11e).

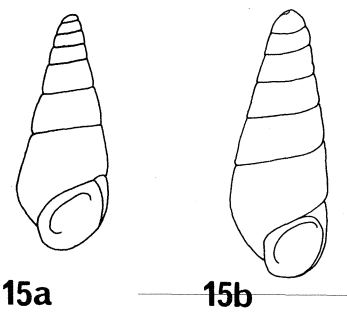
Laseron's (1950: 269) *Estea frauenfeldi* (fig. 3c) is the ribbed form of *albizona* and not *P. frauenfeldi* (Frauenfeld). Our figured specimen is taken from the same lot as Laseron's figured specimen.

13. a. Aperture with narrow, thin inner lip, shell rather thin, narrowly pupoid, whorls often distinctly convex ..... *approxima* (Petterd)
b. Aperture with wide, thickened inner lip, shell solid, conical, whorls almost flat ..... *circumlabra* nov.

14. a. Sutures deeply indented (usually with fine axial riblets) .... *varicifera relata* (Cotton)
b. Sutures not deeply indented 15



15. a. Spire of medium length (2-2½×length of aperture) 16
b. Spire tall (about 3×length of aperture) ..... *voorwindei* nov.

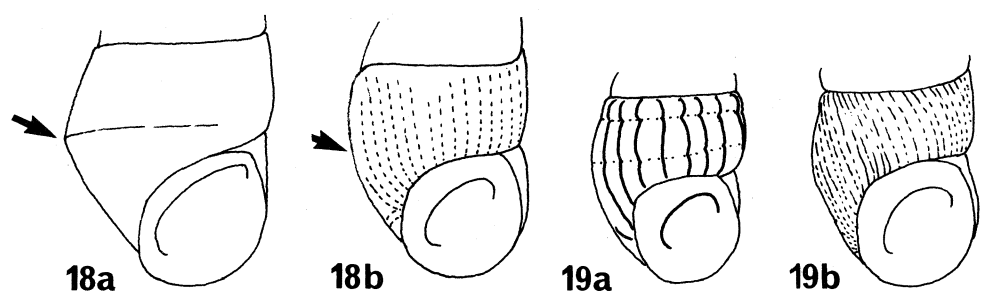


16. a. Pale colour band adapical to sutures or uniform in colour 17
b. Blotchy colour pattern ..... *moretonensis* nov.

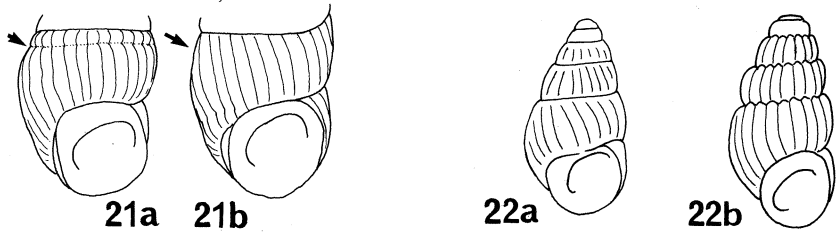
17. a. Teleoconch completely smooth 18
b. Teleoconch with indistinct axial rugae ..... *paucirugosa* nov.

18. a. Periphery subangled ..... *nitida* nov.
b. Periphery evenly convex ..... *bicolor* (Petterd)

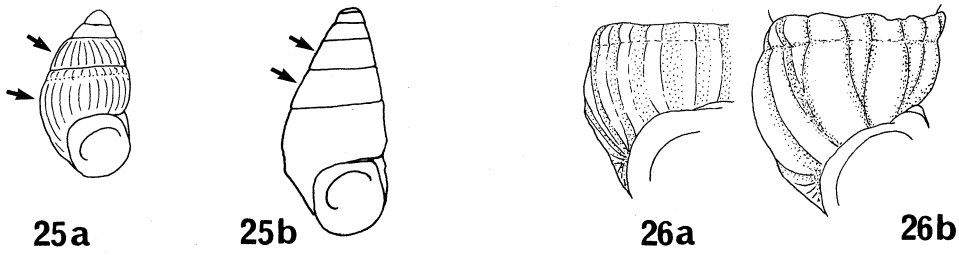
19. a. Axial ribs strong and broad 20
b. Axial ribs weak and threadlike 29



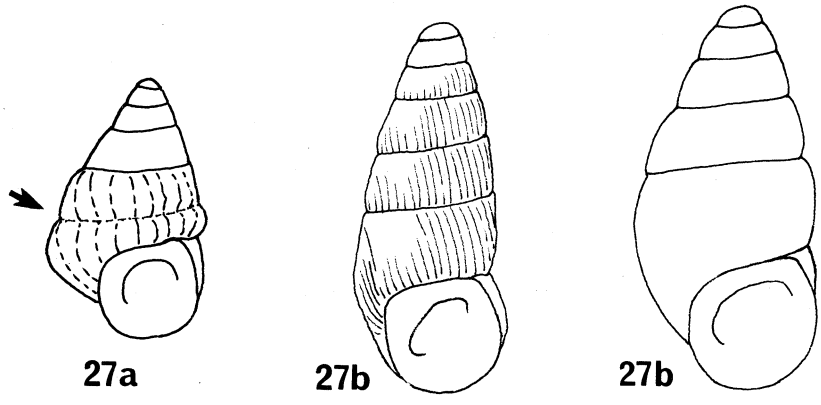
20. a. Axials over whole surface of teleoconch 21
    b. Axials restricted to last two whorls 27
21. a. Row of nodules present abapical to sutures 24
    b. No row of nodules present 22
22. a. Shell inflated, larger than 3mm ..... *frauenfeldi* (Frauenfeld)
    b. Shell narrowly conical, about 3mm or less 23



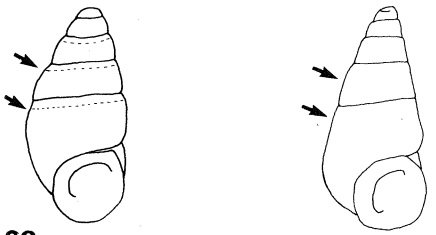
23. a. Axials rounded and about equal in width to interspaces ..... *kershawi* (T. Woods)
    b. Axials flat with very narrow interspaces ..... *costata* (Hedley)
24. a. Axials broken into 3 rows of nodules by spiral grooves ..... *castella* (Laseron)
    b. Axials simple below row of nodules immediately abapical to sutures . 25
25. a. Spire outlines convex, axials often weak on first 2 whorls ..... *olivacea olivacea* (Frauenfeld)
    b. Spire outlines more or less straight 26
26. a. Axials simple, straight, of uniform size ..... *tumida* (T. Woods)
    b. Axials irregular in shape, alternating large and small .. *flindersii* (T. Woods)



27. a. Shell inflated, with spiral depression in middle of body whorl..... *salebrosa* (Frauenfeld)
    b. Shell narrowly conical 28

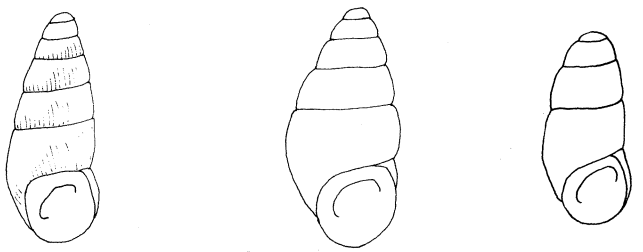


28. a. Outline of spire lightly convex, (sometimes smooth) with pale band abapical to sutures ..... *albizona* (Laseron)
b. Outline of spire straight with no bands (sometimes smooth) .... *tasmanica* (T. Woods)



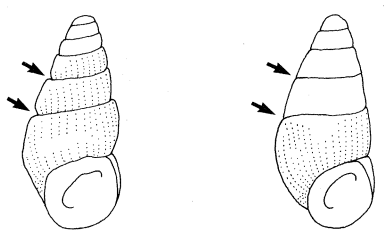
28a 28b

29. a. Shell elongate ..... *columnaria* (Hedley)
b. Shell not elongate 30



29a 29b 29b

30. a. Shell more than 2.8 mm in length 31
b. Shell less than 2.8 mm in length ..... *oblata* (Laseron)
31. a. Sutures deeply indented ..... *varicifera relata* (Cotton)
b. Sutures not deeply indented ..... *paucirugosa* nov.

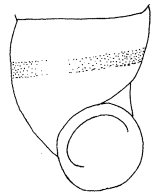


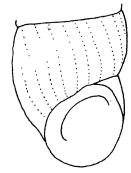
31a 31b

KEY TO THE RECENT TROPICAL AUSTRALIAN AND INDO-PACIFIC SPECIES

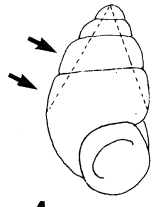
1. a. Teleoconch smooth 2
b. Teleoconch sculptured with axial ribs 6
2. a. Shell larger than 2 mm in length 3
b. Shell smaller than 2 mm in length 4

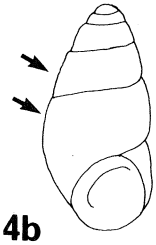
3. a. Shell about 2.2mm in length, with pale central band, aperture strongly contracted ..... *eurychades* (Watson)
b. Shell about 2.3mm in length, with dark orange-brown axial lines, aperture barely contracted ..... *perdigna* (Laseron)


3a

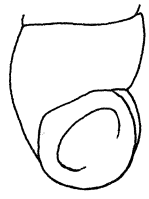

3b

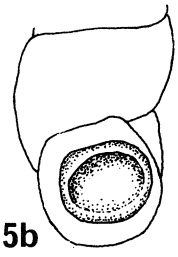
4. a. Spire outline convex 5
b. Spire outline straight ..... *compressa* (Laseron)


4a

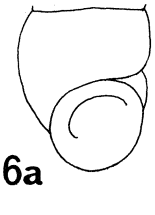

4b

5. a. Aperture simple ..... *tropica* (Laseron)
b. Aperture with internal rim ..... *incipiens* (Laseron)


5a


5b

6. a. Periphery rounded 7
b. Periphery sharply angled ..... *angulata* nov.


6a


6b

LOCATION OF TYPES: *Rissoa approxima* T. M. Lectotype and paralectotype, here chosen (7744/E403, TM10, 891).

Rissoa cyclostoma var *rosea* T.M. 2 syntypes (7766/E425, TM5476).

Estea gemma A.M. Lectotype (C. 79211) and 17 paralectotypes (C. 79212) here chosen.

TYPE LOCALITIES: *Rissoa approxima*. Tamar Heads, Tasm.

Rissoa cyclostoma var *rosea*. Blackmans Bay, Tasm.

Estea gemma. Crookhaven Heads, N.S.W., on algae.

ADDITIONAL MATERIAL EXAMINED: Ballina, N.S.W., open coast under stones, 6 Jan. 1969, coll. W. F. Ponder (A.M.). Forster Beach, N.S.W., Voorwinde Coll. (A.M.). Hawks Nest, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll., 5 lots (A.M.). Off Port Stephens, N.S.W., 64 m, Voorwinde Coll. (A.M.). Port Stephens, N.S.W., Voorwinde Coll., 3 lots (A.M.). Patonga Beach, Hawkesbury River, N.S.W., Voorwinde Coll. (A.M.). Collaroy Beach, Sydney, N.S.W., Voorwinde Coll., 2 lots (A.M.). Long Reef, Collaroy, Sydney, N.S.W., J. Voorwinde Coll., 2 lots (A.M.). Fairlight, Sydney, N.S.W., 3-5 m, Voorwinde Coll. (A.M.). Manly, Sydney, N.S.W., Voorwinde Coll., 2 lots (A.M.). Forty Baskets Beach, Sydney, N.S.W., Voorwinde Coll. (A.M.). Middle Harbour, Sydney, N.S.W.; 5 m, Voorwinde Coll.; coll. C. Hedley (A.M.). Chinamans Beach, Sydney, N.S.W., 3-5m, Voorwinde Coll., 3 lots (A.M.). E. side of Sow & Pigs Reef, Sydney Harbour, N.S.W., near the rocks, rocky bottom, 1865, coll. J. Brazier (A.M.). Port Jackson, Sydney, N.S.W., dredged, Voorwinde Coll. (A.M.). Sydney Harbour, N.S.W., coll. C. Hedley (A.M.). Little Coogee Bay, Sydney, N.S.W., 21 Apr. 1895, coll. J. Brazier (A.M.). Cronulla, Sydney, N.S.W., Voorwinde Coll. (A.M.). Werri Beach, near Gerringong, N.S.W., Voorwinde Coll. (A.M.). Crookhaven Heads, southern N.S.W., C. Laseron Coll.; on algae, Voorwinde Coll., 2 lots (A.M.). Ulladulla, N.S.W., Voorwinde Coll., 2 lots (A.M.). S. side of Ulladulla, N.S.W., outside breakwater on moderately exposed rock platform, on coralline algae, 5 Jan. 1970, coll. W. F. Ponder and P. H. Colman (A.M.). Batemans Bay, N.S.W., Voorwinde Coll. (A.M.). Shelly Beach, Bermagui, N.S.W., Voorwinde Coll. (A.M.). Eden Harbour, N.S.W., Voorwinde Coll. (A.M.). Bass Strait, pres. W. L. May (A.M.). Deal (Erith) Is., Bass Strait, N.E. Tasm., on algae, 6 m, 6 May 1974, coll. S.A. Shepherd (A.M.). Stanley, N. Tasm. (T.M.). Freestone Cove, Wynyard, N. Tasm., on algae, low tide, 12 Oct. 1971, coll. J. Beu (A.M). Badger Head, N. Tasm. (T.M.). West Head, Green Beach, N. Tasm., rocky shore, under stones, in lower littoral amongst coralline algae, Mar. 1973, coll. R. Kershaw (A.M.). Ansons Bay, E. Tasm., 28 Dec. 1966, coll. A. Dartnall (T.M.). Tamar Heads, Tasm., Oct. 1913 (A.M.). Spring Beach, E. Tasm., 2 Feb. 1970, coll. E. Turner (T.M.). Reidle Bay, Maria Is., E. Tasm., Sept. 1967, coll. J. Thwaites (T.M.). Dunally, S. Tasm. (T.M.). Eaglehawk Neck, S. Tasm. (A.M.). Eaglehawk Neck, S. Tasm., pres. C. Hedley, 7 lots (A.M.). Eaglehawk Neck, S. Tasm., 3 June 1967, coll. A. Dartnall, 2 lots (T.M.). Pirates Bay, Eaglehawk Neck, S. Tasm, (30 Mar.-2 Apr. 1970) on *Caulerpa*; in beach sand under *Durvillea* holdfasts; under stones; on intertidal rocks on coralline algae; coll. W. F. Ponder, 10 lots (A.M.). Wedge Bay, S. Tasm., 7 m, Voorwinde Coll. 2 lots (A.M.). Browns River, Tasm., pres. C. Hedley (A.M.). Frederick Henry Bay, S. Tasm., pres. W. L. May (A.M.; S.A.M.). 3 km N. of Granville Harbour, W. Tasm., 23 Nov. 1967, coll. A Dartnall (T.M.). Marrawah, N.W. Tasm., Jan. 1956, coll. E. Aves (T.M.). Off Gabo Is., Vic., 25 m, coll. R. Bell (A.M.). Cape Everard, Vic., 6-9 m, in holdfasts of *Phyllospora*, Feb. 1973, coll. P. Hutchings (A.M.). Bastion Point, Vic., intertidal crevice fauna, 19 Feb. 1973, coll. P. Hutchings, 2 lots (A.M.). N.E. side Bastion Point, Mallacoota, Vic., coralline and short brown algae on exposed rocks, 9 Jan. 1970, coll. W. F. Ponder & P. H. Colman, 2 lots (A.M.). Red Bluff, near Lake Tyers, Vic., lower littoral, on small rocky, exposed point on short red algae; on short brown algae; 11 Jan. 1970, coll. W. F. Ponder & P. H. Colman, 3 lots (A.M.). Western Port, Vic., (A.M.); Gatliff Coll., 2 lots (N.M.V.). Cowes, Phillip Is., Vic., Voorwinde Coll. (A.M.). Shoreham, Vic., Gatliff Coll. (N.M.V.). Flinders, Vic., in beach sand, Voorwinde Coll. (A.M.). Flinders Ocean

Beach Platform, Vic., lower littoral rockpools, beneath stones and on algae, 4 May 1967 (2 lots) coll. B. J. Smith; short algae washings, 16 Feb. 1969, coll. W. F. Ponder & B. J. Smith. Kilcunda, Vic., Gabriel Coll. (N.M.V.). Portsea, Vic., Gatliff Coll. (N.M.V.; A.M.). Moonlight Bay, Vic., rock platform, 11 Mar. 1973, coll. Marine Study Group (A.M.). Port MacDonnell, E.S.A., Verco Coll. (S.A.M.). Off Middle Point, near Cape Northumberland, S.A., 13 m, on algae, 19 Mar. 1974, coll. S. A. Shepherd (A.M.). Robe, S.A., Verco Coll. (S.A.M.). Guichen Bay, S.A., Verco Coll. (S.A.M.). Between Cape Jaffa, Vic., & Kangaroo Is., S.A., 75-155 m, 24-26 July 1962, H.M.A.S. "Gascoyne" G2/71, 72, 76, 77/62 (A.M.). N.W. of Cape Borda, S.A., 64 m (S.A.M.). 3 km S. of Normanville, S.A., on rock strewn platform, medium exposure, 12 Jan. 1971, coll. W. F. Ponder (A.M.). Normanville, S.A., Voorwinde Coll. (A.M.). Glenelg, S.A., Verco Coll. (S.A.M.). St. Vincents Gulf, S.A., Voorwinde Coll. (A.M.). Hardwicke Bay, S.A., pres. H. L. Kesteven (A.M.). Arno Bay, S.A., Garrard Coll. (A.M.). Tumby Bay, S.A., coll J. Thompson, Voorwinde Coll. (A.M.). The Heap, Tumby Bay, N. of Port Lincoln, S.A., coll J. Thompson, Voorwinde Coll. (A.M.). 64 km S. of Cape Wiles, S.A., 183 m, "Endeavour", Aug. 1909 (A.M.). Venus Bay, S.A., Verco Coll. (S.A.M.). Fowlers Bay, S.A., Verco Coll. (S.A.M.). Kilcarnup, N. side of Margaret River, S.W.A., shell sand on beach, 1 Jan. 1972, coll W. F. Ponder (A.M.). Cape Naturaliste, S.W.A., in shell sand, Mar. 1970, coll. J. Hewitt (A.M.). Murchison River mouth, W.A., on rocks at S. side, Oct. 1967 & Oct. 1969, coll. F. H. Plant (A.M.). Yardie Creek, S. of N.W. Cape, W.A., seaward side of mouth, Sep. 1969, coll. F. H. Plant (A.M.). (The last 2 records require confirmation.)

FOSSIL RECORD: Upper Pliocene: Cameron Inlet Formation, Hill's Dam at foot of Dutchman (E. side), Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.).

DISTRIBUTION AND HABITAT: Northern N.S.W. to North West Cape, W. Australia. Lives in the lower intertidal and shallow sublittoral zones on algae, and beneath rocks and stones on open coasts (see fig. 15). The deep-water records refer to dead shells which are probably remnants of a Pleistocene shore-line. Known from the Upper Pliocene of Flinders Island.

REMARKS: This species is rather variable in shape (see figs 3i-l), size and colour. Some populations from the same type of habitat are very constant; others are variable. At one extreme is a form which is usually pink and has a relatively broad spire and small aperture, with rather flat whorls and a swollen spire outline. This form grades through to a longer spired, dark-coloured form with an expanded aperture and convex whorls. This latter form is the one normally encountered in N.S.W. and was named *gemma* by Laseron. Similar shells are seen through other parts of the range of *approxima* and they cannot be satisfactorily separated from the typical form so that *gemma* is here considered to be a synonym of *approxima*.

Pisinna approxima is a distinctive species easily identified with its usually convex whorls, thin inner lip, tall spire and glossy red shell. Some forms of *approxima* approach *vincula* (Laseron) and *circumlabra* nov. (see 'remarks' under those species).

Two lots in the S.A.M. (Venus Bay and Glenelg) identified and recorded by Cotton (1944) as *Scrobs pellyae* (Nevill, 1881), are *P. approxima*. Most of the remainder of Cotton's *pellyae* are *Badepigrus petterdi* (Brazier, 1895), with which *pellyae* Nevill is probably synonymous and is the earlier name.

Pisinna bicolor (Petterd). Fig. 6g.

Rissoa bicolor Petterd, 1884: 137; Pritchard & Gatliff, 1902: 103.

Amphithalamus bicolor.—Hedley, 1911: 106.

DIAGNOSIS: Shell—Of moderate size for genus, solid, smooth, with a tall spire and rounded body whorl.

Protoconch—1½ whorls, dome-shaped, typical, orange to dark red.

Teleoconch—Spire tall, outlines straight, whorls 4, flat, body whorl sometimes slightly swollen, with its suture narrowly stepped. Periphery evenly rounded or with very slight subangle. Surface smooth, shining, with very weak growth lines. Aperture oval to subcircular. Inner lip rather broad, slightly advanced over parietal region. Adapical section of inner lip considerably raised from base. Varix rather prominent, close behind edge of outer lip. Colour dark purple fading to reddish-purple or pinkish-red on spire, with orange-brown or yellowish-brown body whorl; white line at abapical edge of suture on spire, becoming a broad white band on last two whorls. Inner lip orange-brown, outer lip white, aperture brown within.

Dimensions:	length	diameter
Neotype	3.96 mm	1.80 mm
(original dimensions given as 3.5 mm × 2 mm)		
Paratype	3.40	1.50

LOCATION OF TYPES: T.M. (7745/E404, TM 5479) neotype and one paratype.

TYPE LOCALITY: "North coast" of Tasmania (error?). Locality of neotype "South Tasmania".

ADDITIONAL MATERIAL EXAMINED: Derwent Estuary, Tasm., T. A. Garrard Coll. (A.M.). Tasmania, exch. C. E. Beddome, 3 lots (A.M.); 2 lots (N.M.V.). N. of Cape Lodi, E. Tasm., 33 m, 41°50'S, 148°17.3'E, fine medium sand, 24 Mar. 1973, B.M.R. stn S73-2025, M.T. "Sprightly", coll. P. H. Colman (A.M.). Portsea, Vic. pres. J. H. Gatliff (A.M.).

DISTRIBUTION AND HABITAT: See remarks and fig. 17.

REMARKS: The type locality is probably erroneous as no other specimens have been seen from the "North coast" of Tasmania and it is certainly not "abundant at low water" as stated in the original description. The type is apparently lost but the description and dimensions leave little doubt as to the identity of this species. The erection of a neotype is considered to be advisable because Petterd's type material has not been located and there has been some confusion over the identity of this species. One of us (W.F.P.) has personally searched the N.M.V., the A.M., the Queen Victoria Museum, Launceston and the B.M.N.H. but has been unsuccessful in locating any specimens of *bicolor* labelled "North coast" of Tasmania among specimens presented by Petterd. Mr. A. Dartnall of the Tasmanian Museum has indicated that there is also none of this material in that museum. Several lots from other localities, however, identified as *P. bicolor* and originating from Petterd have been examined.

The specimen chosen as the neotype is probably part of the original material obtained from Petterd. As Petterd's type locality is assumed to be in error, the different location for the neotype is justified.

The original description of *bicolor* fits *frenchiensis* moderately well, although the dimensions (3.5 mm × 2 mm) are greater than they would be for that species. *Pisinna nitida* nov. is even larger and does not have a littoral habitat. The original description is sufficiently vague not to have any outstanding discrepancies with *frenchiensis* or *nitida* except that the colour is given as "rich-brown, with a broad sordidly white band next to the suture".

This species is presumably restricted to relatively small areas in the shallow sublittoral zone as it has only been obtained in one of the numerous shelf bottom samples and in none of the littoral samples seen from Tasmania during the present study. A large number of specimens in several lots obtained from C. E. Beddome labelled "Tasmania" in the A.M. all have a very similar appearance and were probably collected from the same locality. They may even represent part of the original lot obtained from Petterd.

This species is similar to *P. tasmanica* (T. Woods) in having an elongate, often pinkish coloured shell. *P. bicolor* is larger, and is completely smooth, whereas *tasmanica* usually has at least weak axial ornament on the body whorl. In addition, the two species differ in apertural details, especially in the outer lip being opisthoclinal in *bicolor* (whereas it is suborthoclinal in *tasmanica*) and in the strong varix in *bicolor*, that of *tasmanica* being weak or absent.

This species name has been mistakenly used for a large species widespread on the continental shelf, which is described as *P. nitida* herein.

Typical *P. bicolor* has not been previously figured. The specimen figured by Gatliff & Gabriel (1913a) as this species is *P. tasmanica* from off Wilsons Promontory. Pritchard & Gatliff (1902) record *bicolor* from Portsea, Victoria and specimens in the A.M. from that locality (donated by J. H. Gatliff) are *P. bicolor* (Petterd). However, a lot of 4 specimens in the Gatliff collection in the N.M.V. from Portsea, and also identified as *bicolor*, are *P. nitida*. Cotton's (1944) deep-water South Australian records refer to *P. voorwindei* nov.

Pisinna castella (Laseron). Fig. 2a.

Estea castella Laseron, 1950: 268, fig. 32.

Nodulestea castella.—Iredale, 1955: 81; Iredale & McMichael, 1962: 41.

DIAGNOSIS: Shell—Small, solid, thick, opaque, with 3 spiral cords and numerous axial ribs.

Protoconch—Conical, 1¾ whorls, weakly convex, slightly stepped at sutures. Dark reddish-orange (type faded to yellowish) in colour, with minutely pitted surface.

Teleoconch—Spire convex; 3-3¼ whorls, channelled at sutures, flat or weakly concave between them. First whorl of teleoconch with 2 spiral grooves one adapical and one abapical to sutures. A median spiral groove commences on second whorl of teleoconch and this becomes equal in strength to other grooves on body whorl, lower groove becoming weak on last 1/3 of body whorl. Numerous axial ribs on all whorls (21 on penultimate whorl in type), which extend over base, cut up by grooves to form 3 spiral rows of nodules. Aperture subcircular; inner lip broad, abapical portion much separated from base. Outer lip orthocline or slightly opisthocline. Base rather flat with weak basal ridge. Varix broad, moderately strong. Deep wine-red in colour, mostly due to inner chitinous layer. Edges of aperture yellowish.

Dimensions:	length	diameter
Holotype	1.88 mm	0.90 mm
Fairlight, Sydney in 3-5 m	1.75	0.90

LOCATION OF TYPE: A.M. Holotype (C. 94734).

TYPE LOCALITY: Off Crookhaven, N.S.W., 55-64 m.

ADDITIONAL MATERIAL EXAMINED: Trawled N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll. (A.M.). Moreton Bay, S. Qld (A.M.). Off Flatrock, N. Stradbroke Is., S. Qld, 24-30 m, on algae, 2 Aug. 1971, coll. R. Ibara (A.M.), Off Crowdy Head, N.S.W., 32°38.9'S, 153°0.8'E, 91 m, 16 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Collaroy, Sydney, N.S.W., Voorwinde Coll. (A.M.). Narrabeen, Sydney, N.S.W., Voorwinde Coll., 2 lots (A.M.). The Spit, Middle Harbour, Sydney, N.S.W., Voorwinde Coll. (A.M.). Fairlight, Sydney, N.S.W., 3-5 m, on red algae, Voorwinde Coll. 2 lots (A.M.). North Harbour, Sydney, N.S.W., Voorwinde Coll. (A.M.). Balmoral, Sydney, N.S.W., 11-15 m, Voorwinde Coll. (A.M.). Chinamans Beach, Sydney, N.S.W., 3-7 m,

Voorwinde Coll. (A.M.). Vaucluse, Sydney, N.S.W., Feb. 1953, coll. N. Jackson; under stones below low tide, N. Jackson Coll. (A.M.). Bottle and Glass Rocks, Sydney, N.S.W., 1967, pres. J. Campbell, Voorwinde Coll. (A.M.). Sow & Pigs Reef, Sydney, N.S.W., 11-16 m, Voorwinde Coll. (A.M.). E. side of Sow & Pigs Reef, Sydney, N.S.W., 4 m, 1865, coll. J. Brazier, 2 lots (A.M.). Kurnell, Botany Bay, Sydney, N.S.W., Voorwinde Coll. (A.M.). Gunnamatta Bay, N.S.W., Voorwinde Coll. (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.). S. side of Ulladulla, N.S.W., outside breakwater on moderately exposed rock platform, on small brown algae, 5 Jan. 1970, coll. W. F. Ponder and P. H. Colman (A.M.). S. side of Ulladulla, N.S.W., inside breakwater, on sheltered reef, on small brown algae and on coralline algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Twofold Bay, N.S.W., 46 m, Voorwinde Coll. (A.M.).

DISTRIBUTION AND HABITAT: Southern Queensland (vicinity of Moreton Bay) to southern N.S.W. (Twofold Bay), occasionally found in the lowest portion of the intertidal zone but usually located in the sublittoral where it extends into moderately deep water. It has been found living on algae and beneath stones (see fig. 19).

REMARKS: This is the type species of Iredale's *Nodulestea* and, as Laseron (1950) pointed out, it is very similar, and probably closely related to *P. olivacea olivacea* (Frauenfeld). The main distinguishing feature is the presence of 2 spiral grooves on the body whorl in addition to the groove also present in *olivacea olivacea* which forms the band of nodules abapical to the sutures. The additional grooves cut the axial ribs into 2 additional spiral rows of nodules.

Pisinna circumlabra sp. nov. Figs 3a-b; 11d.

Estea subfusca.—Gabriel, 1956: 9 (non Hutton, 1873).

DIAGNOSIS: Shell—Minute, broadly to medium pupoid, solid, smooth, shining, orange-red spire and yellowish body whorl and a large, round aperture with wide inner lip.

Protoconch—Dome-shaped, of 1½ whorls, wine red with typical sculpture.

Teleoconch—Spire typically short, broad (but sometimes medium), lightly convex, of 2¾-3 slightly convex whorls, the last very large. Surface smooth except for growth lines and exceedingly faint spiral scratches. Aperture relatively large, subcircular, inner lip broadly expanded across parietal region, edge of adapical half of lip almost at right angles to longitudinal axis. Abapical portion well separated from base but not much expanded. Outer lip orthocline, with no varix. Periphery and base evenly convex. Colour of spire whorls reddish-orange or reddish-purple (due to inner layer showing through). Body whorl pale yellowish-brown, aperture (including inner lip) yellowish-white.

Dimensions:	length	diameter
Holotype	1.82 mm	0.92 mm
Figured paratype	1.62	0.87

Operculum—Typical.

Radula—Central teeth 2 + 1 + 2, lateral cusps sharp, narrow, median cusp narrow, cutting edge rounded, a little longer than adjacent cusps. Lateral teeth with long, sharp lateral cusps, 2 + 1 + 4, median cusp blunt, slightly longer than adjacent cusps. Inner marginal teeth with about 14 small, sharp cusps, outer marginals denticulate (fig. 11d).

LOCATION OF TYPES: A.M. Holotype (C. 95783), figured paratype (C. 95782), 40 paratypes (C. 95720) and 20 paratypes (C. 95721).

TYPE LOCALITY: Pirates Bay, Eaglehawk Neck, S.E. Tasm., on intertidal rocks, exposed N. end, on *Lessonia* holdfasts, 2 Apr. 1970, coll. W. F. Ponder (C. 95783, C. 95782, C. 95720). As above, on *Caulerpa*, 30 March, 1970 (C. 95721).

ADDITIONAL MATERIAL EXAMINED: 24 km off Twofold Bay, N.S.W., 75-154 m, 37°26'S, 150°15'E, 19 June 1962, H.M.A.S. "Gascoyne", G2/58-59/62 (A.M.). East Cove, Deal Is., Bass Strait, N.E. Tasm., 147°20'E, 39°30'S, 6-15 m, 3-10 May 1974, coll. S. A. Shepherd (A.M.). Goat Is., near Ulverstone, N. Tasm., on coralline algae, 18 Mar. 1975, coll. W. F. Ponder & R. Kershaw (A.M.). E. of Grassy, King Is., N. Tasm., ca. 58-77 m, H.M.A.S. "Gascoyne" G2/68-70/62, 23 July 1962 (A.M.). Near Elephant Shoal Reef, 6½ km S.E. of King Island, Bass Strait, 14 m (?), 1937 (N.M.V.). Pirates Bay, Eaglehawk Neck, S.E. Tasm., on intertidal rocks on brown algae; on coralline algae, under *Durvillea* holdfasts, 30-31 Mar. 1970, coll. W. F. Ponder (A.M.). Bond Bay, Pt. Davey, S.W. Tasm., Feb. 1968 (T.M.). 3 km N. of Granville Harbour, W. Tasm., 23 Nov. 1967, coll. A. J. Dartnall (T.M.). S.S.E. side of Gabo Is., E. Vic., red algae, 28 m, Feb. 1973, coll. P. Hutchings (A.M.). S.E.E. side of Gabo Is., E. Vic., below lighthouse, in detritus 15-18 m, Feb. 1973, coll. P. Hutchings (A.M.). 58 km S. of Cape Conran, off Gippsland, Vic., stn. 10, 148°38'40"E, 38°18'20"S, 220-266 m, "Esso-Gipps", May 1969, coll. C. Phipps (A.M.). Flinders Ocean Beach Platform, Vic., lower littoral, under stones and on algae, 4 May 1967, coll. B. J. Smith (A.M.). Flinders, Vic. (N.M.V.). Ocean side of Queenscliff, Port Phillip, Vic., on rocky platform, on small algae, 13 Feb. 1969, coll. W. F. Ponder, 2 lots (A.M.). Point Lonsdale, Vic., near Geelong, under stones and large brown algae, 18 Sept. 1973, 2 lots, coll. W. F. Ponder & R. Burn (A.M.). Portland, Vic., Gabriel Coll. (N.M.V.). Guichen Bay, S.A., Verco Coll. (S.A.M.).

DISTRIBUTION AND HABITAT: Bass Strait, Tasmania and Victoria, lower littoral and sublittoral, under stones and on algae (see fig. 18). Dead material also found on the continental shelf.

REMARKS: The typical broad form of this species is similar to *P. dubitabilis* (Tate) and *megastoma* sp. nov. in shape but differs in its broadly expanded inner lip, that of *dubitabilis* and *megastoma* being narrow with a concave edge. *P. circumlabra* has a paler coloration than any of the sympatric smooth species except *approxima* which is smaller, narrower, with a thinner shell, more convex whorls, more expanded aperture and a narrow, thin, inner lip. The smaller forms of *frenchiensis* also approach the narrower forms of *circumlabra* in shape but the inner lip is always narrower and the two species differ in colour. *P. vincula* is similar, but has a more cylindrical shape and an angled to subangled body whorl.

Pisinna columnaria (Hedley & May). Fig. 2d.

Rissoa columnaria Hedley & May, 1908: 117, pl. 22, fig. 9.

Estea columnaria.—Iredale, 1915: 451; May, 1921: 54; May, 1923: pl. 24, fig. 4; Cotton, 1944: 288.

DIAGNOSIS: Shell—Small, elongate — pupoid, moderately solid. Spire pinkish and base yellow; shining, with very fine axial riblets.

Protoconch—Dome-shaped, reddish, minutely pitted, of 1½ weakly convex whorls.

Teleoconch—Spire outline very weakly convex; whorls 4, weakly convex, usually with an indistinct ridge abapical to the suture followed by a shallow furrow. Numerous, close set fine axial riblets on all whorls, these being crisper on the last two whorls than on others. Ribs prosocline, curved on most of shell, but nearly straight on last half of body whorl and extend on to base. A trace of spiral sculpture between ribs (only visible under high magnification). Base weakly convex, usually with very weak to moderate basal ridge. Aperture protrudes beyond line of spire. Inner lip broad, not much elevated from base; outer lip horizontal, considerably thickened within. Varix moderate to weak, immediately behind outer lip. Colour whitish-yellow, with reddish spire (all material somewhat faded).

Dimensions:	length	diameter
Lectotype	2.65 mm	1.00 mm
Paralectotypes	2.75	1.05
	2.60	1.00

LOCATION OF TYPES: A.M. Lectotype (C. 29047) and 12 paralectotypes (C. 79572). Several paralectotypes in T.M. (7142/E11, C. 331; 442) N.M.V., and S.A.M.

TYPE LOCALITY: 11 km E. of Cape Pillar, S.E. Tasm., in 183 m.

ADDITIONAL MATERIAL EXAMINED: 3 km S. of Tasman Head, South Bruny Is., S.E. Tasm., 43°33.4'S, 147°19.2'E, 73 m, 24 Mar. 1970, coll. W. F. Ponder, F.R.V. "Penghana" (A.M.). D'Entrecasteaux Channel, S. Tasm., 24 Apr. 1965, Voorwinde Coll., H.M.A.S. "Moresby" (A.M.) (locality doubtful). N.W. of Sandy Cape, N.W. Tasm., 41°09.4'S, 144°10.6'E, 132 m, 14 Apr. 1973, B.M.R. stn S73-2120, M.T. "Sprightly" (A.M.).

DISTRIBUTION AND HABITAT: 73-183 metres, Tasmania (see fig. 19).

REMARKS: This species is similar to *P. micronema* (Suter, 1898) from southern New Zealand, but differs in its narrower shell, weaker spiral and axial sculpture, and in the aperture being less raised from the base.

The record of *columnaria* by Gatliff & Gabriel (1913b: 78) from off Wilsons Promontory refers to *P. oblata* (Laseron).

P. columnaria differs from all others in Australian waters by its long, narrow spire and the weak, close, axial threads on all whorls.

Pisinna costata (Hedley). Figs 4a-b; 12a-b.

Amphithalamus costatus Hedley, 1911: 104, pl. 19, fig. 24.

Scrobs costatus.—Cotton, 1944: 311.

Estea hoggartae Gabriel, 1956: 6, fig. 4.

DIAGNOSIS: Shell—Small, pupoid, solid, shining, with strongly convex whorls and heavy, flat, close axial ribs.

Protoconch—Dome-shaped, 1½ whorls, with caniculate suture. Sculptured with weak spiral ridges and minute pits (fig. 12a-b). Varix strong, colour pinkish to yellowish-brown, but fades to white.

Teleoconch—Spire lightly convex; 3¼-3½ whorls, very strongly convex, sutures caniculate. Axial ribs heavy, flat-topped, with very narrow, rather deep interspaces. Ribs extend over weakly convex base. Aperture subcircular, lips thickened within; outer lip opisthocline, inner lip slightly raised above parietal region. Varix very weak or absent. Colour yellowish-white, with rather pale reddish-purple inner layer showing through on spire. Fades to white.

Dimensions:	length	diameter
Holotype	3.10 mm	1.40 mm
Figured paratype of *Estea hoggartae.*	3.15	1.45

LOCATION OF TYPES: *Amphithalamus costatus.* A.M. Holotype (E. 4253) and 17 paratypes (E. 4253 and C. 31878).

Estea hoggartae. N.M.V. Holotype (F. 16127) and 3 paratypes (F. 16128).

TYPE LOCALITIES: *Amphithalamus costatus.* 64 km, S. of Cape Wiles, S.A., 183 m, F.R.V. "Endeavour".

Estea hoggartae. On Bass Strait Cable, between King Island and Stanley, Tasmania. Probably near Elephant Shoal Reef, 6½ km S.E. of King Island, Bass Strait (depth uncertain as it is not clear exactly where this material was collected).

ADDITIONAL MATERIAL EXAMINED: Off S.W. of West Point, N.W. Tasm., 41°09.2'S, 144°24.2'E, 88 m, 14 Apr. 1973, B.M.R. stn 2121, M.T. "Sprightly" (A.M.). 3 km S. Tasman Head, S. Bruny Is., S.E. Tasm., 43°33.45'S, 147°19.21'E, 73 m, 24 Mar. 1970, coll. W. F. Ponder, F.R.V. "Penghana" (A.M.). D'Entrecasteaux Channel, S. Tasm., 24 Apr. 1965, Voorwinde Coll., H.M.A.S. "Moresby" (A.M.) (locality doubtful). E. of Grassy, King Is., Tasm., 58-77 m, 23 July 1962, H.M.A.S. "Gascoyne", stn G2/68-70/62, 2 lots (A.M.). Off Beachport, S.A., 200 m, Verco Coll., 2 lots (S.A.M.). Off Cape Jaffa, S.A., 164 m, Verco Coll., 2 lots (S.A.M.). N.E. of Cape Borda, S.A., 113 m, Verco Coll., 2 lots (S.A.M.). 64 km S. of Cape Wiles, S.A., 182 m (S.A.M.) (topotypes). Between Cape Jaffa and Kangaroo Is., S.A., 75-155 m, 24-26 July 1962, H.M.A.S. "Gascoyne", stn G2/71, 72, 76, 77/62 (A.M.). 80 km S.W. of Cape Adieu, Gt. Aust. Bight, S.A., 32°42'S, 131°27'E, 79 m, 4 July 1962, H.M.A.S. "Gascoyne", stn G2/90/62 (A.M.). Gt. Aust. Bight, S.A., 33°05'S, 128°40'E, 75 m, 5 July 1962, H.M.A.S. "Gascoyne", stn G2/97/62 (A.M.). Off St. Francis Is., S.A., 64 m, Verco Coll., 2 lots (S.A.M.). St. Vincent Gulf, S.A., 46 m, Verco Coll. (S.A.M.). Spencers Gulf, S.A., 73 m, Verco Coll. (S.A.M.). Investigator Strait, S.A., 36 m, Verco Coll. (S.A.M.). E. of Hood Point, W.A., 34°21'S, 121°16'E, 79 m, 9 July 1962, H.M.A.S. "Gascoyne", stn G2/109/62 (A.M.). E. off Cheyne Bay, W.A., 34°55'S, 119°00'E, 75 m, 7 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/150/62, 2 lots (A.M.). S. of Wilson Inlet, W.A., 35°12'S, 117°00'E, 73-77 m, 8 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/160/62 (A.M.). W. of Jurien Bay, W.A., 30°45'S, 114°51'E, 143 m, 11 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/180/62 (A.M.).

DISTRIBUTION AND HABITAT: Tasmania to S.W. Australia on the continental shelf in 36-200 metres (see fig. 16).

REMARKS: This species is readily distinguished by its broad, flattened axials which have very narrow interspaces between them, and its deep sutures.

A possible example of mimicry either of, or by, *P. costata* occurs with a species of *Rissoina*, *R. axisculpta* Cotton, which occurs sympatrically and has virtually identical sculpture on the teleoconch. This style of sculpture is very unusual and has not been seen in any other Australian prosobranch known to the writers.

Estea hoggartae Gabriel is identical to *P. costata*, and as *hoggartae* was not contrasted with *costata*, it can only be assumed that Gabriel was not aware that his species had already been described.

Pisinna dubitabilis (Tate). Fig. 2j.

Rissoa dubius Petterd, 1884: 137; Tryon, 1887: 368; Tate & May, 1901: 391, pl. 26, fig. 71; Pritchard & Gatliff, 1906: 63; May, 1920: 72 (non Defrance, 1827, non Johnston, 1884).

Rissoa dubitabilis Tate, 1899: 232 (nom. nov. pro *Rissoa dubius* Petterd, 1884).

Amphithalamus dubitabilis.—Hedley, 1911: 106.

Estea dubitabilis.—May, 1921: 50; May, 1923: pl. 23, fig. 27.

Dardanula dubitabilis.—Cotton, 1944: 305.

Eatoniella dubitabilis.—Macpherson & Gabriel, 1962: 94.

DIAGNOSIS: Shell—Small, broadly pupoid, solid, smooth, surface somewhat glossy.

Protoconch—1½ whorls, dome-shaped, with spiral rows of minute pits, very dark purple-red.

Teleoconch—Light convex whorls and spire, of 2¾ whorls, body whorl large. Smooth except for growth lines. Aperture large for genus, only moderately thickened, obliquely oval; inner lip narrow, outer edge slightly concave to point where abapical portion free

from base. Outer lip orthocline with distinct but small sinus adapically. No varix. Colour uniform dark reddish-brown, aperture yellow, with brown area on parietal part of inner lip.

Dimensions:	length	diameter
Holotype	2.10 mm	1.05 mm

Operculum — Typical.

Radula — Central teeth 2+1+2, median cusp long, with straight cutting edge, weakly serrated, about 1½ times width of adjacent cusps. Inner lateral cusps about 2/3 length of median cusp, sharp, outer lateral cusps about 1/3 length of inner lateral cusps (almost denticle-like). Lateral teeth 2+1+2, with inner edge bearing a weak denticle. Lateral cusps sharp, median cusps rather blunt, 1 1/3 length of adjacent cusps. Inner marginal teeth with about 10 sharp, small cusps. Outer marginals with about 8 sharp denticles.

LOCATION OF TYPE: T.M. Holotype (7737/E396, TM10885).

TYPE LOCALITY: Tamar Heads, Tasm., on rocks at low water.

ADDITIONAL MATERIAL EXAMINED: "Islands of Bass Strait", 2 lots (A.M.). Green Cape, Maria Is., E. Tasm., 6 m, 26 Mar. 1970, on sublittoral algae, coll. W. F. Ponder & D. C. Wolfe (A.M.). Pirates Bay, Eaglehawk Neck, S. Tasm., 31 Mar. 1970, on *Caulerpa;* brown algae; coralline algae; in beach sand, coll. W. F. Ponder (A.M.). Fossil Is., Eaglehawk Neck, S.E. Tasm., 3 June 1967, coll. A. J. Dartnall (T.M.). Wedge Bay, S. Tasm., 7 m, Voorwinde Coll. (A.M.). Dunally, S.E. Tasm., 30 June 1965, coll. L. Crofts & N. Patterson (T.M.). Tinderbox, S. Tasm., 12 Apr. 1967, coll. E. Aves (T.M.). Gordon, S. Tasm., 15 Apr. 1967, coll. A. J. Dartnall (T.M.). 3 km N. of Granville Harbour, W. Tasm., 23 Nov. 1967, coll. A. J. Dartnall (T.M.). Western Port, Vic. (N.M.V.). Flinders, Vic., ocean beach platform, on short algae, 16 Feb. 1969, coll. W. F. Ponder & B. J. Smith (A.M.). Portland, Vic., Gabriel Coll. (N.M.V.). Portsea, Vic. (N.M.V.). Lorne, Vic. (N.M.V.). Port MacDonnell, S.A., Verco Coll. (S.A.M.). Guichen Bay, S.A., Verco Coll. (S.A.M.). Robe, S.A., Verco Coll. (S.A.M.).

FOSSIL RECORD: Upper Pliocene: Cameron Inlet Formation, Hill's Dam at foot of Dutchman (E. side), Flinders Island, Nov. 1964, coll. T. A. Darragh (N.M.V.).

DISTRIBUTION AND HABITAT: Eastern South Australia, western Victoria, and Tasmania, from low tide to shallow sublittoral on algae (see fig. 17).

REMARKS: This species is distinguished by its squat, smooth shell and rather flat whorls. *P. frenchiensis* has a relatively longer spire and often has narrow colour bands which are never present in *dubitabilis.* The outer edge of the inner lip is straight or slightly convex in *frenchiensis,* never concave when mature as in *dubitabilis. P. megastoma* nov. has a similar outline to *P. dubitabilis* but has a relatively larger, more nearly circular aperture and more convex whorls. In addition the apertural lips are more expanded in *megastoma,* with the abapical portion of the inner lip more separated from the base than in *dubitabilis.* The radulae in the 3 species also show a number of differences.

Cotton's (1944) record of *dubitabilis* from "55 fathoms, Cape Borda, S.A." is based on one very worn specimen which is possibly this species but its identity is impossible to establish with certainty.

Pisinna flindersii (T. Woods). Fig. 5a.

Rissoina flindersii T. Woods, 1877b: 154.

Rissoia (Amphithalamus) flindersii.—May, 1903: 111, text fig. 8.

Amphithalamus flindersii.—Hedley, 1911: 106.

Estea flindersi.—May, 1921: 51; May, 1923: pl. 24, fig. 8.

Subestea flindersi.—Cotton, 1944: 292; Macpherson & Gabriel, 1962: 92.

DIAGNOSIS: Shell—Small, solid, with heavy axial folds and twice as many nodules abapical to sutures.

Protoconch—Typical, of 1½ whorls; faded to white in all available specimens.

Teleoconch—Spire outline very slightly convex, axial folds render sutures crenulate. 5 whorls, each slightly concave adapically, contracted to suture abapically. Sculpture of strong axial folds, rather irregular in shape, about 10 on penultimate whorl, with a row of smaller, weak to moderately strong, nodules abapical to sutures, these being twice as numerous as the axial folds. Folds subobsolete on last 1/3 of body whorl. Base convex. Aperture oval; inner lip rather thin, simple; outer lip thin, slightly produced ventrally in anterior section. Varix weak, broad. Colour yellowish-white to pale brown, axial folds paler than rest of shell (all specimens seen are faded).

Dimensions:	length	diameter
Figured syntype	3.45 mm	1.55 mm

LOCATION OF TYPES: Syntypes (3), T.M. (7747A/E406A, TM 5486).

TYPE LOCALITY: N.W. coast of Tasm., coll. W.F. Petterd.

ADDITIONAL MATERIAL EXAMINED: Largs Bay Jetty, S.A., Verco Coll. (S.A.M.). St. Vincent's Gulf, S.A., Verco Coll. (S.A.M.; N.M.V.). Sceale Bay, S.A., Verco Coll. (S.A.M.). S. of St. Francis Is., S.A., 64 m, Verco Coll. (A.M.; S.A.M.). The Heap, Tumby Bay, S.A., coll. J. Thompson, Voorwinde Coll. (A.M.). Great Aust. Bight, S.A., 33°05'S, 128°40'E, 75 m, 5 July 1962, H.M.A.S. "Gascoyne", stn G2/97/62 (A.M.). 80 km S.W. of Cape Adieu, Great Aust. Bight, S.A., 32°42'S, 131°27'E, ca. 79 m, 4 July 1962, H.M.A.S. "Gascoyne", stn G2/90/62 (A.M.).

DISTRIBUTION AND HABITAT: N.W. Tasmania to the Great Australian Bight (see fig. 16).

REMARKS: This species is easily recognised by its strong axial folds and row of nodules abapical to the suture, with the nodules twice as numerous as the folds.

Cotton (1944: 292) recorded *flindersi* from Hopetoun, W. Australia, but his specimens are not a species of *Pisinna*.

Pisinna frauenfeldi (Frauenfeld). Figs 4e-f; 13h.

Rissoa frauenfeldi Frauenfeld (from Schwartz v. Mohrenstern MS), 1867: 10, pl. 2, fig. 13; Weinkauff, 1885: 136, pl. 6, fig. 22, 23, 24; Tryon, 1887: 340, pl. 68, fig. 86; Tate, 1899: 232 (in part).

Rissoia frauenfeldi.—Angas, 1877: 187; Whitelegge, 1889: 104.

Rissoia (Amphithalamus) frauenfeldi (sic.). — Henn & Brazier, 1894: 174.

Amphithalamus frauenfeldi.—Hedley, 1911: 106.

Estea frauenfeldi.—Hedley, 1918:53.

Estea jervisensis Laseron, 1950: 269, fig. 34.

Estea narrabeenensis Laseron, 1950: 270, fig. 39.

Dardanula frauenfeldi.— Iredale & McMichael, 1962: 41.

Dardanula narrabeenensis.—Iredale & McMichael, 1962: 41.

Dardanula jervisensis.—Iredale & McMichael, 1962: 41.

DIAGNOSIS: Shell—Of rather large size for genus, solid, ovate-conical, with prominent axial ribs on all whorls and orange-brown and mottled white in colour.

Protoconch—Dome-shaped, orange-red, of 1½ whorls, sculptured with spiral rows of minute pits.

Teleoconch—Ovate-conical, spire slightly convex, whorls 3½-4, weakly to moderately convex, sutures incised. Axial ribs rounded, usually prominent but somewhat variable in strength; interstices about ½ width of ribs. Ribs present on all whorls but weak on first whorl and obsolete on last ¼ of body whorl; usually oblique (prosocline), especially on body whorl. Ribs fade on base and usually absent on abapical half of base. 24-26 ribs on penultimate whorl. Indistinct spiral scratches only other sculpture. Base very slightly convex. Aperture typical, rather large, outer lip slightly opisthocline or orthocline, inner lip separated from base abapically. A minute chink behind inner lip forms a false umbilicus. Varix absent. Colour rich golden-brown or orange-brown, with diffuse milky-white band (white coloration usually restricted to axial ribs alone) on middle or entire adapical half of body whorl, represented on spire whorls by a series of blotches adapical to sutures. Abapical part of whorls with a few white streaks and blotches, but these not present on base. Aperture and abapical base yellowish, adapical part of inner lip orange-brown.

Dimensions:	length	diameter
Lectotype	3.2 mm	1.5 mm
Lectotype of *narrabeenensis*	3.45	1.60
Lectotype of *jervisensis*	3.70	1.82

Operculum—Typical, muscle insertion area about 2/3 of surface area (fig. 13h).

Radula — Central teeth 2+1+2, middle cusp about twice width of adjacent cusps, outer cusps about ½ length of inner. Lateral teeth 2+1+5 (+denticle on inner side), main cusp about twice width of adjacent cusps, with bluntly rounded cutting edge. Inner marginal teeth with about 16-17 small, sharp cusps; outer marginal finely denticulate.

LOCATION OF TYPES: *Rissoa frauenfeldi* Naturhistorisches Museum, Vienna. Lectotype and 1 paralectotype (no number). Here chosen.

Estea jervisensis. A.M. Lectotype (C. 95570) and 18 paralectotypes (C. 95056). Here chosen.

Estea narrabeenensis. A.M. Lectotype (C. 95571) and 3 paralectotypes (C. 95057). Here chosen.

TYPE LOCALITIES. *Rissoa frauenfeldi.* "Sidney" (=Sydney, N.S.W.).

Estea jervisensis. Huskisson, Jervis Bay, N.S.W.

Estea narrabeenensis. Long Reef, Collaroy, N.S.W., under stones.

ADDITIONAL MATERIAL EXAMINED: Moreton Bay, S. Qld (A.M.). Off Flatrock, N. Stradbroke Is., S. Qld, 24-30 m, on algae, 2 Aug. 1971, coll. R. Ibara (A.M.). Yamba, N.S.W., coll. J. Kerslake (A.M.). Woolgoolga, N.S.W., coll. Poppins, Iredale Coll., 2 lots (A.M.). Off Port Stephens Lighthouse, N.S.W., 73 m, Voorwinde Coll. (A.M.). Off Port Stephens, N.S.W., 64 m, Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Lake Macquarie, N.S.W., coll. R. L. Cherry (A.M.). Catherine Hill Bay, near Swansea, N.S.W., coll. R. L. Cherry (A.M.). Pittwater, Broken Bay, N.S.W., Voorwinde Coll. (A.M.). Long Reef, Sydney, N.S.W.; on algae, Voorwinde Coll.; in 25 m, Laseron Coll. (A.M.). Narrabeen,

Sydney, N.S.W., Voorwinde Coll. (A.M.). North Harbour, Sydney, N.S.W., Voorwinde Coll. (A.M.). Balmoral, Sydney, N.S.W., 6-8 m; 11-15 m; 18 m; Voorwinde Coll. (A.M.). N. end of Balmoral Beach, Sydney, N.S.W., 2 m, 29 Jan. 1973, coll. W. F. Ponder, 2 lots (A.M.). Middle Harbour, Sydney, N.S.W., Voorwinde Coll.; coll. C. Hedley (A.M.). W. Channel, Port Jackson, Sydney, N.S.W., 27 m, Voorwinde Coll. (A.M.). Port Jackson, Sydney, N.S.W., dredged, Voorwinde Coll. (A.M.). Sydney Harbour, N.S.W., coll. A. U. Henn (A.M.). E. of Sydney, N.S.W., 150 m, 18 July 1962, H.M.A.S. "Gascoyne", stn G2/55-56/62 (A.M.). Little Coogee Bay, Sydney, N.S.W., Apr.-July, 1895, coll. J. Brazier, 3 lots (A.M.). Kurnell, Botany Bay, N.S.W., Voorwinde Coll. (A.M.). Bate Bay, Cronulla Beach, N.S.W., 30 April, 1893, coll. J. Brazier (A.M.). Gunnamatta Bay, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Cronulla, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Crookhaven, near Nowra, N.S.W., 55-64 m, Voorwinde Coll. (A.M.). Honeymoon Bay, Jervis Bay, N.S.W., lower littoral, 18 Jan. 1969, coll. W. F. Ponder (A.M.). Sussex Haven, N.S.W. (A.M.). S. side Ulladulla, N.S.W., outside breakwater on moderately exposed rock platform, on small brown algae and on coralline algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). S. side of Ulladulla, N.S.W., inside breakwater on sheltered reef, on small brown algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.). Batemans Bay, N.S.W., Voorwinde Coll. (A.M.). Merimbula Jetty, Merimbula, N.S.W., on exposed side under stones, 7 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Twofold Bay, N.S.W. (N.M.V.). Eden Harbour, N.S.W., dredged, Voorwinde Coll., 2 lots (A.M.). S.E.E. of Gabo Is., Mallacoota, Vic., 28 m, on algae in sponge bed; on red algae; Feb. 1973, coll. P. Hutchings (A.M.).

DISTRIBUTION AND HABITAT: South Queensland to Mallacoota, E. Victoria. On low tidal and sublittoral algae and beneath stones. Not uncommon (see fig. 18).

REMARKS: This is the largest of the axially ribbed species of *Pisinna*. *P. praecidecosta* (Ponder, 1965) from northern New Zealand is similar in size and shape but the axial ribs are terminated abruptly at the periphery and it is uniform brown in colour.

Estea narrabeenensis Laseron and *E. jervisensis* Laseron are both *frauenfeldi*, differing only slightly from one another. Laseron's (1950) concept of *frauenfeldi* is a sculptural form of *albizona* as shown above.

The type material consists of 2 syntypes both of which are *frauenfeldi*. The lectotype (here chosen) is the specimen figured in the original description of the species. It is a narrower shell than normal, the paralectotype being broader and more typical of the species. A third specimen (ex Mohrenstern Coll.) in the Naturhistorisches Museum, Vienna, is the ribbed form of *albizona*.

Pisinna frenchiensis (Gatliff & Gabriel). Figs 3e-h; 11e; 13g.

Rissoa cyclostoma T. Woods, 1877b: 152; Tate & May, 1901: 392; Pritchard & Gatliff, 1902: 104 (non *R. cyclostoma* Recluz, 1843).

Rissoia (Cingula) cyclostoma.—Tryon, 1887: 344 (the figure on pl. 71, fig. 8 is not this species).

Rissoia (Amphithalamus) cyclostoma.—Tate, 1899: 232.

Rissoa frenchiensis Gatliff & Gabriel, 1908: 379 (new name for *R. cyclostoma*, T. Woods).

Rissoa subfusca.—Gatliff & Gabriel, 1910: 94 (non Hutton, 1873).

Amphithalamus frenchiensis.—Hedley, 1911: 106.

Amphithalamus subfuscus.—Hedley, 1911: 108 (non Hutton, 1873).

Estea frenchiensis.—May, 1923: pl. 24, fig. 2; Cotton, 1944: 288.

Dardanula difficilis Gabriel, 1956: 7, fig. 5.

Pisinna frenchiensis.—Macpherson & Gabriel, 1962: 92.

Pisinna subfusca.—Macpherson & Gabriel, 1962: 92 (non Hutton, 1873).

DIAGNOSIS: Shell—Small, solid, pupoid, smooth; brown, often with narrow dark orange-brown spiral bands.

Protoconch—Dome-shaped, 1½ whorls, colour dark wine-red.

Teleoconch—Spire lightly convex to nearly flat; 3½-3¾ whorls, very weakly convex; sutures incised. Surface smooth except for growth lines, although these sometimes distinct. Base convex. Aperture subcircular, outer lip orthocline to opisthocline, slightly thickened within; inner lip well defined, abapical portion well separated from base. Varix moderate to absent. Spire dark purple-brown or dark red-brown in shallow-water shells, medium or yellow-brown on body whorl; sometimes with three narrow orange-brown bands, one abapical to the suture, other 2 on base. A broad yellowish or pale yellow-brown band sometimes present on the body whorl, this narrow on spire. Aperture yellowish-brown, darker on inner lip. Deep-water specimens yellow to white, usually with the 3 brown bands.

Dimensions:	length	diameter
Lectotype	2.85 mm	1.32 mm
Paratype of *Dardanula difficilis*	2.50	1.26
Figured specimen	2.64	1.32
Figured specimen (fossil specimen)	2.30	1.17

Operculum—Typical (fig. 13g).

Radula—Central teeth 2 + 1 + 2, with blunt, rather short median cusp, and short, sharp lateral cusps. Lateral teeth 2 + 1 + 3, inner edge with small denticle; median cusp blunt. Inner marginal teeth with 12 short cusps. Outer marginal teeth finely serrated (taken from small, uniformly brown specimen) (fig. 11e).

LOCATION OF TYPES: *Rissoa frenchiensis* T.M. Lectotype and paralectotype glued on tablet (7143/E12, TM 5475). Specimen here figured chosen as lectotype.

Dardanula difficilis. N.M.V. Holotype (F. 16129) and 4 paratypes (F. 16130). A.M. 1 paratype (C. 95048).

TYPE LOCALITIES: *Rissoa frenchiensis.* Long Bay, Tasm., coll. H. D. Atkinson.

Dardanula difficilis. On Bass Strait Cable between King Island and Stanley, Tasm. Probably near Elephant Shoal Reef, 7 km S.E. of King Is., Bass Strait (depth uncertain as it is not clear exactly where this material was collected).

ADDITIONAL MATERIAL EXAMINED: Elephant Shoal Reef, S.E. of King Is., Bass Strait, on Telecommunication Cable (N.M.V.). Frazer Bay, King Is., Tasm., 9-18 m, pres. F. Bassett Hull (A.M.). E. of Grassy, King Is., 58-77 m, 23 July 1962, H.M.A.S. "Gascoyne", stn G2/68-70/62, 2 lots (A.M.). Island of Bass Strait, coll. W. F. Petterd, 2 lots (A.M.). S.W. of West Point, N.W. Tasm., 41°09.2'S, 144°24.2'E, 88 m, 14 April 1973, B.M.R. stn 2121, M.T. "Sprightly", 2 lots (A.M.). Stanley, N. Tasm. (T.M.). Freestone Cove, Wynyard, N. Tasm., on algae, 12 Oct. 1971, coll. J. Beu (A.M.). Boat Harbour, N. Tasm., 31 Aug. 1969, coll. A. J. Dartnall (T.M.). West Head, Greens Beach, N. Tasm., under stones and on coralline algae, Mar. 1973, coll. R. Kershaw, 2 lots (A.M.). Badger Head, Tasm. (T.M.). Kelso, Tasm., Cox Coll., 2 lots (A.M.). 4 km N.E. of Beaching Bay, Maria Is., S.E. Tasm. 42°27.5'S, 148°12'E, 82 m, 25 Mar. 1970, coll. W. F. Ponder, F.R.V. "Penghana" (A.M.). Pirates Bay, Eaglehawk Neck, S. Tasm.,

on coralline algae; beach sand; on intertidal rocks, brown algae; under stones, 30-31 Mar. 1970, coll. W. F. Ponder, 3 lots (A.M.). Eaglehawk Neck, S. Tasm., pres. C. Hedley, 2 lots (A.M.). 11 km E. of Cape Pillar, S. Tasm., 182 m, pres. C. Hedley & W. L. May (A.M.). Wedge Bay, S. Tasm., 7 m, Voorwinde Coll., 2 lots (A.M.). S.W. approaches to Storm Bay, S.E. Tasm., H.M.A.S. "Moresby", Voorwinde Coll. (A.M.). Frederick Henry Bay, S. Tasm., W. L. May Coll. (T.M.). Browns River, Hobart, S. Tasm., pres. C. Hedley (A.M.). Tinderbox, Derwent Estuary, Tasm., 15 m, Voorwinde Coll. (A.M.). D'Entrecasteaux Channel, S., Tasm., 24 May 1965, H.M.A.S. "Moresby", Voorwinde Coll. (A.M.). D'Entrecasteaux Channel, S. Tasm., Killora Bay, towards jetty, 43°05'36"S, 147°19'12"E, 7.5 m, F.R.V. "Penghana", 23 Mar. 1970, coll. W. F. Ponder (A.M.). 3 km N. of Granville Harbour, W. Tasm., 23 Nov. 1967, coll. A. J. Dartnall (T.M.). Kilcunda, Vic., Gatliff Coll. (N.M.V.). Between Eagle & Crawfish Rocks, N.W. Arm, Western Port, Vic., 3-5 m, coll. W. F. Ponder & B. J. Smith, 2 lots (A.M.). Western Port, Vic., dredged, pres. J. C. Gabriel (A.M.). Flinders Ocean Beach platform, Vic., under stones, on algae, 4 May 1967, coll. B. J. Smith, 3 lots; 16 Feb. 1969, coll. W. F. Ponder & B. J. Smith (A.M.). Portsea, Vic., Gatliff Coll. (N.M.V., A.M.). MacDonnell Bay, S.A., Verco Coll. (S.A.M.). Port MacDonnell, S.A., Verco Coll. (S.A.M.). Off Beachport, E.S.A., 73 m, Verco Coll. (S.A.M.). W. of Cape Jaffa, E.S.A., 77 m, 25 July 1962, H.M.A.S. "Gascoyne", stn G2/76/62 (A.M.). Between Cape Jaffa and Kangaroo Is., S.A., 75-155 m, H.M.A.S. "Gascoyne", stns. G2/71, 72, 76, 77/62, 24-26 July 1962, 2 lots (A.M.). Normanville, S.A. (ex Tate Coll.), Verco Coll. (S.A.M.); Voorwinde Coll. (A.M.). Guichen Bay, S.A., Verco Coll. (S.A.M.). The Heap, Tumby Bay, S.A., coll. J. Thompson, Voorwinde Coll., 2 lots (A.M.). 64 km S. of Cape Wiles, S.A., 183 m, pres. Fisheries Bureau (A.M.). Waldergrave Is., W. side Eyre Peninsula, S.A., 1 m, on algae, 25 Oct. 1973, coll. S.A. Shepherd (A.M.). Mississippi Bay, 48 km E. of Esperance, S.W.A., on algae in 0-2 m, 6 Feb. 1972, coll. W. F. Ponder (A.M.).

FOSSIL RECORDS: Lower Miocene: Longfordian: Freestone Cove Sandstone (=lower bed), Table Cape (=Fossil Bluff), Tasm., Parr Coll.; Cudmore Coll. (N.M.V.). Table Cape, Tasm., coll. E. D. Atkinson (A.M.). Pliocene: Dry Creek Sands, Bore 41, St. James Park, hundred of Yatala, part section 413, 129 m (S. Aust. Dept. Mines). Bore 28, Woodville Gardens, hundred of Yatala, Sec. 425, 112 m (S. Aust. Dept. Mines). Bore 6, Hindmarsh, hundred of Yatala, Sec. 370, 132-148 m (S. Aust. Dept. Mines). Kalimnan: Grange Burn Formation, McDonald's Bank, Muddy Creek, Hamilton, Vic. (N.M.V.). Upper Pliocene: Cameron Inlet Formation, Hill's Dam at foot of Dutchman (E. side), Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.).

DISTRIBUTION AND HABITAT: Tasmania, Victoria W. of Wilsons Promontory, South Australia to Esperance in S.W. Australia, on algae and beneath stones in the lower littoral, sublittoral, and on the continental shelf (see fig. 19). Dead shells have been located as deep as 183 metres. Fossil specimens referred here to this species range from the Lower Miocene (fig. 3h).

REMARKS: Differs from *albizona*, which is the same size and shape, in usually not having a white band abapical to the sutures (although this is also occasionally absent in *albizona*). The yellowish band sometimes seen in *frenchiensis* is more diffuse and broader. In addition *albizona* frequently develops strong axial ribs, but these are always absent in *frenchiensis*. Whereas *albizona* is apparently restricted to the littoral and shallow sublittoral, *frenchiensis* is found on the continental shelf down to about 100 metres (although dead shells are located in deeper water).

Estea difficilis is the deep-water form of *frenchiensis* and is smaller and paler than shallow-water and littoral specimens. Shells of this form have relatively larger apertures and therefore straighter spire outlines (fig. 3e).

It is of interest to record that the authors of the name *frenchiensis* confused 4 species of *Pisinna* under that name, lots from Western Port including *approxima, oblata, frenchiensis* and *dubitabilis*.

The littoral form usually encountered differs from the more "typical", apparently often sublittoral form, in being smaller and uniformly dark reddish-brown. The lined form (fig. 3f.) only rarely occurs together in the same microhabitat with the small, uniformly coloured variety. It is possible that two species might eventually be recognised, although on shell characters it is very difficult to consistently separate these forms.

Although similar to, and sometimes confused with, the southern New Zealand species, *P. subfusca subfusca* (Hutton), *frenchiensis* is usually slightly smaller and narrower, darker in colour and has a consistently narrower inner lip which is less raised from the base. The New Zealand species also never develops colour bands.

Pisinna gradata sp. nov. Fig. 2c.

DIAGNOSIS: Shell—Minute, smooth, conical, with stepped whorls.

Protoconch—Dome-shaped, 1½-1¾ whorls, pinkish-yellow, with typical sculpture.

Teleoconch—Outlines convex with weakly to strongly stepped whorls, 3-3 1/3 in number. First whorl lightly concave, others lightly convex in paratypes, second concave in holotype. Sculpture very indistinct; oblique, fine, weak axial riblets on spire whorls becoming obsolete on body whorl. Riblets weakly crenulate, weak fold abapical to suture. Weak fold present on second whorl adapical to suture in holotype. Base convex, with a broad fold on abapical base. Aperture subcircular; inner lip broad, abapical portion considerably raised above base, outer lip slightly prosocline. Varix absent. Spire pinkish-red, body whorl and aperture yellowish-white (shell somewhat faded).

Dimensions:	length	diameter
Holotype	1.73 mm	0.84 mm

LOCATION OF TYPES: A.M. Holotype (C. 95027) and 2 paratypes (C. 95028).

TYPE LOCALITY: ca. 360 km E. of Newcastle, N.S.W., 33°04'S, 156°07'E, 230-275 m, B.M.R. stn 865, 21 Sept. 1969.

DISTRIBUTION AND HABITAT: Known only from the type locality, a seamount E. of Newcastle, N.S.W. (see fig. 20).

REMARKS: Although only the holotype and two rather worn paratypes are known, the new species is considered distinctive enough to warrant description. It is probably most closely related to *P. circumlabra* nov. but differs in its stepped sutures and ridge on the base.

Pisinna kershawi (T. Woods). Figs 4c-d.

Rissoina kershawi T. Woods, 1878: 57; Tryon, 1887: 392.

Rissoa olivacea.—Hedley, 1907: 288 (non Frauenfeld, 1867).

Amphithalamus kershawi.—Hedley, 1911: 107.

Estea kershawi.—May, 1920: 60, pl. 15, fig. 11; May, 1921: 51; Gatliff & Gabriel, 1922: 148 (in part); May, 1923: pl. 24, fig. 11; Cotton, 1944: 291; (?Cotton, 1952: 51).

Estea microcosta May, 1920: 61, pl. 15, fig. 12; May, 1921: 51; May, 1923: pl. 24, fig. 12; Cotton, 1944: 291.

Pisinna kershawi.—Macpherson & Gabriel, 1962: 92.

DIAGNOSIS: Shell—Small, solid, with close, oblique, simple axial ribs.

Protoconch—Dome-shaped of 1½ whorls, wine-red; sculpture typical.

Teleoconch—Outlines slightly convex, whorls 4, weakly convex. Sutures moderately impressed. Sculpture of moderate to strong, distinct, rounded, oblique (orthoclinal) ribs with subequal interspaces on all whorls. Ribs sometimes weak on first whorl, absent or subobsolete on last 1/4-1/3 whorl; and continue on to base. 28-48 ribs on penultimate whorl. Fine spiral scratches sometimes visible between ribs. Base convex. Aperture subcircular, thickened within; inner lip broad, outer lip very slightly opisthoclinal. Varix weak, broad. Colour pinkish-red, yellow or yellowish-white on abapical base and outer lip.

Dimensions:	length	diameter
Lectotype	2.58 mm	1.24 mm
Holotype of *Estea microcosta*	2.70	1.17

LOCATION OF TYPES: *Rissoina kershawi.* N.M.V. Lectotype (here chosen) and 3 paralectotypes (F. 654).

Estea microcosta. T.M. Holotype (7753/E412, C. 1701), A.M. paratype (C. 45958).

TYPE LOCALITIES: *Rissoina kershawi.* Long Bay, Tasm., coll. W. F. Petterd.

Estea microcosta. 11 km E. of Cape Pillar, S.E. Tasm., 183 m.

ADDITIONAL MATERIAL EXAMINED: Shelly Beach, Caloundra, S. Qld, Voorwinde Coll. (A.M.). N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll. (A.M.). Off Flatrock, N. Stradbroke Is., S. Qld, on algae, 24-30 m, 2 Aug. 1971, coll. R. Ibara (A.M.). Lake Macquarie, N.S.W., pres. R. L. Cherry (A.M.). Off Port Stephens, N.S.W., 73 m, from trawlers, sandy bottom, 1950-1960, Voorwinde Coll. (A.M.). Pittwater, Broken Bay, N.S.W., Voorwinde Coll. (A.M.). 35 km E. of Narrabeen, N.S.W., 146 m, pres. Prof. Haswell (A.M.). North Harbour, Sydney, N.S.W., Voorwinde Coll. (A.M.). Fairlight, Sydney, N.S.W., 5 m, Voorwinde Coll. (A.M.). Middle Harbour, Sydney, N.S.W., C. Hedley (A.M.). Chinamans Beach, Sydney, N.S.W., 3-7 m, Voorwinde Coll. (A.M.). Bottle and Glass Rocks, Sydney Harbour, N.S.W., 11 m; 17 m; Voorwinde Coll. (A.M.). Bottle and Glass Rocks, Sydney, N.S.W., 1878, coll. J. Brazier (A.M.). Port Jackson, Sydney, N.S.W., dredged, Hargraves Coll; Voorwinde Coll. (A.M.). Off Sydney, N.S.W., 55 m, Voorwinde Coll. (A.M.). Reclamation, Botany Bay, N.S.W., ex. C. Laseron Coll., Voorwinde Coll. (A.M.). Ocean Beach, Kurnell, Botany Bay, N.S.W., 1950-1960, Voorwinde Coll. (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.). S. of Ulladulla, N.S.W., inside Breakwater, sheltered reef, on small brown algae; outside breakwater on small brown algae and on coralline algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). 24 km off Twofold Bay, N.S.W., 37°26'S, 150°15'E, 75-154 m, 19 June 1962, H.M.A.S. "Gascoyne", stn G2/58-59/62 (A.M.). Eden Harbour, Twofold Bay, N.S.W., Voorwinde Coll. (A.M.). E. of Grassy, King Is., Bass Strait, 58-77 m, 23 July 1962, H.M.A.S. "Gascoyne", stn G2/68-70/62 (A.M.). Elephant Shoal Reef, S.E. of King Is., Bass Strait, on Telecommunication Cable (N.M.V.). Off S.W. of West Point, N.W. Tasm., 41°09.2'S, 144°24.2'E, 88 m, 14 April 1973, B.M.R. stn 2121, M.T. "Sprightly" (A.M.). Boat Harbour, N. Tasm., 31 Aug. 1969, coll. A. J. Dartnall (T.M.). Kelso, N. Tasm., ex Cox Coll. (A.M.). Off Waterhouse Point, N.E. Tasm., 40 m, 17 Jan. 1968, "Umitaka Maru" stns 68-30N, 68-31N, 68-32N, 3 lots (T.M.). 4 km N.E. of Beaching Bay, Maria Is., E. Tasm., 42°27.5'S, 148°12'E, 82 m, 25 Mar. 1970, coll. W. F. Ponder, F.R.V. "Penghana" (A.M.). Derwent Estuary, Tasm., Voorwinde Coll. (A.M.). Tinderbox, Derwent Estuary, Tasm., 15 m; 37 m, Voorwinde Coll. (A.M.). Killora Bay, D'Entrecasteaux Channel, S. Tasm., 24 April 1965, H.M.A.S. "Moresby", Voorwinde Coll. (A.M.). D'Entrecasteaux Channel, S. Tasm., towards jetty 43°05'36"S, 147°19'12"E, 7.5 m, 23 March 1970, F.R.V. "Penghana", coll. W. F. Ponder (A.M.). S.E.E. of Gabo Is., Vic., below lighthouse on algae and detritus, 15-18 m, Feb. 1973, coll. P.

Hutchings (A.M.). Between Cape Howe and Lakes Entrance, Vic., 37°55'S, 149°00'E, 75-78 m, 20 July 1962, H.M.A.S. "Gascoyne" stn G2/61/62 (A.M.). Off Wilsons Promontory, Vic., dredged, Gatliff Coll.; Gabriel Coll. (N.M.V.). San Remo, Vic., Voorwinde Coll. (A.M.). Between Eagle Rock and Crawfish Rock, N.W. Arm, Western Port Bay, Vic., 4-6 m, 15 Feb. 1969, coll. W. F. Ponder & B. J. Smith (A.M.). Western Port, Vic., 9 m, pres. J. C. Gatliff; pres. C. J. Gabriel (A.M.). Cowes, Vic., Robin Coll. (N.M.V.). Off Beachport, E.S.A., 365 m; 73 m, Verco Coll. (S.A.M.) (=Cotton's (1944) record of *microcosta*).

FOSSIL RECORDS: The writers have not examined any fossil specimens that can be referred to this species. Cotton (1952) has, however, recorded it from three localities but his specimens have not been examined.

DISTRIBUTION AND HABITAT: South Queensland to eastern South Australia. Living mostly in the shallow sublittoral, but sometimes found in the lower littoral in southern parts of its range (see fig. 16). Also found in deepwater (up to 365 metres) on the continental shelf.

REMARKS: The number of axial ribs is very variable and appears to increase with depth. The population on which *Estea microcosta* was based is from 183 m, and is here regarded as only a finely ribbed variety of *kershawi*. This species is most similar to *P. olivacea olivacea* (Frauenfeld) from which it is easily separated by the absence of a row of nodules abapical to the sutures and the axial ribs being present on all whorls.

The figured specimen is chosen as the lectotype and is taken from 4 here presumed to be the type series as they come from the type locality and were presented by the collector W. F. Petterd. May (1920: 60) notes that the types are in the "Melbourne Museum".

Pisinna laseroni sp. nov. Figs 2k-l.

DIAGNOSIS: Shell—Small, glossy, conical; short spired for genus with large aperture which has a prominent varix and reflected outer lip.

Protoconch—Dome-shaped, of 1½ whorls. Wine red, surface very minutely pitted.

Teleoconch—Spire outline almost flat; 3 whorls, lightly convex except for first whorl which is often slightly concave. Surface smooth and glossy. Base convex. Aperture large, subcircular; outer lip thin, slightly reflected, opisthocline. Inner lip rather thin, extending abaxially on parietal region in middle portion; a broad, shallow sinus formed in adapical and abapical corners of aperture. Varix very heavy, broad. Colour orange-pink, sutures margined on both sides with white or yellowish-white. Outer lip of aperture white.

Dimensions	length	diameter
Holotype	2.50 mm	1.22 mm

LOCATION OF TYPES: A.M. Holotype (C. 95029) and 7 paratypes (C. 95030).

TYPE LOCALITY: Off entrance to Port Stephens, N.S.W., 71 m, J. Voorwinde Coll.

ADDITIONAL MATERIAL EXAMINED: Off Sydney, N.S.W., 36 m, Voorwinde Coll. (A.M.). 35 km E. of Narrabeen, N.S.W., 146 m, coll. Haswell (A.M.). Off Port Kembla, N.S.W., 115-137 m, coll. C. Hedley (A.M.). 43 km S.E. of Cape Everard, E. Vic., 164-273 m, 9 May 1914 (A.M.).

DISTRIBUTION AND HABITAT: Port Stephens, N.S.W. to Cape Everard, Victoria on the continental shelf in 36-273 metres (see fig. 18).

REMARKS: This species is distinguished by its short, blunt spire, relatively large aperture and strong, prominent varix.

It is named for the late Mr. C. F. Laseron, who has been responsible for much of the recent work on minute Australian Mollusca.

Pisinna megastona sp. nov. Figs 2b; 11c; 13b.

DIAGNOSIS: Shell—Conical, with rapidly expanding whorls and large aperture. Surface smooth, colour dark purple-red or brown.

Protoconch—Dome-shaped, of 1½ convex whorls, with spiral rows of minute pits. Colour deep wine-red.

Teleoconch—Spire rather short, outline nearly straight. 2¾-3 moderately convex whorls. Surface smooth and shining, with very weak axial growth lines and subobsolete spiral striae. Base weakly convex, aperture large and expanded. Inner lip thin and narrow across parietal region, edge concave, expanded abapically. Outer lip orthoclinal or slightly prosoclinal. Varix absent. Colour dark purple-red to dark yellow-brown with pale yellow-brown aperture; edge of peristome darker brown. Inner lip at parietal region deep wine red to dark brown.

Dimensions:	length	diameter
Holotype	1.80 mm	1.00 mm

Operculum—Typical. The figure (fig. 13b) shows the outer layer partially separated from the inner layer.

Radula—Central teeth 2 + 1 + 2, with a small denticle on each side. Median cusp long, narrow, blunt, cutting edge with 2-4 denticles; lateral cusps rather long and sharp. Lateral teeth 3 + 1 + 3, inner edge with small denticle. Cusps narrow, long and sharp. Inner marginal teeth with 9 sharp cusps and a small denticle on outer edge. Outer marginals sharply denticulate (fig. 11c).

Headfoot—Typical of genus. Black dorsally, except for tentacles, which are unpigmented.

LOCATION OF TYPES: A.M. Holotype (C. 95031), 10 paratypes (C. 95032) and 15 paratypes (C. 95639).

TYPE LOCALITY: Pirates Bay, Eaglehawk Neck, S.E. Tasm., beneath stones (C.95031, 95032) and on brown algae (C. 95639) in the lower littoral, 30 Mar. 1970, coll. W. F. Ponder.

ADDITIONAL MATERIAL EXAMINED: Eaglehawk Neck, S.E. Tasm., 3 June 1967, coll. A. J. Dartnall (T.M.). 3 km N. of Granville Harbour, W. Tasm., 23 Nov. 1967, coll. A. J. Dartnall (1 specimen) (T.M.). Ocean side of Queenscliffe, Port Phillip, Vic., 13 Feb. 1969, under stones on rock platform, coll. W. F. Ponder (A.M.).

DISTRIBUTION AND HABITAT: S.E. and W. Tasmania, and W. Victoria, beneath stones and on algae on open coasts in the lower littoral. Infrequently collected (see fig. 17).

REMARKS: Similar to *frenchiensis* and *dubitabilis* but can be distinguished by its short, conical spire, convex whorls, large expanded aperture, and uniformly dark colour.

Four of the paratypes are heavily encrusted with a coralline growth.

Pisinna moretonensis sp. nov. Fig. 7a.

DIAGNOSIS: Shell—Large size for genus, solid, smooth, with irregular brown and white markings.

Protoconch—Dome-shaped, of 1½ whorls. Sculpture typical, colour pale brown.

Teleoconch—Spire weakly convex. Whorls 4½-5, very weakly convex; sutures impressed, the adapical edge of each whorl slightly stepped. Surface smooth, apart from very weak, irregular growth lines (the holotype has a slight peripheral groove at the

commencement of the body whorl but this is not typical of the species). Base convex; aperture circular, with internally thickened lips. Inner lip projects abaxially on to parietal region beyond remainder of aperture; outer lip opisthoclinal. Varix very broad but weak (stronger in holotype than in paratypes). Colour light purplish-brown on adapical part of spire, last two whorls yellowish or greyish-white with irregular orange or purplish-brown vertical blotches and streaks, very pale in the adapical 1/3 of whorls. Brown markings merge at periphery in a band, sharply cut off from the pale yellow-brown base. Sometimes a few brown streaks on base. Aperture yellowish-white except for a brown blotch on inner lip and sometimes 2 or 3 brown markings on outer lip.

Dimensions:	length	diameter
Holotype	5.40 mm	2.42 mm

LOCATION OF TYPES: A.M. Holotype (C. 95033), 7 paratypes (C. 95034), and 2 paratypes (C. 94991).

TYPE LOCALITY: N.E. of Cape Moreton Lighthouse, S. Qld, 115 m, Voorwinde Coll. (C. 95033, 95034); T.A. Garrard Coll. (C. 94991).

DISTRIBUTION AND HABITAT: Type locality only (see fig. 17).

REMARKS: This species differs from *P. paucirugosa* nov. in its larger size, smooth surface and colour pattern. *P. nitida* nov. is relatively more elongate, with a less evenly rounded body whorl and has a different colour pattern. This is the largest species of *Pisinna* yet recorded.

Pisinna nitida sp. nov. Figs 6h-i.

Rissoa bicolor.—Tate & May, 1901: 391, pl. 26, fig. 63; Pritchard & Gatliff, 1902: 103; Hedley, 1907: 288 (non Petterd, 1884).

Scrobs bicolor.—Hedley, 1903: 355 (in part) (non *bicolor* Petterd).

Estea bicolor.—Hedley, 1918: 53; May, 1921: 51 (in part); May, 1923: pl. 24, fig. 6; Cotton, 1944: 288 (in part); Laseron, 1950: 271, fig. 46; Iredale & McMichael, 1962: 41 (non *bicolor* Petterd).

DIAGNOSIS: Shell—Rather large for genus, with a tall, straight-sided spire; subangled to weakly angled periphery, almost flat whorls, surface shining, nearly smooth.

Protoconch—Dome-shaped, 1½-1¾ whorls, very close rows of exceedingly minute punctures, colour pale yellow-brown.

Teleoconch—Spire tall, straight-sided, periphery subangled to weakly angled. 4½-5 whorls, very lightly convex, almost flat. Surface superficially smooth but with variable, weak axial growth lines and microscopic spiral scratches. Base almost flat to lightly convex. Aperture obliquely oval, somewhat angled in abapical and adapical corners. Inner lip thick, advancing abaxially over middle section of parietal region; outer lip thickened within, orthoclinal or slightly opisthoclinal. Abapical section of inner lip sloping slightly abaperturally or horizontal with vertical axis of shell and therefore not much raised from base. Varix a broad, weak swelling; a minute false umbilical chink behind inner lip. Colour of spire purplish-brown when fresh, with a rather diffuse greyish-white band abapical to sutures. Body whorl yellow-brown, inner lip darker brown. Dead shells fade to orange-brown on the spire and eventually to yellow.

Dimensions:	length	diameter
Holotype	5.20 mm	2.08 mm
Paratype	4.40	1.84

LOCATION OF TYPES: A.M. Holotype (C. 95640) and 9 paratypes (C. 95052).

TYPE LOCALITY: Between Sydney Harbour Heads, N.S.W., in 27 m, sandy bottom, coll. C. F. Laseron.

ADDITIONAL MATERIAL EXAMINED: Caloundra, S. Qld, C. Hedley (A.M.). N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll. (A.M.). Woolgoolga, N.S.W., Poppins Coll. (A.M.). Manning River, N.S.W., 40 m (A.M.). Off Port Stephens, N.S.W., 91 m; 64 m, Voorwinde Coll. (A.M.). Pittwater, Broken Bay, N.S.W., dredged, Voorwinde Coll. (A.M.). 35 km E. of Narrabeen, N.S.W., 146 m, pres. Prof. Haswell (A.M.). Middle Harbour, Sydney, N.S.W., C. Hedley, (A.M.). Sow & Pigs Reef, Port Jackson, Sydney, N.S.W., 11-16 m, Voorwinde Coll. (A.M.). E. of Sydney, N.S.W., 150 m, 18 July, 1962, H.M.A.S. "Gascoyne", stn G2/55-56/62, 2 lots (A.M.). Off Sydney, N.S.W., trawled, Voorwinde Coll. (A.M.). Cronulla, N.S.W., Voorwinde Coll. (A.M.). Off Port Jibbon, N.S.W., 70 m, 3-7 July, 1943, Iredale Coll. (A.M.). Crookhaven, N.S.W., 64 m, Voorwinde Coll. (A.M.). Moruya, N.S.W., 101 m, Iredale Coll. (A.M.). Off Picaninny Point, E. Tasm., 41°40'S, 148°18.4'E, 27 m, 24 Mar. 1973, coll. P. H. Colman, B.M.R. stn 2032 (A.M.). D'Entrecasteaux Channel, S. Tasm., Voorwinde Coll. (A.M.). Tasmania, pres. Miss Lodder (A.M.). Off Gabo Is., Vic., 14-27 m, coll. R. Bell, 2 lots (A.M.). Portsea, Vic., Gatliff Coll. (N.M.V.).

DISTRIBUTION AND HABITAT: South Queensland to Portsea, Victoria and Tasmania (see fig. 17). Probably restricted to soft (sandy) substrate in the sublittoral and on the continental shelf. Known depth range ?0-150 metres.

REMARKS: This is the species mistaken for *P. bicolor* by most authors, mainly due to Tate and May (1901) figuring this species as *Rissoa bicolor* (see remarks under *P. bicolor*). *P. nitida* differs from *P. bicolor* in having a much larger adult size, a subangled (fig. 6i) or angled (fig. 6h) periphery and a relatively smaller aperture. The abapical portion of the inner lip is horizontal to the vertical axis of the shell or it slopes slightly abaperturally as it meets the outer lip. This results in the abapical portion of the inner lip being less separated from the base than in *P. bicolor*. In addition the varix is relatively weaker and the outer lip is less strongly opisthocline than in *P. bicolor*.

Pisinna oblata (Laseron). Figs 6a-c.

Rissoa columnaria.—Gatliff & Gabriel, 1913b: 78 (non Hedley & May, 1908).

Scrobs oblata Laseron, 1956: 444, fig. 156.

DIAGNOSIS: Shell—Minute, pupoid, semi-opaque with relatively large aperture and fine axial ribs. Rather variable in size.

Protoconch—Dome-shaped, of 1½ whorls, sculptured with spiral rows of minute pits.

Teleoconch—Spire convex, of 3-3½ very weakly convex (almost flat), false margined whorls. Sculpture of numerous fine, rather weak axial riblets, slightly oblique (prosocline) on spire, strongly oblique on body whorl where the ribs are stronger. Base flat except for a weak basal bulge abapically. Aperture rather D-shaped, large, but does not protrude much beyond line of spire whorls. Inner lip rather narrow, abapical part sharply separated from base. Outer lip orthoclinal or slightly opisthoclinal. Varix rather distinct, close to edge of outer lip. Colour yellow in type (dead shell), deep reddish-purple in fresh shells due to inner shell layer showing through, body whorl and aperture yellowish-brown to white.

Dimensions:	length	diameter
Holotype	1.46 mm	0.67 mm
Bermagui, N.S.W.	1.55	0.68
Cronulla, N.S.W. (figured)	2.30	1.00

LOCATION OF TYPE: A.M. Holotype (C. 79574).

TYPE LOCALITY: Noosa Head, S. Qld, coll. Mrs. B. Page.

ADDITIONAL MATERIAL EXAMINED: Noosa Heads, S. Qld, Voorwinde Coll. (A.M.). N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll., 2 lots (A.M.). Off Crowdy Head, N.S.W., 32°38.9'S, 153°0.8'E, 91 m, 16 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll., 2 lots (A.M.). Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Off Port Stephens, N.S.W., dredged on sandy bottom, 64 m, Voorwinde Coll., 3 lots (A.M.). Off Laurieton, S. of Lake Macquarie, N.S.W., 73 m, Voorwinde Coll. (A.M.). Collaroy Beach, Sydney, N.S.W., Voorwinde Coll. (A.M.). Off Long Reef, Collaroy, Sydney, N.S.W. 25 m, C. F. Laseron Coll. (A.M.). Middle Harbour, Sydney, N.S.W. (A.M.). Chinamans Beach, Sydney, N.S.W., 4-7 m; 15 m, Voorwinde Coll., 4 lots (A.M.). Sow and Pigs Reef, Sydney, N.S.W. 11-16 m, Voorwinde Coll.; 9 Jan. 1879, coll. J. Brazier (A.M.). Port Jackson, Sydney, N.S.W., dredged, Voorwinde Coll. (A.M.). Cronulla, N.S.W., Voorwinde Coll. (A.M.). Ocean Beach, Kurnell, Botany Bay, N.S.W., 1950-1960, Voorwinde Coll. (A.M.). 26 km E. of Wollongong, N.S.W., 183 m (A.M.). Crookhaven Heads, N.S.W., 64 m, Voorwinde Coll. (A.M.). Batemans Bay, N.S.W., Voorwinde Coll. (A.M.). Wimbie Beach, Batemans Bay, N.S.W., under stones on fairly exposed rocks, 6 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Batemans Bay, N.S.W., Voorwinde Coll. (A.M.). Shelly Beach, Bermagui, N.S.W., Voorwinde Coll. (A.M.). W. of Grassy, King Is., Tasm., 58 m, Voorwinde Coll. (A.M.). Islands of Bass Strait, Petterd Coll. (A.M.). Off S.W. of West Point, N.W. Tasm., 41°09.2'S, 144°24.2'E, 88 m, 14 Apr. 1973, B.M.R. stn 2121, M.T. "Sprightly" (A.M.). D'Entrecasteaux Channel, S. Tasm., 24 Apr. 1965, H.M.A.S. "Moresby", Voorwinde Coll. (A.M.) (locality doubtful). Off Cape Pillar, Tasm., 183 m, May Coll. (S.A.M.). Port Albert, Vic., Worcester Coll. (N.M.V.). Off Wilsons Promontory, Vic., 2 lots (N.M.V.). Western Port, Vic. (A.M.); N.M.V.). Portsea, Vic., Gabriel Coll. (N.M.V.). Off Beachport, S.A., 73 m, Verco Coll., 4 lots (S.A.M.).

DISTRIBUTION AND HABITAT: South Queensland to W. Bass Strait and S.E. Tasmania (see fig. 19). Shallow sublittoral to 183 m.

REMARKS: Distinguished by its small size, fine, close-set, oblique axial ribs on the body whorl and convex spire outline. *P. columnaria* is similarly sculptured but evenly over the whole teleoconch, and has a much longer spire. Gatliff and Gabriel's records from off Wilsons Promontory, Victoria of *microcosta* (May) (1922: 148) and *columnaria* (1913b: 78) refer in part to this species and Cotton (1944) recorded it from off Beachport as *"Estea" janjucensis* (Gatliff & Gabriel).

This species is most similar to *Pisinna angustata* (Powell) from New Zealand, but the New Zealand species differs in its smaller size, narrower shell and relatively larger aperture.

There is considerable variation in size (cf. figs 6b, 6c), southern shells tending to be larger than those from the northern part of the range (including the holotype).

Pisinna olivacea olivacea (Frauenfeld). Figs 5c-e; 11f; 12c-f; 13c-d.

Alvania olivacea Frauenfeld, 1867: 11, pl. 2, fig. 14; Weinkauff, 1885: 183, pl. 24, fig. 4; Tryon, 1887: 339, pl. 66, fig. 43; Tate, 1899: 232; Kesteven, 1902: 206.

Alvania olivacea.—Angas, 1877: 187.

Rissoa diemenensis Petterd, 1884: 138; Tryon, 1887: 368.

Rissoa olivacea "Dunker".—Whiteleggᵉ, 1889: 266; Tate & May, 1901: 391; Pritchard & Gatliff, 1902: 103.

Rissoa (Amphithalamus) olivacea "Dunker".—Brazier, 1895: 696.

Amphithalamus olivacea.—Hedley, 1911: 107.

Estea olivacea.—Hedley, 1918: 53; may, 1921: 51; May, 1923: pl. 24, fig. 10; Cotton, 1944: 292; Laseron, 1950: 268; Ponder, 1965c: 137, pl. 21, fig. 4.

Estea olivacea "Dunker".—May, 1920: 60.

Dardanula olivacea.—Iredale & McMichael, 1962: 41.

Pisinna olivacea.—Macpherson & Gabriel, 1962: 92.

DIAGNOSIS: Shell—Small, rather variable, solid, conical to conico-pupoid, with moderately strong axial ribs and a single row of nodules abapical to sutures.

Protoconch—Dome-shaped, 1½ whorls, colour wine-red, yellow when faded. Sculptured with spiral rows of minute pits (fig. 12e-f).

Teleoconch—Spire lightly convex of about 31/3 lightly convex whorls. Axial ribs slightly oblique, variable in strength, usually subobsolete on last 1/3 of body whorl. First whorl of teleoconch with very weak axial threads or riblets, weak ribs on second whorl. A distinct furrow separates a row of nodules abapical to sutures and occasionally, a second, weaker row is present abapical to this. Nodules very variable in strength. Occasionally a weak, central, spiral depression present on body whorl. Periphery rounded to subangled, base lightly convex. Aperture rather large, varying from almost circular to D-shaped. Edges of lips thin and almost orthoclinal. Varix absent; colour red-brown, orange-red or orange-brown, often with sutural row of nodules white (as in lectotype). Sublittoral specimens tend to be unicoloured and paler than littoral specimens. Aperture yellowish, parietal area brown in dark-coloured specimens. Spire frequently dark red due to inner shell layer.

Dimensions:	length	diameter
Lectotype	2.00 mm	1.05 mm
Lectotype of *Rissoa diemenensis*	2.15	1.08
Paralectotype of *R. diemenensis*	2.30	1.10
Figured specimens	2.15	1.15
	1.72	0.93

Operculum—Typical (fig. 13c-d).

Radula—Central teeth 1+1+1 (+ rather prominent denticle on outer edges), middle cusp about same to almost twice width of adjacent cusp, but with blunt cutting edge broken up into 2 or 3 minute serrations. Lateral teeth 2+1+3, with minute denticle on inner edge; main cusp rather blunt, about twice width of adjacent cusps. Inner marginal teeth with about 13-14 small, sharp cusps, outer marginals with about 12 denticles (fig. 11f).

LOCATION OF TYPES: *Alvania olivacea.* Naturhistorisches Museum, Vienna. 4 lots of syntypes (Sydney, Botany Bay, Bondi, and Sydney ex Mohrenstern Coll.). 3 lots contain many specimens and 1 (Bondi) contains 3 specimens (no numbers). A lectotype (Botany Bay) (here chosen) has been segregated.

Rissoa diemenensis. T.M. Lectotype and paralectotype (7145/E14, TM 5486, C268).

TYPE LOCALITIES: *Alvania olivacea.* See above. All Sydney area, N.S.W.

Rissoa diemenensis. "Table Cape and Tamar Heads", Tasm.

ADDITIONAL MATERIAL EXAMINED: Noosa Heads, S. Qld, J. Voorwinde Coll. (A.M.) (identification uncertain). N.E. of Cape Moreton Light, S. Qld, J. Voorwinde Coll. (A.M.). Sandgate, Moreton Bay, S. Qld, 2 lots (A.M.). S.W. of Solitary Is., N.S.W., 15 m, on

small boulder, 17 May 1972, coll. P. Hutchings & P. Weate (A.M.). Bellingen River, N.S.W., J. Voorwinde Coll. (A.M.). Off Crowdy Head, N.S.W., 32°38.9'S, 153°08'E, 91 m. 16 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Off Point Halliday, N.S.W., 32°06'S, 152°54.2'E, 118 m, 5 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Off Forster, N.S.W., 32°11.2'S, 152°54.2'E, 117 m, Dec. 1957, H.M.A.S. "Warrego" (A.M.). Off Sugarloaf Point, N.S.W., 32°18'S, 152°50'E, 113 m, Dec. 1957, H.M.A.S. "Warrego" (A.M.). Port Stephens, N.S.W., dredged 1950-60, Voorwinde Coll., 2 lots (A.M.). Off Lighthouse, Port Stephens, N.S.W., 73 m, Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Seal Rocks, N. of Newcastle, N.S.W., Voorwinde Coll. (A.M.). Pittwater, Broken Bay, N.S.W., Voorwinde Coll., 2 lots (A.M.). Long Reef, Sydney, N.S.W., Voorwinde Coll., 4 lots (A.M.). Narrabeen, Sydney, N.S.W., dredged, Voorwinde Coll., 3 lots (A.M.). 5 km E. of Long Point, Sydney, N.S.W., 39 m, rocky bottom, 14 Apr. 1972, coll. Shelf Benthic Survey (A.M.). Fairlight, Sydney Harbour, N.S.W., on mixed short algae, low tide, 23 Dec. 1968, coll. W. F. Ponder (A.M.). Fairlight, Sydney Harbour, N.S.W. (3 lots); *Zonaris* wash (2 lots); 4-6 m (1 lot), Voorwinde Coll. (A.M.). Little Manly Cove, Port Jackson, Sydney, N.S.W., 13 Sep. 1894, coll. J. Brazier (A.M.). North Harbour, Sydney, N.S.W., Voorwinde Coll., 3 lots (A.M.). Balmoral, Sydney, N.S.W., 18 m; 11-14 m, Voorwinde Coll. (2 lots); on brown algae, 19 Jan. 1969, coll. W. F. Ponder & J. Voorwinde (A.M.). Middle Harbour, Sydney, N.S.W., 5 m, Voorwinde Coll.; coll. C. Hedley (A.M.). Chinamans Beach, Sydney, N.S.W., 3-7 m, Voorwinde Coll. (A.M.). Ny-ar-gine Point, Sydney, N.S.W., 19 Dec. 1968, coll. A.M. party (A.M.). Bottle and Glass Rocks, Sydney, N.S.W., 9 Oct. 1968, coll. W. F. Ponder (A.M.). Off Bottle and Glass Rocks, Sydney, N.S.W., 9 m, 1878, coll. J. Brazier (A.M.). Sow and Pigs Reef, Sydney, N.S.W., 9 m, Voorwinde Coll., 2 lots (A.M.). E. side of Sow and Pigs Reef, Port Jackson, N.S.W., near the rocks, rocky bottom, 1865, coll. J. Brazier (A.M.). Little Coogee Bay, Sydney, N.S.W., rock pools, 13 July 1895; 21 Apr. 1895, coll. J. Brazier, 5 lots (A.M.). Off Sydney, N.S.W., trawled in 37 m, Voorwinde Coll. (A.M.). Kurnell, Botany Bay, N.S.W., Voorwinde Coll. (A.M.). Gunnamatta Bay, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Port Kembla, N.S.W., 115-137 m (A.M.). Honeymoon Beach, Jervis Bay, N.S.W., under stones in lower littoral; beach sand; 18 Jan. 1969, coll. W. F. Ponder & N. Coleman (A.M.). Wreck Bay, N.S.W., C. Hedley (A.M.). Ulladulla, southern N.S.W., Voorwinde Coll. (A.M.). S. side of Ulladulla, N.S.W., inside breakwater on sheltered reef on small brown algae; on coralline algae; 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). S. side of Ulladulla, N.S.W., outside breakwater, on moderately exposed rock platform, on small brown algae; on coralline algae; 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Batemans Bay, N.S.W., Voorwinde Coll., 3 lots (A.M.). Lake at Merimbula, N.S.W., Voorwinde Coll. (A.M.). Merimbula Jetty, Merimbula, N.S.W., on exposed side, under stones, 7 Jan. 1970, coll. W. F. Ponder & P. H. Colman, 3 lots (A.M.). Twofold Bay, N.S.W., C. Hedley (A.M.). Badger Head, N. Tasm. (T.M.). West Head, Greens Beach, N. Tasm., under stones and on coralline algae, Mar. 1973, coll. R. Kershaw (A.M.). Kelso, Tamar River, N. Tasm., Cox Coll. (A.M.); W. L. May Coll. (T.M.). Off Waterhouse Point, N.E. Tasm., ca. 40 m, 17 Jan. 1968, "Umitaka Maru" Stn. 68-30 N, 68-31 N, 68-32 N (3 lots) (T.M.). Tinderbox, S. Tasm., 12 Apr. 1967, coll. E. Aves (T.M.). Pirates Bay, Eaglehawk Neck, S.E. Tasm., under stones, lower littoral, 30 Mar.-2 Apr. 1970, coll. W. F. Ponder (A.M.). Pirates Bay, Eaglehawk Neck, S.E. Tasm., C. Hedley (A.M.). Derwent River, Tasm., W. L. May (A.M.). Derwent River Estuary, Tasm., Voorwinde Coll. (A.M.). S.S.E. side of Gabo Is., E. Vic., 28 m, on red algae, Feb. 1973, coll. P. Hutchings, 2 lots (A.M.). Monumental Bay, Gabo Is., E. Vic., 15-18 m, on boulder fauna, Feb. 1973, coll. P. Hutchings (A.M.). S.E. side of Gabo Is., E. Vic., 28 m, in sponge bed, Feb. 1973, coll. P. Hutchings (A.M.). S.S.E. side of Gabo Is., E. Vic., below lighthouse, 15-18 m, on algae and in detritus, Feb. 1973, coll. P. Hutchings (A.M.). Gabo Is., S. of Cape Howe, Vic., 26 m, coll. R. Bell (A.M.). Upper San Remo, Vic., dredged in 5-7 m, Voorwinde Coll. (A.M.). Kilcunda, Vic., Gatliff Coll. (N.M.V.). Shoreham, Western Port, Vic., Gatliff Coll. (N.M.V.). Flinders, Western Port, Vic., shell sand, Voorwinde Coll. (A.M.). Flinders Ocean Platform, Vic., on short algae, low tide, 16 Feb. 1969, coll. W. F. Ponder & B. J. Smith (A.M.). Between Eagle Rock and Crawfish Rock, N.W. Arm, Western Port, Vic., 3-5 m, 15 Feb. 1969, coll. W. F. Ponder & B. J. Smith (A.M.).

DISTRIBUTION AND HABITAT: South Queensland to E. Victoria and N. and S. Tasmania (see fig. 16). This species is very abundant in N.S.W., but rather uncommon in the other parts of its range. It lives in the middle to lower littoral and shallow sublittoral on short algae and beneath stones etc. Specimens dredged on the continental shelf are all dead shells and are probably Holocene or Pleistocene fossils from fossil shore lines.

REMARKS: The sculpture of *olivacea olivacea* and *castella* is very similar, *olivacea olivacea* sometimes producing all of the elements seen in *castella* with three incipient rows of nodules. The difference is mainly one of degree and, although it is possible that they are but sculptural forms of a single species, this is thought to be unlikely.

Two forms of *P. olivacea olivacea* can sometimes be distinguished. A dark-coloured form with a white band across the strong sutural row of nodules (fig. 5c) contrasts markedly with a smaller, paler, uniformly coloured form which often has a weaker row of sutural nodules (Fig. 5d). The two forms, however, are frequently encountered in the same samples and intermediates are common.

The New Zealand counterpart of this species is *P. impressa* (Hutton, 1885) (see Ponder, 1965c: 136). Australian and New Zealand specimens are hardly separable and it is probable that they are conspecific. The New Zealand specimens usually have strong axial ribs extending over all whorls of the teleoconch and for this reason they are here considered to be subspecifically distinct from *olivacea olivacea* which usually has no axials or only weak ribs on the first whorl of the teleoconch.

A very beach worn series of 8 specimens from Noosa Heads is referred to this species with some doubt. In some respects these shells resemble miniature forms of *P. tumida simplicosta* nov., to which a further 5 larger specimens from the same sample are tentatively referred.

Hedley's (1905, 1907) deep-water N.S.W. records of this species refer to *P. tumida simplicosta* and *P. kershawi* respectively.

Pisinna paucirugosa sp. nov. Fig. 7h.

Scrobs bicolor.—Hedley, 1903: 355 (in part) (non Petterd, 1884).

DIAGNOSIS: Shell—Moderately large for genus, pupoid, very solid, with dull surface and very fine, weak, blunt axial threads.

Protoconch—Typical, dome-shaped, of 1½ whorls.

Teleoconch—Spire outline slightly to moderately convex, whorls 4¼-4½, slightly convex. Sutures impressed, sometimes very slightly stepped, and occasionally narrowly caniculate. Weak, close, oblique, blunt riblets on all whorls, sometimes very indistinct. Base convex; aperture subcircular, heavily thickened within. Outer lip slightly opisthocline; varix very weak, broad. Colour reddish-purple, fading to purplish-grey or grey with a broad white band abapical to the sutures, the abapical edge of which is rather diffuse. Base and aperture yellowish-white or white, a pale purplish-red patch on inner lip.

Dimensions:	length	diameter
Holotype	4.40 mm	2.00 mm

LOCATION OF TYPES: A.M. Holotype (C. 95035) and 16 paratypes (C. 95036).

TYPE LOCALITY: 115 m, N.E. of Cape Moreton Lighthouse, S. Qld, J. Voorwinde Coll.

ADDITIONAL MATERIAL EXAMINED: Off Cape Moreton, Qld, 115 m, T. A. Garrard Coll. (A.M.). Off Manning River, N.S.W., 40 m (A.M.). Off Laurieton, N. of Taree, N.S.W.,

73 m, Voorwinde Coll. (A.M.). Off Soldiers Point, Port Stephens, N.S.W., 20 m, Voorwinde Coll. (A.M.). Off Norah Head, near the Entrance, N.S.W., 45-55 m, Coll. McNeill & Livingstone (A.M.). Off Broughton Island, Port Stephens, N.S.W., coll. J. Brazier. (A.M.). Newcastle Bight, N.S.W., 45-50 m (A.M.). E. of Sydney, N.S.W., 150 m, 18 July 1962, H.M.A.S. "Gascoyne", stn G2/55-56/62 (A.M.). Off Sydney, N.S.W., trawled, J. Voorwinde Coll. (A.M.). Off Crookhaven Heads, N.S.W., 64 m, J. Voorwinde Coll. (A.M.). Off Moruya, N.S.W., 101 m, T. Iredale Coll. (A.M.).

FOSSIL RECORD: Cheltenhamian: Black Rock Sands, shell band above nodule bed, Beaumaris, Vic., Cudmore Coll. (N.M.V.) (1 specimen).

DISTRIBUTION AND HABITAT: South Queensland to at least as far as Moruya, southern N.S.W. on the continental shelf from 20-150 metres (see fig. 15).

REMARKS: Similar in size to *P. nitida* nov. but differs in its more ovate shell, weak axial rugae and in other details. It is of similar size to *P. varicifera relata* (Cotton) from which it differs in its heavier, more compact shell, less distinctly caniculate sutures and different style of axial ornament, the axials being thin and sharp in *varicifera relata*. *P. paucirugosa* is sympatric with *P. moretonensis* in the type locality of the latter, from which it differs in its slightly smaller size, presence of axial sculpture, and in the details of colour.

Two juveniles from 31-37 m, Masthead Island, Capricorn Group, Qld (A.M.) appear to be this species but adult specimens are needed for confirmation.

Pisinna salebrosa (Frauenfeld). Fig. 5b.

Alvania salebrosa Frauenfeld, 1867: 11, pl. 2, fig. 15.

Rissoa salebrosa.—Weinkauff, 1885: 183, pl. 24, figs 5, 6; Tryon, 1887: 327, pl. 66, fig. 44; Henn & Brazier, 1894: 173; Whitelegge, 1889: 266; Kesteven, 1902: 206; Pritchard & Gatliff, 1902: 102.

Alvania salebrosa "Dunker".—Angas, 1877: 187.

Rissoa salebrosa "Dunker".—Tate, 1899: 232.

Scrobs salebrosus.—Hedley, 1903: 355.

Amphithalamus salebrosus.—Hedley, 1911: 108.

Estea salebrosa.—Hedley, 1918: 53; Laseron, 1950: 269, fig. 33.

Subestea salebrosa.—Cotton, 1944: 291; Macpherson & Gabriel, 1962: 92.

Feldestea salebrosa.—Iredale, 1955: 81.

Dardanula salebrosa.—Iredale & McMichael, 1962: 41.

DIAGNOSIS: Shell—Small, solid, broadly conical, with short spire, angled periphery and median indentation on the axially ribbed body whorl.

Protoconch—Conico-dome shaped. Colour wine-red, fades to yellow-brown or yellow.

Teleoconch—Spire outline conical, slightly convex, spire whorls very weakly convex. 3 1/3-3 3/4 whorls: first 1 1/2 (approx.) with extremely weak axial riblets or threads. Penultimate whorl and body whorl with stout, orthocline ribs, rounded in section with interspaces of about equal width; 12-14 on body whorl usually becoming obsolete on last 1/4 whorl. A weak depression on centre of body whorl, commencing on last 1/4 of penultimate whorl; axial ribs narrower over depressed area, thickened adapically and abapically. Ribs continue across periphery, but are weak or absent on base. Base almost flat,

at about 45° to adapical part of the whorl. Periphery distinctly angled. Aperture oval, with peristome somewhat D-shaped; inner lip rather thin and straight, abapical portion well separated from base; outer lip orthocline, thin-edged, thickened within. Varix absent. Colour dark orange-brown fading to yellowish-orange. Adapical part of spire deep purplish; aperture yellow-brown to pale yellowish with a brown parietal region.

Dimensions	length	diameter
Syntype (from original description)	3.2 mm	1.5 mm
Figured specimen	2.40	1.40

LOCATION OF TYPES: Naturhistorisches Museum, Vienna (no number) 3 lots. No lectotype was designated as all specimens in the type series were *P. salebrosa* and showed little variation.

TYPE LOCALITIES: "Sidney" (=Sydney) (6 specimens+4 ex Mohrenstern Coll.) and Botany Bay (5 specimens), N.S.W.

ADDITIONAL MATERIAL EXAMINED: N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll. (A.M.). Off Moreton Bat, S. Qld, 27°31'S,153°40'E, 75-85 m, H.M.A.S. "Kimbla", 29 Mar. 1969, coll. W. F. Ponder (A.M.). Off Flatrock, N. Stradbroke Is., S.Qld, 24-30 m, on algae, 2 Aug. 1971, coll. R. Ibara (A.M.). Port Macquarie, N.S.W., 183 m, C. Hedley (A.M.). Lighthouse, Port Stephens, N.S.W., 73 m, Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Port Stephens, N.S.W. (A.M.). Reclamations, Bayview, Pittwater, N.S.W., C. Laseron Coll. (A.M.). Narrabeen, Sydney, N.S.W., Voorwinde Coll. (A.M.). Long Reef, north side, Sydney, N.S.W., Voorwinde Coll. (A.M.). S. side of Long Reef, Sydney, N.S.W., on short, brown algae, 16 June 1969, Coll. W. F. Ponder & P. H. Colman (A.M.). Little Fairlight, Sydney, N.S.W., Voorwinde Coll. (A.M.). Balmoral, Sydney, N.S.W., 11-15 m, Voorwinde Coll. (A.M.). Middle Harbour, Sydney, N.S.W., Voorwinde Coll.; C. Hedley (A.M.). Chinamans Beach, Sydney, N.S.W., 3-7 m, Voorwinde Coll. (A.M.). Bottle and Glass Rocks, Sydney, N.S.W., 9 m, 1878, coll. J. Brazier; lower littoral, 9 Oct. 1968, coll. W. F. Ponder (A.M.). Off Green Point, Watsons Bay, Port Jackson, Sydney, N.S.W., 7 m, June 1868, coll. J. Brazier (A.M.). Sow and Pigs Reef, E. side, Sydney, N.S.W., 3 m, 1865, coll. J. Brazier (A.M.). Port Jackson, Sydney, N.S.W., dredged, Voorwinde Coll., 2 lots (A.M.). Port Jackson, Sydney, N.S.W., Hargraves Coll. (A.M.). Sydney Harbour, N.S.W., coll. A. U. Henn (A.M.). Little Coogee Bay, Sydney, N.S.W., July 1895, coll. J. Brazier (A.M.). Kurnell, Botany Bay, N.S.W., Voorwinde Coll. (A.M.). Gunnamatta Bay, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.).

DISTRIBUTION AND HABITAT: This species extends from at least south Queensland to Ulladulla, N.S.W. (see fig. 19). It is uncommon over most of its range and, although sometimes found alive in the lower littoral, it is presumed to prefer a sublittoral habitat as most of the specimens available are dead shells from beach drift. The records from the continental shelf are almost certainly fossil shells from Pleistocene or Holocene shore lines.

REMARKS: This species is readily distinguished by its broadly conical shell, and ribbed, centrally depressed body whorl.

Pisinna tasmanica (T. Woods). Figs 6d-f.

Eulima tasmanica.—T. Woods, 1876a: 29; Tryon, 1886: 278.

Rissoa tasmanica.—Tate, 1899: 233; Pritchard & Gatliff, 1902: 108.

Rissoa tasmanica.—May, 1903: 110, text fig. 6.

Amphithalamus tasmanicus.—Hedley, 1911: 108.

Rissoa bicolor.—Gatliff & Gabriel, 1913a: 69, pl. 8, figs 5, 6 (non Petterd, 1884).

Estea tasmanica.—May, 1921: 52; May, 1923: pl. 24, fig. 3; Cotton, 1944: 290; Laseron, 1950: 269; Iredale & McMichael, 1962: 41.

Pisinna tasmanica.—Macpherson & Gabriel, 1962: 92.

DIAGNOSIS: Shell—Small, narrowly conical, smooth, shining; body whorl sometimes with axial riblets or ribs.

Protoconch—Typical, of 1½-1¾ whorls, orange-red.

Teleoconch—Spire outline very slightly convex, almost straight; of 3½-4 whorls, very slightly convex, sutures distinct, impressed on last whorl. Smooth except for extremely fine axial growth threads and occasional spiral scratches, body whorl often with close axial riblets or ribs, sometimes very weak. Subangled to rounded periphery, base weakly convex to almost flat. Aperture nearly circular, slightly contracted, the lips thickened within. Inner lip somewhat advanced abaxially over parietal region, free portion considerably separated from base, usually with a shallow chink behind; outer lip with edge almost orthocline. Varix very weak or absent. Colour white, yellowish, or yellowish-brown with the wine-red or purple inner layer showing through shell, especially on the spire. Aperture white, shallow-water shells sometimes have pale yellowish-brown inner lip.

Dimensions:	length	diameter
Holotype	2.60 mm	1.15 mm
Figured specimens	2.56	1.14
	2.34	1.10

LOCATION OF TYPE: T.M. Holotype (7762/E421, TM5428).

TYPE LOCALITY: Long Bay, Tasm., 11 m.

ADDITIONAL MATERIAL EXAMINED: N.E. of Cape Moreton, S. Qld, 128-182 m, Voorwinde Coll. (A.M.). Trawled N.E. of Cape Moreton Light, S. Qld, 115 m, Voorwinde Coll. (A.M.). Moreton Bay, S. Qld, C. Hedley (A.M.). Off Laurieton, N.S.W., 55 m, Voorwinde Coll. (A.M.). Off lighthouse, Port Stephens, N.S.W., 73 m, Voorwinde Coll. (A.M.). Soldiers Point, Port Stephens, N.S.W., 18 m, Voorwinde Coll. (A.M.). Port Stephens, N.S.W., trawled, Voorwinde Coll. (A.M.). Cape Three Points, near Tuggerah Lakes, N.S.W., 75-91 m (A.M.). Off Broken Bay, N.S.W., 137 m, Voorwinde Coll. (A.M.). Port Jackson, Sydney, N.S.W., 46 m, Voorwinde Coll. (A.M.). Off Sydney, N.S.W., 82 m, Voorwinde Coll. (A.M.). E. of Sydney, N.S.W., 150 m, 18 July 1962, H.M.A.S. "Gascoyne", stn G2/56/62, 3 lots (A.M.). Sydney, N.S.W., trawled, Voorwinde Coll. (A.M.). Off Botany Bay, Sydney, N.S.W., 110 m, Voorwinde Coll. (A.M.). 29 km E. of Malabar, Sydney, N.S.W., 192-203 m, stn 43, 9 Aug. 1973, coll. Shelf Benthic Survey (A.M.). Jibbon, near Cronulla, N.S.W., 80 m, 9 Jan. 1964, Voorwinde Coll. (A.M.). Off Cronulla, N.S.W., 46 m, Voorwinde Coll. (A.M.). Off Port Kembla, N.S.W., 115-137 m, C. Hedley (A.M.). Off Crookhaven, N.S.W., 55-64 m, Voorwinde Coll. (2 lots); Laseron Coll. (A.M.). 40 km E. of Twofold Bay, N.S.W., 37°27'S, 150°17'E, 294-304 m, 19 June 1962, H.M.A.S. "Gascoyne", stn G2/60/62 (A.M.). 24 km off Twofold Bay, N.S.W., approx 37°26'S, 150°15'E, 75-154 m, 19 June 1962, H.M.A.S. "Gascoyne", stn G2/58-59/62 (A.M.). 32 km S.E. of Twofold Bay, N.S.W., 37°26'S, 150°15'E, 149 m, H.M.A.S. "Gascoyne", stn G2/59/62, 19 June 1962 (A.M.). Elephant Shoal Reef, S.E. of King Is., Bass Strait, on Telecommunication Cable (N.M.V.). Off Devonport and Launceston, Tasmania, Voorwinde Coll. (A.M.). Off Cape Naturaliste, N.E. Tasm., 40°50.6'S, 148°46.5'E, 399 m, 26 Mar. 1973, M.T. "Sprightly", stn 2051, coll. P. H. Colman (A.M.). Off Piccaninny Point, N. of Bicheno, E. Tasm., 41°40'S, 148°18.4'E, 27 m, 24 Mar. 1973, M.V. "Sprightly", stn 2032, coll. P. H. Colman (A.M.). Marion Bay, S. of Maria Island, S.E. Tasm., 42°50'S, 147°59.8'E, 58 m, 13

Mar. 1973, M.T. "Sprightly", stn 1993, coll. P. H. Colman (A.M.). Port Arthur, S. Tasm., May Coll. (S.A.M.). Derwent Estuary, S. Tasm., Voorwinde Coll. (A.M.). Tinderbox, Derwent Estuary, S. Tasm., 15 m, Voorwinde Coll. (A.M.). Storm Bay, S. Tasm., H.M.A.S. "Moresby", Voorwinde Coll. (A.M.). 17 km S.W. of Cape Raoul, S. Tasm., 43°25'S, 147°45'E, 117 m, 24 Mar. 1970, F.R.V. "Penghana", coll. W. F. Ponder (A.M.). Off Cape Everard, Vic., 128-146 m, T. Iredale Coll. (A.M.). 57 km S. of Cape Conran, off Gippsland, Vic., 38°18.20'S, 148°40'E, 218-264 m, "Esso-Gipps" stn 10, May 1969, coll. C. Phipps (A.M.). 113 km S. of Lakes Entrance, Vic., 39°00'S, 148°24.50'E, 95 m, sand, May 1969, "Esso-Gipps" stn 20, coll. C. Phipps (A.M.). Off 90 Mile Beach, Vic. (N.M.V.). 29 km S. by S.E. of Lakes Entrance, Vic., W.S. Ayres, Gabriel Coll. (N.M.V.). 16 km W. of Lakes Entrance, Vic., 18 m (N.M.V.). Off Wilsons Promontory, Vic., Gabriel Coll. (N.M.V.). Off Cape Jaffa, S.A., 164 m, Verco Coll. (S.A.M.). Off Beachport, S.A., 365 m, Verco Coll. (S.A.M.). N.W. of Cape Borda, S.A., 113 m, Verco Coll. (S.A.M.). Coll. (S.A.M.).

FOSSIL RECORDS: Upper Pliocene: Cameron Inlet Formation, Hill's Dam at foot of Dutchman (E. side), Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.). Kalimnan: Jemmys Point Formation, 0-2 m, above beach in cliff, 50-100 m E. of Kalimna Jetty, lower shell bed (bed c), Vic. (N.M.V.). Mitchellian: Rose Hill Marl Member, Tambo River Formation, Moondara Farm, Mitton's (Old Rose Hill), about ½ way down hill near E. fence of paddock behind milking shed, Bairnsdale, Vic., coll. T. A. Darragh (N.M.V.).

DISTRIBUTION AND HABITAT: South Queensland to mid-South Australia, common on the continental shelf (see fig. 18).

REMARKS: The axial ribbing on the body whorl is generally much more frequently encountered in northern populations (i.e. central N.S.W. northwards) and is usually more pronounced than in southern populations.

This species is distinguished by its narrowly conical, shining, mostly smooth shell with the slightly contracted almost circular aperture.

Pisinna tumida tumida (T. Woods). Fig. 5f.

Diala tumida T. Woods, 1876b: 147; Tryon, 1887: 283; Tate & May, 1901: 391 (in part).

Estea tumida.—May, 1920: 60, pl. 15, fig. 9; May, 1921: 52; Gatliff & Gabriel, 1922: 147; May, 1923: pl. 24, fig. 9; Cotton, 1944: 292.

Pisinna tumida.—Macpherson & Gabriel, 1962. 92.

DIAGNOSIS: Shell—Small, solid, with heavy axial ribs and a nodular cord abapical to sutures.

Protoconch—Dome-shaped, of 1½-2 whorls. Wine-red in colour with typical sculpture.

Teleoconch—Conical, slightly convex spire; 3¾-4½ whorls, almost flat or slightly convex; sutures impressed. All whorls with strong axial ribs, rounded in section and slightly oblique, about 18 on body whorl, becoming sub-obsolete on last ¼ of body whorl, persisting on to base. A row of weak nodules abapical to sutures on last 2 whorls, strongest on body whorl. Base convex with weak spiral ridge on abapical part. Aperture subcircular, typical, inner lip slightly opisthocline. Varix weak, broad. Colour of spire reddish-orange to reddish-purple due to inner layer showing through. Body whorl and aperture yellowish-white or very pale yellowish-brown with 3 pale brown bands, one on abapical half of sutural row of nodules, other 2 on base, uppermost just abapical to periphery.

Dimensions:	length	diameter
Neotype	3.00 mm	1.34 mm

LOCATION OF TYPE: T.M. Neotype (7765/E424, C. 711), ex May Coll. Neotype here chosen (2 syntypes completely destroyed except for a few small, unidentifiable fragments (TM 7146/E15). No other type material known to exist).

TYPE LOCALITY: Frederick Henry Bay, S.E. Tasm. (original type locality Swansea, Tasm.).

ADDITIONAL MATERIAL EXAMINED: E. of Grassy, King Is., N.Tasm., ca. 58-77 m, 23 July 1962, H.M.A.S. "Gascoyne", stn G/68-70/62 (A.M.). W. of Kangaroo Is., Furneaux Group, N.E. Tasm., 49 m, 17 Jan. 1968, "Umitaka Maru", stn 68-35 N (T.M.). Bass Strait Islands, Tasm., exch. Petterd (A.M.). Off Waterhouse Point, N.E. Tasm., 36 m, 17 Jan. 1968, "Umitaka Maru", stn 68-31 N; 32 N (T.M.). Green Cape, Maria Is., Tasm., 5.5 m, on sublittoral algae, 26 Mar. 1970, coll. W. F. Ponder & D. C. Wolfe (A.M.). Pirates Bay, Eaglehawk Neck, S.E. Tasm., on intertidal rocks on coralline algae, 31 Mar. 1970, coll. W. F. Ponder (A.M.). Tasmania, pres. W. L. May (A.M.). Cowes, Vic., Robin Coll. (N.M.V.). Portsea, Vic., Gatliff Coll. (N.M.V.). Western Port, Vic., Gatliff Coll. (N.M.V.). Dredged off Rhyll, Vic., Gatliff Coll. (A.M.). MacDonnell Bay, S.A., Verco Coll. (S.A.M.). Port MacDonnell, S.A., Verco Coll. (S.A.M.). Off Middle Point, near Cape Northumberland, S.A., 13 m, on algae, 19 Mar. 1974, coll. S.A. Shepherd (A.M.). Off Beachport, S.A., 73 m, Verco Coll. (S.A.M.). Between Cape Jaffa and Kangaroo Is., S.A., 75-155 m, 24-26 July 1962, H.M.A.S. "Gascoyne", stn G2/71, 72, 76, 77/62 (A.M.). St. Francis Is., S.A., 27-36 m, Verco Coll., 2 lots (S.A.M.). 81 km S.W. of Cape Adieu, Gt. Aust. Bight, S.A., 32°42'S, 131°27'E, ca. 79 m, H.M.A.S. "Gascoyne", stn G2/90/62, 4 July 1962 (A.M.). Great Aust. Bight, S.A., 33°05'S, 128°40'E, 5 July 1962, H.M.A.S. "Gascoyne", stn G2/97/62 (A.M.).

FOSSIL RECORDS: Upper Pliocene: Cameron Inlet Formation, Hill's Dam at foot of Dutchman (E. side), Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.). Kalimnan: Grange Burn Formation, Forsythes Bank, S.E. side of Grange Burn, near Hamilton, Vic., in shell bed 2 m above creek, coll. T. A. Darragh (N.M.V.).

Both of these records are single specimens. They agree moderately well with Recent material except that their whorls are more convex. Both specimens are rather worn.

DISTRIBUTION AND HABITAT: Tasmania, Victoria W. of Wilsons Promontory to the eastern side of the Great Australian Bight (see fig. 16). Rarely found in the intertidal, living on sublittoral algae and dredged as dead shells on the continental shelf.

REMARKS: Differs from *P. olivacea olivacea* in having heavier axial ribs which are strong on all postnuclear whorls, and in possessing colour bands.

The 2 syntypes are destroyed to the extent that, in our opinion, they are completely unidentifiable. May (1920) figured a specimen, presumably from the lot from which the neotype has been selected, stating that he had carefully compared his specimens with the original type material.

Two subspecies are here recognised and described as new below. All three forms are separable from *P. olivacea olivacea*, to which they bear the closest resemblance, by their straighter, more widely separated axials and, in the case of *tumida tumida* which is over part of its range, sympatric with *olivacea olivacea*, by its larger shell which has colour bands.

Pisinna cf. tumida (T. Woods).

Two worn, damaged specimens similar to *tumida* from the Miocene of Victoria are too imperfect for accurate identification or description. They agree rather well with *tumida* except they are smaller than Recent specimens.

Dimensions:	length	diameter
	1.84 mm	0.84 mm
	1.84	0.88

LOCALITY: Miocene: Balcombian: "Clifton Bank", Muddy Creek, Vic. (=Muddy Creek Marl, lower beds), G. B. Pritchard Coll. (N.M.V., P. 33139).

Pisinna tumida simplicosta subsp. nov. Fig. 5h.

Rissoa olivacea.—Hedley, 1905: 42 (non Frauenfeld, 1867).

DIAGNOSIS: Shell—Small, solid, of pale colour, with strong, orthocline axial ribs.

Protoconch—Typical, of 1½ whorls, pink colour.

Teleoconch—Spire outline very slightly convex, whorls 3½-4, almost flat. Very strong, orthocline or very slightly prosocline ribs with about equal interspaces on all whorls, about 17 on penultimate whorl. A very weak cord causes indistinct nodulation of the axials immediately abapical to the sutures. Last 1/3 of body whorl (abaxial to varix) with weak, irregular riblets only. Aperture circular, outer lip slightly opisthocline in anterior portion. Varix broad, rather weak, about 1/3 whorl adaxial to aperture. Colour pale yellowish, spire pink, due to internal shell layer showing through the translucent shell.

Dimensions:	length	diameter
Holotype	2.00 mm	1.00 mm
Paratype	2.48	1.12

LOCATION OF TYPES: A.M. Holotype (C. 95041), 1 paratype (C. 95042) and 8 paratypes (C. 19885).

TYPE LOCALITIES: N.N.E. of Cape Moreton, S. Qld, 128-183 m, J. Voorwinde Coll. (C. 95041, C. 95042). E. of Cape Byron, N.S.W., 203 m, coll. G. H. Halligan (C. 19885).

ADDITIONAL MATERIAL EXAMINED: Noosa Heads, S. Qld, in beach drift, J. Voorwinde Coll. (A.M.) (5 worn specimens only tentatively identified as this species).

DISTRIBUTION AND HABITAT: South Queensland and northern N.S.W., in 128-203 m (see fig. 16). A related form, or the same subspecies, has been collected in beach drift at Noosa Heads, South Queensland.

REMARKS: This subspecies is extremely similar to *P. tumida wilsoni* nov. but differs from this and *P. tumida tumida* in having consistently more regularly orthocline axial ribs on the body whorl which tend to line up with the ribs on the previous whorls, a feature not often seen in *wilsoni*. The colour of the Queensland subspecies is pale yellowish and pink, this being in sharp contrast to the dark orange-brown West Australian subspecies. *P. tumida simplicosta* is readily distinguished from *P. olivacea olivacea* by its stronger, orthocline ribs, weaker row of gemmules, taller, less inflated spire and relatively smaller aperture.

Pisinna tumida wilsoni subsp. nov. Fig. 5g.

DIAGNOSIS: Differs from the typical form in being slightly smaller in size and of uniform deep red-brown colour, although faded specimens sometimes show a dark band on the abapical portion of the base; the axial ribs are often paler in colour, being more yellowish than the rest of the shell.

Dimensions:	length	diameter
Holotype	2.45 mm	1.20 mm

LOCATION OF TYPE: A.M. Holotype (C. 95037) and 14 paratypes (C. 95038). 2 paratypes in W.A.M.

TYPE LOCALITY: Off Dunsborough, S.W.A., 16 m, on algae on limestone and coral reef, coll. W. F. Ponder, B. R. Wilson & N. Coleman.

ADDITIONAL MATERIAL EXAMINED: 80 km S.W. of Cape Adieu, Great Aust. Bight, S.A., 32°42'S, 131°27'E, 79 m, 4 July 1962, H.M.A.S. "Gascoyne", stn G2/90/62 (A.M.). 129 km W. of Eucla, Great Aust. Bight, W.A., 148 m, Verco Coll. (S.A.M.). E. of Hood Point, W.A., 34°21'S, 121°16'E, 79 m, 9 July 1962, H.M.A.S. "Gascoyne", stn G2/109/62 (A.M.). West of Bold Is., W.A., 34°55'S, 119°00'E, 71 m, 7 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/150/62 (A.M.). S. of Wilson Point, W.A., 35°12'S, 117°00'E, 73-77 m, 8 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/160/62 (A.M.). W. of Bunbury, W.A., 33°03'S, 114°44'E, 156 m, 10 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/175/62 (A.M.).

DISTRIBUTION AND HABITAT: Western Great Australian Bight to S.W. Australia (see fig. 16). Deep sublittoral (16 metres) to 156 metres.

REMARKS: Two populations, here recognised as *tumida tumida* from the Great Australian Bight, are intermediate in size. Although all of the 28 specimens are faded to white, some show remnants of the three colour bands typical of *tumida tumida*.

This subspecies is named for Dr. B. R. Wilson who assisted greatly in the collection of samples of micro-Mollusca while one of us (W.F.P.) was in Western Australia.

Pisinna varicifera varicifera (T. Woods). Fig. 7c.

Rissoina varicifera T. Woods, 1877a: 101.

?Rissoa dubia Johnston, 1880: 33; Johnston, 1888: pl. 31, fig. 2, 2a; Pritchard, 1896: 116; May, 1919: 72 (non Defrance, 1827).

Estea varicifera.—May, 1919: 73, pl. 11, fig. 19.

Epigrus variciferus.—Chapman & Crespin, 1928: 113.

Zebinella varicifera.—Darragh, 1970: 205.

DIAGNOSIS: Shell—Small, solid, almost smooth, with deeply impressed, usually channelled sutures and tall spire.

Protoconch—Dome-shaped, of 1½-1¾ whorls.

Teleoconch—Spire outlines very slightly convex. 4½-5 lightly convex whorls which are usually sharply cut into the sutures. Sculpture very indistinct; close, very weak, axial riblets sometimes present on body whorl, otherwise smooth except for growth lines and occasional indistinct spiral scratches. Base convex. Aperture subcircular, inner and outer lips heavily thickened within. Outer lip opisthocline. Varix broad, moderately strong.

Dimensions:	length	diameter
Figured specimen	4.50 mm	1.75 mm

LOCATION OF TYPES: Lost? (Possibly unrecognised in the T.M.).

TYPE LOCALITY: Table Cape, Tasm. (Lower Miocene).

ADDITIONAL MATERIAL EXAMINED: Lower Miocene: Table Cape (=Fossil Bluff), N. Tasm., G. B. Pritchard Coll. (N.M.V.); coll. E. D. Atkinson (A.M.). Freestone Cove Sandstone (=lower bed), Table Cape, Tasm., Cudmore Coll. (N.M.V.). Fossil Bluff Sandstone (=upper bed), Table Cape, Tasm., Cudmore Coll. (N.M.V.). Bairnsdalian, Bullenmeri Clay, edge of Lake Bullenmeri, Jan. 1935, Parr Coll. (N.M.V.). Moondara Farm, Mitton's (=Old Rose Hill) about half way down hill near E. fence of paddock behind milking shed, Bairnsdale, Vic., coll. T. A. Darragh (N.M.V.). Upper Pliocene. Cameron Inlet Formation, Hill's Dam at foot of

Dutchman, on E. side, Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.). Cameron Inlet Formation; North Patriarch drain, 1 km E. of Link Road, a small side drain on S. side between first and second weirs E. of Link Road, near Monana, Flinders Is., coll. T. A. Darragh, Nov. 1964 (N.M.V.).

DISTRIBUTION: Lower Miocene to Upper Pliocene in N. Tasmania, Flinders Island and E. Victoria (see fig. 15).

REMARKS: *Rissoa dubia* Johnston is probably based on a juvenile shell of *varicifera*, as far as can be judged from the author's (1888) figure. Three specimens (ex Pritchard collection) in the National Museum of Victoria, which are presumably the basis of Pritchard's (1896) record and which bear the name *dubia*, are juvenile *varicifera*.

Many of the records listed by Chapman & Crespin (1928) refer to species other than *varicifera*, and some are not *Pisinna*.

The type has not been located in the Tasmanian Museum and may be lost.

This subspecies is ancestral to *P. varicifera relata* from which it differs in its more elongate shell, relatively smaller aperture and weaker sculpture.

Pisinna varicifera relata (Cotton). Figs 7d-g.

Rissoa tumida.—Tate and May, 1901: 391, 459, pl. 26, fig. 67 (not of T. Woods, 1876).

Scrobs bicolor.—Hedley, 1903: 355 (in part) (non Petterd, 1884).

Estea relata Cotton, 1944: 290, pl. 16, fig. 3.

Eusetia laterna Cotton, 1952: 51, pl. 3, fig. 11.

DIAGNOSIS: Shell—About medium size for genus, inflated, solid, grey to yellowish-brown with purple-red spire. Weak axial threads, especially on body whorl, and channelled sutures.

Protoconch—Dome-shaped, 1½-1¾ whorls. Purple-red; surface with close, spiral rows of minute pits.

Teleoconch—Spire slightly inflated, 3½-4½ whorls, moderately convex to almost flat; usually cut in sharply at sutures forming a narrow channel but this less pronounced in shells from western part of range. Sculpture of very fine, oblique (orthocline) irregular axial riblets on all whorls, which usually become more prominent and more oblique on body whorl; especially on shells from eastern part of range. Traces of subobsolete spiral sculpture can sometimes be seen. Sculpture is easily worn off. Base convex; aperture medium to moderately large, obliquely oval. Inner lip well separated from base, with fold developed behind lip in eastern shells; western shells with abapical portion of inner lip less raised and usually without a thickened fold behind. Outer lip extends beyond line of spire in eastern shells, not in western shells, edge slightly opisthocline. Varix broad, very weak to moderate. Colour yellowish-brown to greyish-white, a purple-red chitinous layer showing through on spire on fresh specimens. Dead shells uniform yellow, brown or white.

Dimensions:	length	diameter
Holotype	3.05 mm	1.62 mm
Paratype (large)	3.45	1.60
Paratype (small)	2.80	1.40
Holotype of *E. laterna*	3.40	1.70
Paratype of *E. laterna*	3.40	1.45
Figured specimen (N.S.W.)	4.58	1.92
Figured specimen (W.A.)	3.63	1.55

LOCATION OF TYPES: *Estea relata*. S.A.M. Holotype and 6 paratypes (D. 14186).

Of the 7 specimens in the type series, Cotton selected the most worn as the holotype.

E. laterna Cotton. S.A.M. Holotype (D. 14443) and 5 paratypes, one of which is an eatoniellid or rastodentid, another is *Pisinna* sp. and one an unidentifiable juvenile. The two remaining paratypes are *P. v. relata* one of which is broken.

TYPE LOCALITIES: *Estea relata*. 26 m, Gulf St. Vincent, S.A.

Eusetia laterna. 366 m. off Beachport, S.A., coll. J. C. Verco.

ADDITIONAL MATERIAL EXAMINED: Off Hallidays Point, N.S.W., 32°06'S, 152°54.2'E, 118 m, 5 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Soldiers Point, Port Stephens, N.S.W., 18 m, Voorwinde Coll. (A.M.). Off Cape Three Points, near Tuggerah Lakes, N.S.W., 75-91 m (A.M.). Off Broken Bay, N.S.W., 137 m, Voorwinde Coll. (A.M.). 35 km E. of Narrabeen, N.S.W., 146 m, pres. Haswell (A.M.). Off Sydney, N.S.W., 55-70 m, Voorwinde Coll. (A.M.). E. of Sydney, N.S.W., 150 m, H.M.A.S. "Gascoyne", stn G2/55-56/62, 18 July 1962, 2 lots (A.M.). 29 km E. of Malabar, Sydney, N.S.W., 192-203 m, 9 Aug. 1973, coll. Shelf Benthic Survey, stn 43 (A.M.). Off Botany Bay, N.S.W., 91-95 m (A.M.). Off Cronulla, N.S.W., 109 m, 2 Aug. 1964, H.M.A.S. "Gascoyne" (A.M.). Off Port Kembla, N.S.W., 115-137 m, "Thetis" stn 49 (A.M.). Crookhaven, N.S.W., 55 m, Voorwinde Coll., 2 lots (A.M.). Off Twofold Bay, N.S.W., 51 m, Voorwinde Coll. (A.M.). 24 km off Twofold Bay, N.S.W., approx. 37°26'S, 150°15'E, 75-154 m, H.M.A.S. "Gascoyne" stn G2/58-59/62, 19 June 1962 (A.M.). 32 km S.E. of Twofold Bay, N.S.W., 37°26'S, 150°15'E, 149 m, H.M.A.S. "Gascoyne", stn G2/59/62, 19 June 1962 (A.M.). E. off Grassy, King Is., Tasm., ca. 58-77 m, "Gascoyne", stn G2/68-70/62, 23 July 1962 (A.M.). Elephant Shoal Reef, S.E. of King Is., Bass Strait, on Telecommunication cable (N.M.V.). Off Waterhouse Point, N.E. Tasm., ca. 40 m, "Umitaka Maru" stns 68-30 N, 31 N, 32 N, 17 Jan. 1968, 3 lots (T.M.). Off Scamander, N.E. Tasm., 41°30'S, 148°17.5'E, 31 m, B.M.R. stn 2033, M.T. "Sprightly", 24 Mar. 1973, coll. P. H. Colman (A.M.). Off Piccaninny Point, N. of Bicheno, N.E. Tasm., 27 m, B.M.R. Stn. 2032, M.T. "Sprightly", 24 Mar. 1973, coll. P. H. Colman (A.M.). 4 km N.E. of Beaching Bay, Maria Is., E. Tasm., 42°27.5'S, 148°12'E, 82 m, F.R.V. "Penghana", 25 Mar. 1970, coll. W. F. Ponder (A.M.). Marion Bay, S. of Maria Is., E. Tasm., 42°50'S, 147°59.8'E, 58 m, B.M.R. stn 1993, M.T. "Sprightly", 13 Mar. 1973, coll. P. H. Colman (A.M.). 11 km E. of Cape Pillar, S.E. Tasm., 183 m, C. Hedley & W. L. May, 2 lots (A.M.). Derwent River, S. Tasm., W. L. May (A.M.). Derwent Estuary, Tasm. (A.M.). Killora Bay, Tinderbox, Derwent Estuary, S. Tasm., 14 m, Voorwinde Coll. (A.M.). D'Entrecasteaux Channel, S.E. Tasm., H.M.A.S. "Moresby", 24 Apr. 1965, Voorwinde Coll. (A.M.). D'Entrecasteaux Channel, S.E. Tasm., towards jetty, 43°05'36"S, 147°19'12"E, 7.5 m, 23 Mar. 1970, F.R.V. "Penghana", coll. W. F. Ponder (A.M.). 3 km S. of Tasman Head, S. Bruny Is., S.E. Tasm., 43°33'45"S, 147°19'21"E, 73 m, 24 Mar. 1970, F.R.V. "Penghana", coll. W. F. Ponder (A.M.). 58 km S. of Cape Conran, off Gippsland, Vic., 38°18'20"S, 148°38'40"E, 220-265 m, "Esso-Gipps", stn 10, May 1969, coll. C. Phipps (A.M.). 121 km S. of Cape Conran, off Gippsland, Vic., 148°31'50"E, 39°00'00"S, on continental slope, 183-146 m, shelly sand, "Esso-Gipps", stn 18, May 1969, coll. C. Phipps (A.M.). Off Rhyll, Western Port, Vic., dredged, 11-14 m, Gatliff Coll. (N.M.V.). Off Beachport, S.A., 365 m; 73 m, Verco Coll., 2 lots (S.A.M.). Off Cape Jaffa, S.A., 237 m, Verco Coll., 2 lots (S.A.M.). Between Cape Jaffa, S.A., and Kangaroo Is., S.A., 75-155 m, H.M.A.S., "Gascoyne", stns G2/71-72-76-77/62, 24-26 July 1962, 2 lots (A.M.). N.W. of Cape Borda, Kangaroo Is., S.A., 113 m, Verco Coll. (S.A.M.). 64 km S. of Cape Wiles, S.A., 183 m, F.R.V. "Endeavour" (A.M.). 51 km S.S.W. of St. Francis Is., S.A., 64 m (A.M.). Off St. Francis Is., S.A., 64 m, J. C. Verco (S.A.M.). 81 km S.W. of Cape Adieu, Great Australian Bight, S.A., 32°42'S, 131°27'E, ca. 79 m, H.M.A.S. "Gascoyne", stn G2/90/62, 4 July 1962 (A.M.). Great Australian Bight, S.A., 33°05'S, 128°40'E, 75 m, H.M.A.S. "Gascoyne", stn G2/97/62, 5 July 1962 (A.M.). 120 km E. of Rocky Point, Great Australian Bight, S.A., 33°43'S, 125°04'E, 77-80 m, H.M.A.S. "Gascoyne", stn G2/104/62, 7 July 1962 (A.M.). Between Eucla

and Esperance, W.A., 79-147 m, H.M.A.S. "Gascoyne", stns G2/96-97/62, 5 July 1962 (A.M.). E. of Cheyne Bay, W.A., 34°55'S, 119°00'E, 75 m, H.M.A.S. "Gascoyne", G3/150/62, 7 Aug. 1962 (A.M.). E. of Hood Point, S.W.A., 34°21'S, 120°16'E, 79 m, H.M.A.S. "Gascoyne", stn G2/109/62, 9 July 1962 (A.M.). E. of Hood Point, (N.E. of Albany), S.W.A., 150 m, H.M.A.S. "Gascoyne", stn G3/108/62, July 1962 (A.M.). W. of Bunbury, S.W.A., 33°03'S, 114°44'E. 156 m, H.M.A.S. "Gascoyne", stn G3/175/62, 10 Aug. 1962 (A.M.).

DISTRIBUTION AND HABITAT: Mid N.S.W. to E. Tasmania and S.W. Australia, on the continental shelf with a known depth range of about 13 to 365 m (see fig. 15).

REMARKS: The variation throughout the range of this subspecies is considerable. South eastern shelf specimens are readily distinguished from south western shelf specimens (c.f. figs 7e, 7f) but off the eastern coast of South Australia, populations are generally intermediate in form (figs 7d, 7g). A few South Australian specimens in the S.A.M. are like east coast shells and these grade into typical southern Australian specimens. The two species named by Cotton (*relata* and *laterna*) are both rather typical of the central southern shelf form. It thus appears that a cline exists from the south western form, which has a narrower shell, very weak axials (some almost smooth), a rather constricted aperture and weakly indented sutures, to a larger, distinctly axially sculptured shell with channelled sutures and a rather large aperture.

This species and *P. tasmanica* are the two common species on the south eastern shelf (including Tasmania). They are readily distinguished by the larger size of *varicifera relata* and the relatively finer axials (when *P. tasmanica* is axially sculptured the axials are rather few and coarse); and this together with the indented sutures of *varicifera relata*, allows separation to be readily achieved.

Pisinna vincula (Laseron). Figs 2h-i.

Scrobs vincula Laseron, 1950: 274, fig. 51.

Anabathron nothus Laseron, 1950: 275, fig. 58.

Obescrobs vincula.—Iredale & McMichael, 1962: 41.

Nannoscrobs nothus.—Iredale & McMichael, 1962: 42.

DIAGNOSIS: Shell—Minute, conico-pupoid, with weakly to strongly angled periphery and orange-red in colour.

Protoconch—Typical, and of 1½ whorls, wine-red in colour.

Teleoconch—Spire outlines weakly convex, 3-3¼ almost flat whorls with impressed sutures. Surface with growth lines only, sometimes these fairly conspicuous. A peripheral subangulation or angulation, sometimes a peripheral cord, and occasionally additional smooth cords abapical and adapical to sutures present. Base weakly convex. Aperture subcircular, inner lip thickened, separated from base in abapical portion, outer lip orthocline. Varix absent. Colour orange-red or red, base and aperture fading to yellowish, inner lip stained with orange-red over parietal area.

Dimensions:	length	diameter
Lectotype of *S. vincula*	1.54 mm	0.80 mm
Holotype of *A. nothus*	1.90	0.82

LOCATION OF TYPE: *Scrobs vincula.* A.M. Lectotype (C. 95043) and 1 paralectotype (C. 95044).

Anabathron nothus. A.M. Holotype (C. 95054).

TYPE LOCALITY: *Scrobs vincula*. Fairlight, North Harbour, Sydney, N.S.W., on algae in rock pools.

Anabathron nothus. Point Halliday, N.S.W., on algae.

Operculum—Typical.

Radula—Central teeth 2 + 1 + 2, outermost cusps very small and almost denticle-like, median cusp long, blunt with 2-3 denticles on cutting edge, about same width as bases of adjacent cusps. Lateral teeth 2+1+2-3, lateral cusps sharp, median cusp blunt. Inner marginal teeth with about 9 sharp cusps, outer marginal teeth finely dentate (general details and shape of cusps and teeth like those of *P. approxima* and *P. olivacea olivacea*).

ADDITIONAL MATERIAL EXAMINED: Off Flatrock, N. Stradbroke Is., S. Qld, 27-34 m, on algae, 2 Aug. 1971, coll. R. Ibara (A.M.). Off Crowdy Head, N.S.W., 32°38'9"S, 153°00'08"E, 91 m, 16 Dec. 1957, H.M.A.S. "Warrego" (A.M.). Forster, N.S.W., on green algae, open coast, lower littoral; on coralline algae, boulder beach, lower littoral, 4 Jan. 1969; coll. W. F. Ponder (A.M.). Fishermans Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Fingal Bay, Port Stephens, N.S.W., Voorwinde Coll. (A.M.). Pittwater, Broken Bay, N.S.W., dredged 1950-60, Voorwinde Coll. (A.M.). Narrabeen, Sydney, N.S.W., Voorwinde Coll. (A.M.). Long Reef, Collaroy, Sydney, N.S.W., 1950-60, Voorwinde Coll. (A.M.). North Harbour, Sydney, N.S.W., 18 m, Voorwinde Coll. (A.M.). Fairlight, Sydney, N.S.W., Voorwinde Coll. (A.M.). Middle Harbour, Sydney, N.S.W., C. Hedley, 2 lots (A.M.). Ny-ar-gine Point, Middle Harbour, Sydney, N.S.W., 19 Dec. 1968, coll. A.M. Party (A.M.). Chinamans Beach, Sydney, N.S.W., 3-7 m, Voorwinde Coll. (A.M.). E. of Sow & Pigs Reef, Sydney, N.S.W., near rocks, 1865, coll. J. Brazier (A.M.). Kurnell, Botany Bay, N.S.W., Voorwinde Coll. (A.M.). Gunnamatta Bay, Port Hacking, N.S.W., Voorwinde Coll. (A.M.). Honeymoon Beach, Jervis Bay, N.S.W., under stones, sand beach, lower littoral; red and brown algae, 18 Jan. 1969, coll. W. F. Ponder & N. Coleman (A.M.). Ulladulla, N.S.W., Voorwinde Coll. (A.M.). S. of Ulladulla, N.S.W., inside breakwater on sheltered reef, on small brown algae, 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Wimbie Beach, Batemans Bay, N.S.W., on exposed rocks, under stones, 6 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). Shelly Beach, Bermagui, N.S.W., Voorwinde Coll. (A.M.). Merimbula Jetty, exposed side, Merimbula, N.S.W., under stones, 7 Jan. 1970, coll. W. F. Ponder & P. H. Colman (A.M.). S.S.E. of Gabo Is., Vic., on red algae, 28 m, Feb. 1973, coll. P. Hutchings (A.M.).

DISTRIBUTION AND HABITAT: Restricted to N.S.W. and the south eastern corner of Victoria (see fig. 17), although it appears to be more abundant north of Sydney. Found alive at extreme low water on algae and beneath stones, as well as in the sublittoral, usually in open coastal situations.

REMARKS: The peripheral angulation is variable, occasionally barely noticeable and, rarely, the body whorl is strongly bi-keeled (as in the type of *nothus*). This species is very similar to *approxima* from which it differs in the peripheral angulation, consistent orange-red or red colour, flatter whorls, more conical shape and non-expanded aperture.

Pisinna voorwindei sp. nov. Fig. 7b.

DIAGNOSIS: Shell—Elongate, smooth, shining, with a small aperture.

Protoconch—Dome-shaped, of 1½ whorls, the tip broad and expanded, sculpture typical. Yellowish in colour (in type), fresher specimens reddish-pink.

Teleoconch—Narrow, elongate with about five rather flat, slightly stepped whorls. Smooth, shining, except for weak axial growth lines and close spiral scratches. Base convex; periphery evenly convex in adult, strongly angled in juveniles. Aperture small, slightly contracted. Inner lip spread over parietal region, not much separated from base

adapically; outer lip slightly opisthocline, varix absent. Colour white, the purplish-brown inner shell layer showing through on spire turning it to reddish-pink or red-brown to greyish on abapical 2/3 of whorls. Aperture with yellow lips, remainder white.

Dimensions:	length	diameter
Holotype	4.10 mm	1.42 mm

LOCATION OF TYPES: A.M. Holotype (C. 90351) and 6 paratypes (C. 95045).

TYPE LOCALITY: 120 km E. of Rocky Point, Great Australian Bight, S.A., 77-80 m, 33°43'S, 125°04'E, 7 July 1962, H.M.A.S. "Gascoyne", stn G2/104/62.

ADDITIONAL MATERIAL EXAMINED: "South Australia", Verco Coll. (S.A.M.). 80 km S.W. of Cape Adieu, Great Aust. Bight, S.A., 32°42'S, 131°27'E, 79 m, 4 July 1962, H.M.A.S. "Gascoyne", stn G2/90/62 (A.M.). Great Aust. Bight, S.A., 33°05'S, 128°40'E, 75 m, 5 July 1962, H.M.A.S. "Gascoyne", stn G2/97/62 (A.M.). Between Eucla and Esperance, W.A., 79-147 m, 5 July 1962, H.M.A.S. "Gascoyne", stn G2/96-97/62 (A.M.). E. of Hood Point, W.A., 34°21'S, 121°16'E, 79 m, 9 July 1962, H.M.A.S. "Gascoyne", stn G2/109/62 (A.M.). W. of Bald Is., W.A., 34°55'S, 119°00'E, 71 m, 7 Aug. 1962, H.M.A.S. "Gascoyne", stn G3/150/62 (A.M.).

DISTRIBUTION AND HABITAT: Great Australian Bight to at least as far W. as Bald Island in 75-147 m (see fig. 15).

REMARKS: The elongate, almost smooth shell of this species is very distinctive, differing from all of the other large species in its shape.

Cotton (1944) based his deep-water South Australian records of *Estea bicolor* on specimens of this species.

This species is named for Mr. J. Voorwinde of Sydney for his considerable contribution in providing much of the material on which this study has been based.

PART 2. TROPICAL AUSTRALIAN AND INDO-PACIFIC SPECIES.

Pisinna angulata sp. nov. Fig. 8b.

DIAGNOSIS: Shell—Small, elongate, with strong spiral ridges, abapical and adapical to suture, and weak, oblique axial ribs.

Protoconch—Dome-shaped, 1½ whorls.

Teleoconch—Spire outlines straight, sutures strongly stepped. 4 whorls, concave between abapical sutural ridge and adapical sutural cord. Adapical sutural cord increases in strength towards body whorl where it causes a distinct peripheral angulation. Oblique (prosocline), sharp, narrow, very numerous axial ribs cross surface, including spiral ridges and base, and occur on all whorls. Weak spiral scratches present. Base weakly convex. Aperture oval, outer lip almost orthocline, inner lip thickened, raised from parietal region and well separated from base. Varix weak. All specimens available have faded to white.

Dimensions:	length	diameter
Holotype	3.13 mm	1.13 mm
Paratypes (C. 95021)	2.80	1.10
(C. 95022)	4.00	1.40
	4.16	1.40

LOCATION OF TYPES: A.M. Holotype (C. 95020), and 9 paratypes (C. 95021, C. 95022, C. 95641); 2 paratypes in W.A.M.

TYPE LOCALITIES: ca. 216 km N.W. of Roebuck Bay, W.A., 17°34'S, 120°22'E, 188 m, 30 Nov. 1967, B.M.R., M.V. "Kos 2", stn K67-252 (2 specimens) (C. 95020, C. 95021). ca. 224 km N. of Cape Leveque, W.A., 14°29'S, 123°03'E, 124 m, 12 Nov. 1967, B.M.R., M.V. "Kos 2", stn K67-181 (1 specimen) (C. 95022). ca. 336 km N. of Broome, W.A., 14°50'S, 121°49'E, 230 m, 18 Nov. 1967, B.M.R., M.V. "Kos 2", stn K67-205 (9 specimens) (C. 95641).

DISTRIBUTION: Continental shelf of N.W. Australia in 100-200 m (see fig. 20).

REMARKS: A very distinct species which cannot be confused with any other species of *Pisinna*. The combination of a strongly angled body whorl with axial ribbing is not found in any other species of *Pisinna* and consequently the relationships of *P. angulata* are not clear.

Pisinna bikiniensis (Ladd). Fig. 8a.

Amphithalamus (Pisinna) bikiniensis Ladd, 1966: 62, pl. 12, fig. 1.

DIAGNOSIS: Shell—Minute, pupoid, polished, smooth except some have a few weak axial folds on body whorl.

Protoconch—Typical, of 1½ whorls. Teleoconch of 4 very weakly convex whorls; sutures moderately impressed. Aperture oval, slightly constricted, thickened within.

Dimensions:	length	diameter
Holotype	1.70 mm	0.70 mm
Figured paratype	1.78	0.80

LOCATION OF TYPES: U.S. National Museum, No. 648354 (holotype and paratypes). A.M. (1 paratype) (C. 77650).

TYPE LOCALITY: In drill hole 2B on Bikini Atoll, Marshall Group, Pacific, at 556-589 m (1839-1850 ft), early Miocene.

REMARKS: This species is the only fossil *Pisinna* known from the tropical Pacific. It is probably related to *P. chasteri* (Melvill & Standen) which, although sharing a tropical Pacific distribution, is well south of the Marshall Group. *P. chasteri* differs from *bikiniensis* mostly in being larger, and in having a more inflated spire.

Pisinna chasteri (Melvill & Standen). Figs 9c-e.

Barleeia chasteri Melvill & Standen, 1895: 120, pl. 3, fig. 22.

Estea ? chasteri.—Tomlin, 1936: 148.

DIAGNOSIS: Shell—Small, axially ribbed on last two whorls, usually whitish with a broad, brown band on the periphery and adapically to the sutures.

Protoconch—A rather pointed dome of 1½ convex whorls, red-brown in colour and with spiral rows of minute pits.

Teleoconch—Ovate-conical, spire weakly convex of 3½ very weakly convex whorls. Spire smooth except for axial growth lines, last 1½-2 whorls axially ribbed, the ribs rather weak, simple, slightly oblique (prosocline), usually obsolete on last ¼ of body whorl, about 23 on penultimate whorl in some specimens (usually obsolete over part of this whorl). Base weakly convex, with a weak bulge behind inner lip. Aperture subcircular, inner lip moderately thickened, not much separated from base in adapical portion. Outer lip orthoclinal, not protruding beyond line of spire. Varix weak or absent in most specimens, moderate to strong in some. Basic colour white, rarely uniform, usually with a broad brown band abapical to suture continued as a peripheral band on the body whorl, this sometimes

interrupted by white blotches. Sometimes spire is uniform brown and the peripheral band is often diffusely split into two bands (the adapical one narrow) by a row of closely spaced white spots. Axial ribs generally white on body whorl, except on basal part of colour band. Abapical part of base white; aperture white except for brown parietal wall.

Dimensions:	length	diameter
Holotype (fide Melvill & Standen)	1.75 mm	1.00 mm
Loyalty Is. (figured spec.)	2.20	1.00
Noumea, New Caledonia (figured spec.)	2.20	1.14
Noumea, New Caledonia (figured spec.)	1.80	0.94

LOCATION OF TYPES: Manchester Museum. Holotype and paratypes. Paratypes also in B.M.N.H.

TYPE LOCALITY: Lifu, Loyalty Islands.

ADDITIONAL MATERIAL EXAMINED: Lifu, Loyalty Is., near New Caledonia, ex T. Iredale Coll. (A.M.). Loyalty Is., Voorwinde Coll. (A.M.). W. side of Île Signal, off Noumea, New Caledonia, 25 Apr. 1972, on algae, 0-2 m, coll. P. H. Colman, 3 lots (A.M.). Ile St. Marie, Noumea, New Caledonia, S.W. point on high tide line, 2 May 1971, coll. P. H. Colman (A.M.).

DISTRIBUTION AND HABITAT: Loyalty Islands and New Caledonia (near Noumea). The only living material examined was from algae just below low tide in New Caledonia (see fig. 20).

REMARKS: The description is largely taken from the New Caledonian material because of its superior condition. Melvill and Standen state that the shell is "extremely smooth". The holotype and paratypes under low magnification superficially appear to be smooth but all have, in fact, worn axial ribs on the last whorl.

Pisinna colmani sp. nov. Fig. 9a.

DIAGNOSIS: Shell—Small, purple-brown with oblique, simple ribs on body whorl.

Protoconch—Typical, of 1½ whorls, wine red.

Teleoconch—Spire with lightly convex outline; 4 very slightly convex whorls. About 17-24 rounded, rather low prosocline axial ribs on body whorl, and ribs also on up to last 1/3 of penultimate whorl. Ribs with slightly narrower interspaces, becoming obsolete to subobsolete on base. Indistinct, irregular spiral striae present. Base convex. Aperture circular, heavily thickened within. Inner lip broad, thin; outer lip slightly opisthocline in abapical section. Varix low, broad. Colour of adapical spire purple-red, body whorl dull purple-brown with faint whitish blotches and a whitish band abapical to suture. Abapical base and outer lip yellowish-white.

Dimensions:	length	diameter
Holotype	2.73 mm	1.25 mm
Paratypes	2.42	1.22
	2.24	1.20
	2.80	1.28

LOCATION OF TYPES: A.M. Holotype (C. 95023) and 3 paratypes (C. 95024).

TYPE LOCALITY: 24 km S. of Double Island Point, near Maryborough, Qld, 26°09.5'S, 153°18.5'E, 56 m, 27 Oct. 1970, B.M.R. stn 1426, M.V. "San Pedro Sound" (A.M.).

DISTRIBUTION: Known only from the type locality (see fig. 20).

REMARKS: Differs from the northern New Zealand *P. hipkinsi* (Ponder) (fig. 9b), to which it is very similar, in having a more inflated body whorl, more nearly circular aperture and somewhat weaker axial ribs. The colour pattern is also different in the two species, *hipkinsi* having 2 brown bands on the body whorl and a paler body whorl and spire. In addition, a large brown colour spot behind the aperture in *hipkinsi* is absent in *colmani*. *P. colmani* is also similar to *P. kershawi* in having simple, oblique, axial ribs, but these do not extend on to the spire whorls as in *kershawi*; and the new species also differs in its darker colour, broader shell and glossy surface.

This species is named for Mr. P. H. Colman as a small mark of recognition for his considerable assistance in many ways during the course of this work.

Pisinna compressa (Laseron). Fig. 9h.

Scrobs compressa Laseron, 1956: 442, fig. 152.

DIAGNOSIS: Shell—Small, solid, smooth, shining, with relatively small aperture.

Protoconch—Dome-shaped, of 1½ whorls, with spiral rows of minute pits, dark wine-red in colour.

Teleoconch—Spire medium to rather tall, outline weakly convex; periphery sometimes subangled, strongly angled in juveniles; 3-3¼ very weakly convex whorls. Surface smooth except for weak axial growth lines, sometimes forming close, very weak ribs on body whorl, and faint spiral scratches. Base convex, usually with a weak ridge-like swelling abapically. Aperture almost circular, rather small, outer lip in line with spire; very slightly prosocline, orthocline or slightly opisthocline; inner lip not much raised from base in abapical section. Varix weak to moderate, rather broad. Colour dark orange-brown to yellowish-brown, spire usually darker than body whorl. Sometimes a broad, pale yellow, yellow-brown or white band abapical to sutures. Aperture white to brown, inner lip dark to pale brown.

Dimensions:	length	diameter
Holotype	1.60 mm	0.77 mm
Paratype	1.53	0.77

LOCATION OF TYPES: A.M. Holotype (C. 95025) and 7 paratypes (C. 95026) (1 a species of *Notoscrobs (Microfossa)*, and 1 *Pisinna tropica* (Laseron)).

TYPE LOCALITY: Michaelmas Cay, Qld, coll. T. Iredale.

ADDITIONAL MATERIAL EXAMINED: Murray Is., Torres Str., Qld, 9-14 m (A.M.). Michaelmas Cay, N. Qld, June 1926, "Great Barrier Exped." (A.M.). Great Barrier Reef, off Cairns, N. Qld, coll. Pitt, pres. McCulloch (A.M.). S.W. side of Euston Reef, off Cairns, N. Qld, 21 m, sandy bottom of steep coral wall, 30 Nov. 1972, coll. P. H. Colman (A.M.). Port Denison, Bowen, Qld, dredged, Voorwinde Coll. 2 lots (A.M.).

DISTRIBUTION AND HABITAT: North Queensland, from Murray Island to Bowen; shallow sublittoral to at least 20 m (see fig. 20).

REMARKS: This species differs from *perdigna* (Laseron) in its smaller size, thicker shell, shorter spire and different coloration. It is also similar to *tropica* (Laseron) from which it differs in its more solid shell, straighter spire outline, flatter whorls, non-expanded aperture and different coloration.

P. microthyra (Martens) from Mauritius is extremely similar to *P. compressa* but has a uniform colour, a narrower inner lip which is even less separated from the base abapically, and there is no basal ridge. The two species might well be shown to merge if more material becomes available from intermediate localities.

Pisinna eurychades (Watson). Fig. 8c.

Eulima eurychades Watson, 1883: 129 (err. *eurychada);* Watson, 1886: 522, pl. 37, fig. 7; Tryon, 1886: 278.

Estea eurychades.—Laseron, 1956: 441, fig. 149.

DIAGNOSIS: Shell—Elongate, smooth, whorls rather flat, aperture relatively small, contracted.

Protoconch—Broadly dome-shaped, of 1½ whorls; the first whorl large and evenly convex.

Teleoconch—Spire outlines nearly straight, base contracted. 4¾-5 whorls, flat, body whorl slightly convex. Surface smooth, glossy, with very fine growth lines and indistinct spiral striae. Base convex, retracted; aperture circular, not much thickened within; outer lip opisthocline in anterior section, its edge reflected outwards as a narrow, curved rim. Inner lip slightly separated from parietal region. Colour porcellaneous white, banded in the middle of each whorl with smokey-brown, the colour deepening at the apex (brown colour due to inner shell layer).

Dimensions:	length	diameter
Holotype (from dimensions given by Watson)	3.03 mm	1.27 mm
Figured syntype	3.24	1.22

LOCATION OF TYPES: B.M.N.H. 7 syntypes (reg. no. 87.2.9.1624-30); A.M. 3 syntypes (C. 35006).

Watson remarks that "40 or 50" specimens were located.

TYPE LOCALITY: Challenger stn 185 B, off Raine Island, Cape York, N. Australia, 11°38'15"S, 143°59'38"E, 284 m, in coral sand, 31 Aug. 1874.

DISTRIBUTION: Known only from the type locality (see fig. 20).

REMARKS: This species apparenthly has not been recollected since its original discovery. It is readily distinguishable, the elongate glossy shell and contracted, thin lipped aperture are features in which it resembles no other species.

Pisinna incipiens (Laseron). Figs 8e-f.

Scrobs incipiens Laseron, 1956: 443, fig. 153.

DIAGNOSIS: Shell—Small, pupiform, smooth, solid, with convex whorls and an inner rim in aperture. Colour pale yellow-brown with a broad brown band.

Protoconch—Dome-shaped, of 1½ whorls, yellowish, sculpture typical.

Teleoconch—Spire convex, of 2¾ convex whorls, sutures impressed. Sculpture of very indistinct axial threads and traces of spiral scratches over whole surface. Weak peripheral cord sometimes present. Aperture subcircular, inner lip rather thin, its edge straight across parietal region. A raised rim surrounds inner edge of aperture, well separated from edge of peristome. Outer lip orthoclinal to very slightly prosoclinal. Varix weak, base convex. Colour pale yellowish-brown to yellowish-white, with pale,orange-brown band on abapical ½ of spire whorls and middle of body whorl. Aperture yellowish-white, inner lip pale yellowish-brown.

Dimensions:	length	diameter
Holotype	1.55 mm	0.70 mm

LOCATION OF TYPES: A.M. Holotype (C. 95630) and 6 paratypes (C. 95631).

TYPE LOCALITY: Heron Island, Capricorn Group, Qld, under coral blocks, coll. J. Laseron.

ADDITIONAL MATERIAL EXAMINED: Heron Is., Qld, tide mark, J. Voorwinde Coll. (A.M.). Capricorn Group, Qld, J. Voorwinde Coll. (A.M.). Masthead Is., Qld, 31-37 m, pres. C. Hedley (A.M.).

DISTRIBUTION AND HABITAT: Capricorn Group, Queensland, lower littoral and shallow sublittoral (see fig. 20).

REMARKS: In the Capricorn Group this species is sympatric with, and very similar to, *P. tropica*. It differs in being slightly larger, with a more solid, more opaque shell which has a dull surface, not a shining one as in *tropica*. The very weak sculpture and the inner apertural rim are also features of *incipiens* which separate it from *tropica*.

The internal apertural rim is a unique feature of this species and provides a ready recognition point. It is possible that, on examination of the soft parts, a new genus-group name may be required. On shell characters however, apart from the apertural rim, this species is a typical *Pisinna*.

Pisinna kis (Winckworth). Fig. 8g.

Amphithalamus (Estea) kis Winckworth, 1931: 146.

DIAGNOSIS: Shell—Minute, solid, orange-brown, with narrow, oblique axial ribs on all whorls.

Protoconch—Dome-shaped, 1½ whorls, orange-brown in colour.

Teleoconch—Pupiform, spire convex, 2½-3¼ moderately convex whorls. Sculpture of oblique (prosocline), rather sharply rounded, narrow axial ribs on all whorls, interspaces 2-3 times wider than ribs, about 23-27 axials on body whorl, these continuing to outer lip, although slightly weaker on last part of body whorl. A very weak fold abapical to sutures present; ribs thickened slightly on fold. Base convex. Aperture rather large, oval, much thickened within, inner lip broad, almost straight across parietal region; edge of outer lip orthocline to very slightly opisthocline. Varix very weak, broad. Colour uniform orange-brown, fading to yellow-brown. When faded a narrow yellowish-white band present immediately abapical to sutural fold.

Dimensions:	length	diameter
Holotype (from original description)	1.3 mm	0.6 mm
Figured paratype	1.60	0.73

LOCATION OF TYPES: B.M.N.H. Holotype and 4 paratypes (No. 197440).

Additional paratypes National Museum of Wales (no number). Original Material consisted of 40 specimens.

TYPE LOCALITY: Trincomali, E. coast of Ceylon, 18 m (=Trincomalee, Sri Lanka).

DISTRIBUTION: Known only from the type locality.

REMARKS: This species is distinctive in its small size and in its narrow axial ribs which extend over all whorls. It is perhaps most similar to *P. oblata* which differs in its much finer, closer ribs which are predominent only on the last two whorls.

Winckworth states that the types are in his collection. The specimens in the National Museum of Wales include one marked type and 3 marked paratypes. There is also another series of several specimens with one separated and marked "figured specimen". The 5 specimens in the B.M.N.H. are also marked type and paratypes and the specimen here taken as the holotype is the one so marked in the B.M.N.H.

Pisinna microthyra (Martens). Fig. 8h.

Barleia? microthyra Martens, 1880: 285, pl. 20, fig. 18.

Rissoia (Amphithalamus) microthyra.—Tryon, 1887: 339, pl. 63, fig. 69.

DIAGNOSIS: Shell—Minute, smooth, simple, usually uniform orange-brown, sometimes with a white thread at suture. Protoconch typical.

Dimensions:	length	diameter
Type (from original description)	1.5 mm	0.6 mm
Figured specimen	1.60	0.76

LOCATION OF TYPES: Zoologischen Museum, Humboldt Univ., E. Berlin. Many syntypes. 3 syntypes in A.M. (C. 95800).

TYPE LOCALITY: Mauritius, Indian Ocean.

DISTRIBUTION: Only known from type locality.

REMARKS: The drawing is taken from a paratype in the A.M. This species differs from *P. tropica,* which it superficially resembles, in its more conical shape, in colour, and in the form of the aperture. *P. compressa* is very similar as noted in the remarks on that species.

Pisinna perdigna (Laseron). Fig. 9f.

Estea perdigna Laseron, 1956: 441, fig. 148.

DIAGNOSIS: Shell—Of medium size, solid, with rather tall, slightly convex spire, small aperture, smooth, shining surface and axial colour streaks.

Protoconch—Dome-shaped, of 1¾ whorls with spiral rows of minute pits; orange-brown to wine-red in colour.

Teleoconch—Rather elongate, spire outline slightly convex, sutures moderately distinct. Smooth except for very weak axial growth lines, and faint spiral scratches. Base evenly convex, aperture rather small, slightly retracted. Inner lip narrow, slightly raised from base in abapical portion; outer lip slightly prosocline; varix absent. Colour pale pinkish-white to purplish-brown with darker yellowish-brown or brown axial streaks extending from suture to suture and over base. A pale greyish band on adapical 1/3-1/2 of whorls visible in darker specimens. Aperture yellowish-white, inner lip orange-brown.

Dimensions:	length	diameter
Holotype	2.24 mm	1.00 mm
Topotype (small)	1.90	0.85
Topotype (large)	2.25	1.02

LOCATION OF TYPES: A.M. Holotype (C. 79575) and 6 paratypes (C. 79576). Also several topotypes (C. 19595).

TYPE LOCALITY: Masthead Island, Capricorn Group, Qld, 31-37 m, coll. C. Hedley.

ADDITIONAL MATERIAL EXAMINED: 3 km N.E. of W. side of Gillett Cay, Swains Reef, Southern Barrier Reef, Qld, 37-46 m; 64-73 m; 17-19 Oct. 1962, coll. A.M. party (A.M.). W. of North Keppel Is. Qld, 4 m, Voorwinde Coll. (A.M.). N.E. of Rockhampton, Qld, 22°50'S, 151°39'E, 64 m, B.M.R. str. 1261, M.V. "San Pedro Strait", 25 Sept. 1970 (A.M.).

DISTRIBUTION AND HABITAT: Southern Qld, from the Swains Reef to Masthead Island, in 4-73 m (see fig. 20).

REMARKS: *P. perdigna* is similar to *P. chasteri* in size but differs in its more elongate shape and in lacking axial ribs. This species is rather constant in shape and coloration.

Pisinna tropica (Laseron). Fig. 8d; 10e-f; 13e-f.

Scrobs tropica Laseron, 1956: 442, fig. 151.

DIAGNOSIS: Shell—Minute, pupiform, with protruding aperture and variable colour pattern.

Protoconch—Dome-shaped, of 1½ whorls, wine-red in colour and with spiral rows of minute pits.

Teleoconch—Spire convex, rather short, of 2¾ convex whorls. Surface smooth except for close, regular axial growth lines, usually very weak but in some specimens moderately prominent. Base convex with thickened rim behind abapical portion of inner lip. Aperture subcircular, edge of inner lip almost straight across parietal region, outer lip very slightly prosocline. Varix absent. Yellowish-brown, usually with spire darker orange-brown and irregular milk-white markings forming bands or rows of blotches adapical and abapical to sutures and, often a band on base. Sometimes uniform red-brown or orange-brown or almost uniform milky-white. Aperture pale yellowish-brown, inner lip darker brown.

Dimensions:	length	diameter
Holotype	1.26 mm	0.62 mm
Port Vila, New Hebrides	1.34	0.74

Operculum—Typical in all respects except for an elongated, low swelling a little in from middle of columellar edge (fig. 13e-f).

Radula—Central teeth 1 + 1 + 1, median cusp rectangular, up to 3 times length of lateral cusps, cutting edge almost flat, minutely serrate. A very minute denticle on outer side of each lateral cusp. Lateral teeth 2 + 1 + 2, innermost cusp very short (almost denticle-like), next large, pointed, median cusp a little longer, blunt, outer 2 cusps short, pointed. Inner and outer marginal teeth with about 7 small, sharp cusps (fig. 10e-f).

LOCATION OF TYPES: A.M. Holotype (C. 95053) and many paratypes (C. 95055).

TYPE LOCALITY: Heron Is., Capricorn Group, Qld, alive under coral blocks, coll. J. Laseron.

ADDITIONAL MATERIAL EXAMINED: Hood Lagoon, 112 km S.E. of Port Moresby, Papua (A.M.). E. side of Eagle Is., W. of Lizard Is., Qld, *Caulerpa* washings, 12 Dec. 1974, coll. P. H. Colman (A.M.). Green Is., off Cairns, N. Qld, on algae, 1969, coll. R. W. Ponder (A.M.). Michaelmas Cay, Qld, coll. T. Iredale (A.M.) (one of paratypes of *P. compressa* (Laseron)). Hook Reef, Proserpine, Qld, behind reef crest, 2 Oct. 1971, coll. I. Loch (A.M.). Hayman Is., Qld, Voorwinde Coll. (A.M.). Masthead Is., Capricorn Group, Qld, 31-37 m, pres. C. Hedley (A.M.). Heron Is., Capricorn Group, Qld, tide mark; 4 m on reef; Voorwinde Coll. 2 lots, (A.M.). S.E. of Heron Is., reef, Capricorn Group, Qld, 6 m, Voorwinde Coll. (A.M.). Capricorn Group, Qld, 11 m, Voorwinde Coll. (A.M.). S. outer face of One Tree Is.,

Capricorn Group, Qld, 1.5-4.5 m, 7 Dec. 1966, coll. F. H. Talbot (A.M.). Lagoon off Dawsons Point, Lord Howe Is., 25 m, 18 Feb. 1973, coll. J. Randall (A.M.). Lord Howe Is., outside reef, W. of Erscotts Passage, 18-24 m, steeply sloping bottom, Feb. 1973, coll. J. Randall (A.M.). Lord Howe Is., 3 lots, coll. R. Bell, pres. T. Iredale (A.M.). W. of Île Signal, off Noumea, New Caledonia, 0.2 m, on algae, on sandy and dead coral bottom, 25 Apr. 1972, 2 lots, coll. P. H. Colman (A.M.). Ile St. Marie, Noumea, New Caledonia, S.W. point on high tide line, 2 May 1971, coll. P. H. Colman (A.M.). Port Vila, Efate, New Hebrides, on algae, lower littoral, Jan. 1967, 3 lots, coll. W. F. Ponder (A.M.). Point Ardel, Port Vila, New Hebrides, under coral blocks and on algae, at low tide, Jan. 1967, coll. W. F. Ponder (A.M.). Vunda Point, S. of Lautoka, Viti Levu, Fiji, on short algae; on sheltered reef flat on algae under coral rubble, 15 Jan. 1967, coll. W. F. Ponder (A.M.). Suva, Fiji, pres. A. M. Hocart (A.M.).

DISTRIBUTION AND HABITAT: The Great Barrier Reef, Queensland, Lord Howe Island, New Caledonia, New Hebrides, Papua and Fiji. Living on algae and beneath coral blocks at low tide and in the shallow sublittoral (see fig. 20).

REMARKS: *P. tropica* can be readily distinguished by its small size, convex whorls, short bulbous spire and extended aperture. The only two similar tropical species are *P. incipiens* and *P. compressa*. The features distinguishing these species from *P. tropica* are discussed above.

The operculum of *P. tropica* bears a weak process not found in any other species of *Pisinna* yet examined. This species is also unusual in having such a wide distribution.

PART 3. TEMPERATE INDIAN OCEAN AND MEDITERRANEAN SPECIES

Pisinna cazini (Velain). Fig. 9j.

Rissoa cazini Velain, 1876: 285 (nomen nudum); Velain, 1877: 114, pl. 3, fig. 15.

Rissoia (Cingula) cazini.—Tryon, 1887: 344, pl. 71, fig. 84.

Estea cazini.—Dell, 1972: 35.

DIAGNOSIS: Shell—Smooth, bluish-white, with purplish apex. Whorls convex, aperture much thickened, inner lip rather narrow, outer lip opisthoclinal.

Dimensions:	length	diameter
From original description	2 mm	1 mm

LOCATION OF TYPES: Museum National D'Histoire Naturelle, Paris, 2 syntypes (no number).

TYPE LOCALITY: Island of St. Paul, Indian Ocean.

DISTRIBUTION: Type locality only.

REMARKS: The illustration is taken from a polaroid photograph of one of the syntypes.

Pisinna crawfordi (Smith). Fig. 9i.

Rissoia crawfordi Smith, 1901: 107, pl. 1, fig. 13.

Rissoa crawfordi.—Thiele, 1925: 77/43, pl. 5, fig. 44; Turton, 1932: 145; Barnard, 1963: 181.

DIAGNOSIS: Shell—Small, solid, elongate-pupoid, whorls moderately convex. Aperture subcircular, rather small, thickened within. Colour of spire reddish to purple, body whorl and aperture greyish.

Dimensions:	length	diameter
Holotype (from original description)	4.33 mm	1.50 mm

Operculum (from Barnard)—Oval, no internal process.

LOCATION OF TYPES: B.M.N.H. 3 syntypes (No 99.9.9.131-3).

TYPE LOCALITY: Algoa Bay, S. Africa, 36 m.

ADDITIONAL MATERIAL EXAMINED: "Valdiva" Expedition stns 95, 104 and 106 (stn 95, 34°51'S, 19°37.8'E, 80 m; stn 104, 35°16'S, 22°26.7'E, 155 m, off Cape Agulhas, S. Africa; stn 106, 35°26.8'S, 20°56.2'E (no depth given), Agulhas Bank, S. Africa (all in Zoologischen Museum, Humboldt Univ., E. Berlin).

ADDITIONAL RECORDS: Port Alfred (Turton); off Cove Rock (East London) in 40 m; Algoa Bay, 46 and 60 m; 34°5'S, 25°55'E, 123 m; 34°26'S, 25°42'E, 227 m; 34°27'S, 25°42'E, 468 m (all Barnard).

DISTRIBUTION: 36-468 m, southern coast of Africa.

REMARKS: The illustration is taken from a Polaroid photograph of one of the syntypes.

A species described by Turton (1932) is a possible additional species of *Pisinna*, but we have not had the opportunity of examining the unique type specimen. This is *Diala lara* (p. 137, pl. 30, fig. 986), from Port Alfred, S. Africa.

Pisinna punctulum (Philippi). Figs 9g; 10c-d; 12g; 13i.

Rissoa punctulum Philippi, 1836: 154, pl. 10, fig. 11.

Rissoa (Pisinna) punctulum.—Monterosato, 1878: 86.

Rissoa (Peringiella) glabrata.—Bucquoy, Dautzenberg and Dollfus, 1884: 312, pl. 37 (see also for additional references to *glabrata* auct. (in part) non *glabrata* v. Mühlfeldt).

Pisinna punctulum.—Monterosato, 1884: 26; Nordsieck, 1972: 165, pl. R4, fig. 31.

Amphithalamus (Pisinna) punctulum.—Nordsieck, 1968: 46, fig. 26.50.

DIAGNOSIS: Shell—Minute, pupoid, solid, smooth, reddish in colour.

Protoconch—Dark orange-red, dome-shaped, of 1½ whorls, sculpture of minute pits in spiral rows (fig. 12g).

Teleoconch—Spire lightly convex, whorls 21/3-23/4, moderately convex. Surface rather dull, smooth except for growth lines and exceedingly faint spiral scratches. Aperture subcircular, inner lip with edge convex, abapical portion well separated from base. Outer lip orthoclinal to slightly ophisthoclinal. Varix very weak. Colour orange-red to wine-red, aperture yellowish.

Dimensions:	length	diameter
Figured specimen	1.70 mm	0.80 mm

Operculum—Typical. Muscle insertion area occupying about half of surface. Columellar side with marginal area well defined (fig. 13i).

Radula—Central teeth rather large, typical in form, 1 + 1 + 1 with broad, blunt median cusp about twice width of lateral cusps. Lateral cusps sharp, narrow, about ½ length of median cusp. Denticles on either side in addition to cusps. Base of teeth with protruding

convex edge. Lateral teeth 2+1+2, median cusp broad, blunt, lateral cusps long, sharp. Inner marginal teeth with 8-10 small, sharp cusps, outer marginals with about 6 denticles (fig. 10c-d).

LOCATION OF TYPES: Not known.

TYPE LOCALITY: Sicily.

MATERIAL EXAMINED: Mediterranean Sea (A.M.). Mediterranean, ex Monterosato (A.M.). Island of Corsica (A.M.). Gulf of Marseilles, France (A.M.). Also several lots in various Museums in Europe, the B.M.N.H. and the U.S. National Museum (Nat. Hist.), all from the Mediterranean Sea.

DISTRIBUTION: Mediterranean Sea, living on coralline algae in the littoral zone.

REMARKS: In the most recent review of Mediterranean species of *Pisinna* Nordsieck (1972) has included 4 species in *Pisinna: — punctulum, sabulum* (Cantraine, 1842), *glabratum* (v. Mühlfeldt, 1824) (with a "form" *turritum* (Bucquoy, Dautzenberg and Dollfus, 1883)), and *seminulum* (Monterosato, 1877). We have not been able to examine any original material of *sabulum* (Cantraine) but it appears as though at least Nordsieck's interpretation of this species may fall within the variation of *punctulum*. He lists *punctum* Cantraine, 1842 as a synonym but "cotypes" of that species examined in the Naturhistorisches Museum, Vienna, are a *Peringiella* very similar to *nitida* Monterosato, 1878. *P. glabratum* seems best included in *Peringiella* on apertural features and *P. seminulum* probably belongs near *Barleeia*.

The fossil species *Cingula (Pisinna) pupa* (Doderlein) (as figured by Sacco, 1895: 33, pl. 1, fig. 91) from the Miocene of Italy is probably a *Pisinna* and may be ancestral to *punctulum*.

ACKNOWLEDGEMENTS

We wish to thank Dr. B. J. Smith and Mr. T. A. Darragh of the National Museum of Victoria, Dr. H. Laws formerly of the South Australian Museum, Mr. A. J. Dartnall, Miss A. Green and Mrs. E. Turner of the Tasmanian Museum, Mrs. K. Way and Mr. J. Peake of the British Museum (Natural History), Dr. N. H. Ludbrook, of the South Australian Dept. of Mines and Mr. W. O. Cernohorsky of the Auckland Institute and Museum for the loan of material, including types.

Several museums have kindly made their facilities available for the examination of their material during an overseas study tour by one of us (W.F.P.). Finance for this tour was generously supplied by the Ian Potter Foundation, the Science and Industry Endowment Fund, the Australian Research Grants Committee, the British Council, and the Trustees of the Australian Museum. This work has been supported to a very considerable extent by a grant from the Australian Research Grants Committee.

Mr. S. Shepherd of the South Australian Dept. of Fisheries and Fauna Conservation and Dr. H. Jones and Dr. P. Davies of the Bureau of Mineral Resources, Canberra have made many samples available and the Fisheries Division, Dept. of Agriculture, Tasmania generously provided sea-time for the collection of material.

The scanning electron microscope photographs were taken at Sydney University and we are indebted to Dr. C. Nockolds for his help and advice.

We are especially grateful to Mr. J. Voorwinde who has devoted a considerable amount of time to the sorting of samples and to Miss C. Robinson, Miss E. Mangan, Mr. P. H. Colman, and Mrs. J. Ponder for their assistance with the final preparation of the manuscript.

REFERENCES

Angas, G. F., 1877. A further list of additional species of marine Mollusca to be included in the fauna of Port Jackson and the adjacent coasts of New South Wales. *Proc. zool. Soc. Lond.*, 1877: 178-191.

Barnard, K. H., 1963. Contributions to the knowledge of South African marine Mollusca. Part 3. Gastropoda: Prosobranchiata: Taenioglossa. *Ann. S. Afr. Mus.*, 47: 1-199.

Brazier, J. W., 1895. On some Australian and Tasmanian Mollusca, with their synonyms. *Proc. Linn. Soc. N.S.W.*, Ser. 2, 9: 691-700.

Bucquoy, E., Dautzenberg, P. & Dollfus, G., 1884 (1882-1886). *Les Mollusques marins du Roussillon. Gastropodes.* Paris, Baillière & Fils (with atlas of 66 plates). Fasc. 8 (including *Rissoa*), 1884, pp. 299-342.

Chapman, F. & Crespin, I., 1928. The Sorrento bore, Mornington Peninsula, with a description of new or little-known fossils. *Rec. geol. Surv. Vic.*, 5: 1-195.

Cossmann, M., 1921. *Essais de paléoconchologie comparée.* 12. Paris, author. Pp. 1-338, 11 plts.

Cotton, B. C., 1944. Recent Australian species of Rissoidae (Mollusca). *Trans. R. Soc. S. Aust.*, 68 (2): 286-314.

———1952. Australian Recent and Tertiary Mollusca (Terebridae, Rissoinidae, Rissoidae, Fasciolariidae, Volutidae). *Trans. R. Soc. S. Aust.*, 75: 38-54.

Cox, L. R., 1955. Observations on gastropod descriptive terminology. *Proc. malac. Soc. Lond.*, 31 (5-6): 190-202.

——— 1960. General characteristics of Gastropoda, in *Treatise on Invertebrate Paleontology.* Part I, Mollusca 1: 84-169.

Darragh, T. A., 1970. Catalogue of Australian Tertiary Mollusca (except chitons). *Mem. Nat. Mus. Vic.*, 31: 125-212.

Dell, R. K., 1972. Notes on the nomenclature of some Mollusca from Antarctica and southern South America. *Rec. Dom. Mus., Wellington,* 8 (3): 21-42.

Frauenfeld, G. R. von, 1867. Mollusken. *Reise Novara,* 2 (3): 1-16.

Gabriel, C. J., 1956. Mollusca from south east of King Island, Bass Strait. *Mem. natn. Mus. Vict.*, 22 (4): 1-16.

Gatliff, J. H. & Gabriel, C. J., 1908. Additions to and revision of the catalogue of Victorian marine Mollusca. *Proc. R. Soc. Vict.*, (n.s.) 21 (1): 368-391.

——— 1910. Additions to the catalogue of the marine shells of Victoria. *Proc. R. Soc. Vict.*, (n.s.) 23 (1): 87-98.

——— 1913a. On some new species and varieties of Victorian marine Mollusca. *Proc. R. Soc. Vict.*, (n.s.) 26 (1): 67-70.

——— 1913b. Additions to the catalogue of the marine shells of Victoria. *Proc. R. Soc. Vict.*, (n.s.) 26 (1): 71-87.

——— 1922. Additions to and alterations in the catalogue of Victorian marine Mollusca. *Proc. R. Soc. Vict.*, (n.s.) 34 (2): 128-161.

Hedley, C., 1903. Scientific results of the trawling expedition of H.M.C.S. "Thetis". Mollusca. Part 2, Scaphopoda and Gastropoda. *Mem. Aust. Mus.*, 4: 325-402.

——— 1905. Mollusca from one hundred and eleven fathoms, east of Cape Byron, New South Wales. *Rec. Aust. Mus.*, 6: 41-54.

——— 1907. The results of deep sea investigation in the Tasman Sea. Mollusca from eighty fathoms off Narrabeen. *Rec. Aust. Mus.*, 6: 283-304.

——— 1911. Report on the Mollusca obtained by F.I.S. "Endeavour", chiefly off Cape Wiles, South Australia. Part 1. *Zool. Results of the Fishing Experiments carried out by the F.I.S. "Endeavour", 1909-10,* pt. 2: 89-114.

——— 1918. A checklist of the marine fauna of New South Wales. Part 1. Mollusca. *J. Proc. R. Soc. N.S.W.*, 51: M1–M120.

Hedley, C. & May, W. L., 1908. Mollusca from one hundred fathoms, seven miles east of Cape Pillar, Tasmania. *Rec. Aust. Mus.*, 7: 108-125.

Henn, A. U., 1897. In "Notes and Exhibits." *Proc. Linn. Soc. N.S.W.*, 21: 500.

Henn, A. U. & Brazier, J. W., 1894. List of Mollusca found at Green Point, Watson's Bay, Sydney, by Arnold U. Henn. With a few remarks upon some of the most interesting species and descriptions of the new species, by John Brazier. *Proc. Linn. Soc. N.S.W.*, Ser. 2, 9: 165–182.

Johnston, R. M., 1880. Third contribution to the natural history of the Tertiary marine beds of Table Cape with a description of 30 new species of Mollusca. *Pap. Proc. R. Soc. Tasm.* (for 1879): 29–41.

——— 1888. *Systematic account of the geology of Tasmania.* Hobart, Govt. Printer. 408 pp., 57 plts.

Kesteven, H. L., 1902. In "Notes and Exhibits". *Proc. Linn. Soc. N.S.W.*, 27: 206.

Iredale, T., 1915. A commentary on Suter's "Manual of the New Zealand Mollusca". *Trans. N.Z. Inst.*, 47: 417–497.

——— 1955. Rissoid sectional names. *Proc. R. zool. Soc. N.S.W.*, (1953–54): 81.

Iredale, T. & McMichael, D. F., 1962. A reference list of the marine Mollusca of New South Wales. *Mem. Aust. Mus.*, 11: 1–109.

Ladd, H., 1966. Chitons and gastropods (Haliotidae through Adeorbidae) from the Western Pacific Islands. *Prof. Pap. U.S. Geol. Surv.*, 531: 1–98 (with 16 plates).

Laseron, C. F., 1950. Review of the Rissoidae of New South Wales. *Rec. Aust. Mus.*, 22 (3): 257-287.

——— 1956. The families Rissoinidae and Rissoidae (Mollusca) from the Solanderian and Dampierian zoogeographical provinces. *Aust. J. Mar. Freshwat. Res.*, 7 (3): 384–484.

Ludbrook, N. H., 1956. The molluscan fauna of the Pliocene strata underlying the Adelaide Plains. Part 3. Scaphopoda, Polyplacophora, Gastropoda (Haliotidae to Tornidae). *Trans. R. Soc. S. Aust.*, 79: 1–36.

Macpherson, J. H. & Gabriel, C. J., 1962. *Marine molluscs of Victoria.* Melbourne Univ. Press, 475 pp.

Martens, E. von, 1880. Mollusken. *Beitrage zur Meeresfauna der Insel Mauritius und der Seychellen,* Berlin. 352 pp., 4 plts.

May, W. L., 1903. On Tenison-Wood's types in the Tasmanian Museum, Hobart. *Pap. Proc. R. Soc. Tasm.* (1902): 106-114.

——— 1919. Critical remarks on the Table Cape fossil Mollusca in the Johnston collection, with figures. *Pap. Proc. R. Soc. Tasm.* (1918): 69–73.

——— 1920. New species of Tasmanian Mollusca, with critical remarks on several described species, and additions to the list. *Pap. Proc. R. Soc. Tasm.* (1919): 55–69.

——— 1921. *A checklist of the Mollusca of Tasmania.* Hobart, Govt. Printer. 114 pp.

——— 1923. *W. L. May's illustrated index of Tasmanian shells.* Hobart, Govt. Printer. 47 plts.

Melvill, J. C. & Standen, R., 1895. Notes on a collection of shells from Lifu and Uvea, Loyalty Islands, formed by the Rev. James and Mrs. Hadfield, with list of species. *J. Conch., Lond.*, 8 (3–5): 84–132.

Monterosato, T. A. Di., 1878. Enumeratione e sinonimica delle conchiglie Mediterranee. *G. Sci. nat. econ. Palermo,* 13: 1-55.

———1884. *Nomenclatura generica e spezifica di alcune conchiglie Mediterranee.* Palermo, 152 pp.

Nordsieck, F., 1968. *Die europäischen Meeres-Gehäuseschnecken (Prosobranchia) vom Eismeer bis Kapverden und Mittelmeer.* Stuttgart, Gustav Fischer. 273 pp.

——— 1972. *Die europäischen Meeresschnecken (Opisthobranchia mit Pyramidellidae; Rissoacea) vom Eismeer bis Kapverden Mittelmeer und Schwarzes Meer.* Stuttgart, Gustav Fischer. 327 pp.

Petterd, W. F., 1884. Description of new Tasmanian shells. *J. Conch., Lond.,* 4 (5): 135–145.

Philippi, R. A., 1836. *Enumeratio molluscorum Siciliae cum viventium tum in tellure tertiaria fossilium...* 1, Berlin. 268 pp. 28 plts.

Ponder, W. F., 1965a. The family Eatoniellidae in New Zealand. *Rec. Auckland Inst. Mus.,* 6 (2): 47–99.

——— 1965b. A revision of the New Zealand Recent species previously known as *Notosetia* Iredale, 1915 (Rissoidae, Gastropoda). *Rec. Auckland Inst. Mus.,* 6 (2): 101–130.

——— 1965c. A revision of the New Zealand Recent and fossil species of *Estea* Iredale, 1915. *Rec. Auckland Inst. Mus.,* 6 (2): 131-161.,

——— 1966. A new family of the Rissoacea from New Zealand. *Rec. Dom. Mus., Wellington,* 5 (18): 177–184.

——— 1967. The classification of the Rissoidae and Orbitestellidae with descriptions of some new taxa. *Trans. R. Soc. N.Z., Zool.,* 9 (17): 193–224.

——— 1968a. The morphology of some small New Zealand prosobranchs. *Rec. Dom. Mus., Wellington,* 6 (6): 61–95.

——— 1968b. Notes on New Zealand prosobranchs with descriptions of new species and subspecies. *Rec. Dom. Mus., Wellington,* 6 (8): 113-124.

Pritchard, G. B., 1896. A revision of the fossil fauna of the Table Cape beds, Tasmania, with descriptions of new species. *Proc. R. Soc. Vict.,* 8: 74–150.

Pritchard, G. B. & Gatliff, J. H., 1902. Catalogue of the marine shells of Victoria. Part 5. *Proc. R. Soc. Vict.,* (n.s.) 14 (2): 85-138.

——— 1906. Catalogue of the marine shells of Victoria. Part 9. With complete index to the whole catalogue. *Proc. R. Soc. Vict.,* (n.s.) 18 (2): 39–92.

Risbec, J., 1942. Recherches anatomiques sur les prosobranches de Nouvelle Caledonie. *Annls Sci. nat., Zool.,* 4, Rissoidae 69–73.

Sacco, F., 1895. I Molluschi dei terreni terziari del Piemonte de della Liguria. Parte 18, Torino, Carlo Clausen.

Smith, E. A., 1901. On South African marine shells, with descriptions of new species. *J. Conch., Lond.,* 10: 104–116.

Tate, R., 1899. Contributions to a revision of the Recent Rissoidae of Australia. *Trans. R. Soc. S. Aust.,* 23 (2): 230-244.

Tate, R. & May, W. L., 1901. A revised census of the marine Mollusca of Tasmania. *Proc. Linn. Soc. N.S.W.* (1901): 344–471.

Thiele, J., 1925. Gastropoden der Deutschen Tiefsee-Expedition II. *Wiss. Ergebn. deutsch. Tiefsee-Exped.,* 17 (2): 36-282.

——— 1929-35. *Handbuch der systematischen Weichtierkunde.* Jena, 1134 pp.

Tomlin, J. R. Le B., 1936. Shells from the Loyalty Islands. *Proc. malac. Soc. Lond.,* 22 (3): 145–152.

Tryon, G. W., 1879–1898. *Man. Conch.,* Ser. 1. Philadelphia Vol. 8 (1886), Vol. 9 (1887).

Turton, W. H., 1932. *The marine shells of Port Alfred, S. Africa.* Oxford University Press. 331 pp, 70 plts.

Velain, C., 1876. Sur la faune malacologique des îles Saint Paul et Amsterdam. *C. r. hebd. Séanc. Acad. Sci., Paris,* 83: 284–287.

——— 1877. Passage de Vénus sur de Soleil. Expédition Francaise aux Iles Saint-Paul et Amsterdam. Zoologie. Observations générales sur la faune des deux iles suivies d'une description des mollusques. *Archs. Zool. exp. gén.*, 6: 1-144.

Watson, R. B., 1883. Mollusca of H.M.S. Challenger Expedition. *J. Linn. Soc. (Zool.)*, 17: 112–130.

——— 1886. Report on the Scaphopoda and Gastropoda. *Rep. scient. Res. Voy. H.M.S. Challenger 1873–76, Zool.* 15 (42), 756 pp, 53 plts.

Weinkauff, H. C., 1885. Die Gattungen *Rissoina* und *Rissoa. Systematisches Conchylien-Cabinet von Martini und Chemnitz*. Bd. 1, Abth. 21. Nürnberg.

Wenz, W., 1938-1944. Handbuch der Paläozoologie, 6. Gastropoda 1. Berlin, Gebrüber Borntraeger. 1639 pp.

Whitelegge, T., 1889. List of the marine and freshwater invertebrate fauna of Port Jackson and the neighbourhood. *J. Proc. R. Soc. N.S.W.*, 23: 163-323.

Winckworth, R., 1931. A new rissoid from Ceylon. *J. Conch., Lond.*, 19 (5): 146.

Woods, J. E. Tenison, 1876a. On some new species of Tasmanian marine shells. *Pap. Proc. R. Soc. Tasm.* (1875): 27–29.

——— 1876b. Description of new Tasmanian shells. *Pap. Proc. R. Soc. Tasm.* (1875): 134–162.

——— 1877a. Notes on the fossils referred to in the foregoing paper. *Pap. Proc. R. Soc. Tasm.* (1876): 91–116.

——— 1877b. On some new Tasmanian marine shells. *Pap. Proc. R. Soc. Tasm.* (1876): 131–159.

——— 1878. On some new marine Mollusca. *Trans. R. Soc. Vict.*, 14: 55–65.

Manuscript received 3rd February, 1975

Figure 2. a. *Pisinna castella* (Laseron), Off Crookhaven, N.S.W., holotype, A.M. (C. 94734). 1.88 mm × 0.90 mm. b. *P. megastoma* sp. nov., Pirates Bay, Eaglehawk Neck S.E. Tasmania, holotype, A.M. (C. 95031). 1.80 mm × 1.00 mm. c. *P. gradata* sp. nov., 360 km E. of Newcastle, N.S.W., 230-275 m, holotype, A.M. (C. 95027). 1.73 mm × 0.84 mm. d. *P. columnaria* (Hedley & May), Off Cape Pillar, S.E. Tasmania, 183 m, lectotype, A.M. (C. 29047). 2.65 mm × 1.00 mm. e. *P. approxima* (Petterd), Tamar Heads, Tasmania, lectotype, T.M. (7744/E403, TM10891). 1.65 mm × 0.75 mm. f. *P. approxima* (Petterd), (lectotype of *Estea gemma* Laseron), Crookhaven Heads, N.S.W., A.M. (C. 79211). 1.43 mm × 0.36 mm. g. *P. approxima* (Petterd), (syntype of *Estea cyclostoma var. rosea* T. Woods), Blackmans Bay, Tasmania, T.M. (7766/E425, TM5476). 1.46 mm × 0.65 mm. h. *P. vincula* (Laseron), (holotype of *Anabathron nothus* Laseron), Point Halliday, N.S.W., A.M. (C. 95054). 1.90 mm × 0.82 mm. i. *P. vincula* (Laseron), Fairlight, Sydney, N.S.W., lectotype, A.M. (C. 95043). 1.54 mm × 0.80 mm. j. *P. dubitabilis* (Tate), Tamar Heads, Tasmania, holotype, T.M. (7737/E396, TM10885). 2.10 mm × 1.05 mm. k & l. *P. laseroni* sp. nov., Off Lighthouse, Port Stephens, N.S.W., 71 m, holotype, A.M. (C. 95029). 2.50 mm × 1.22 mm, k. apertural view, l. side view.

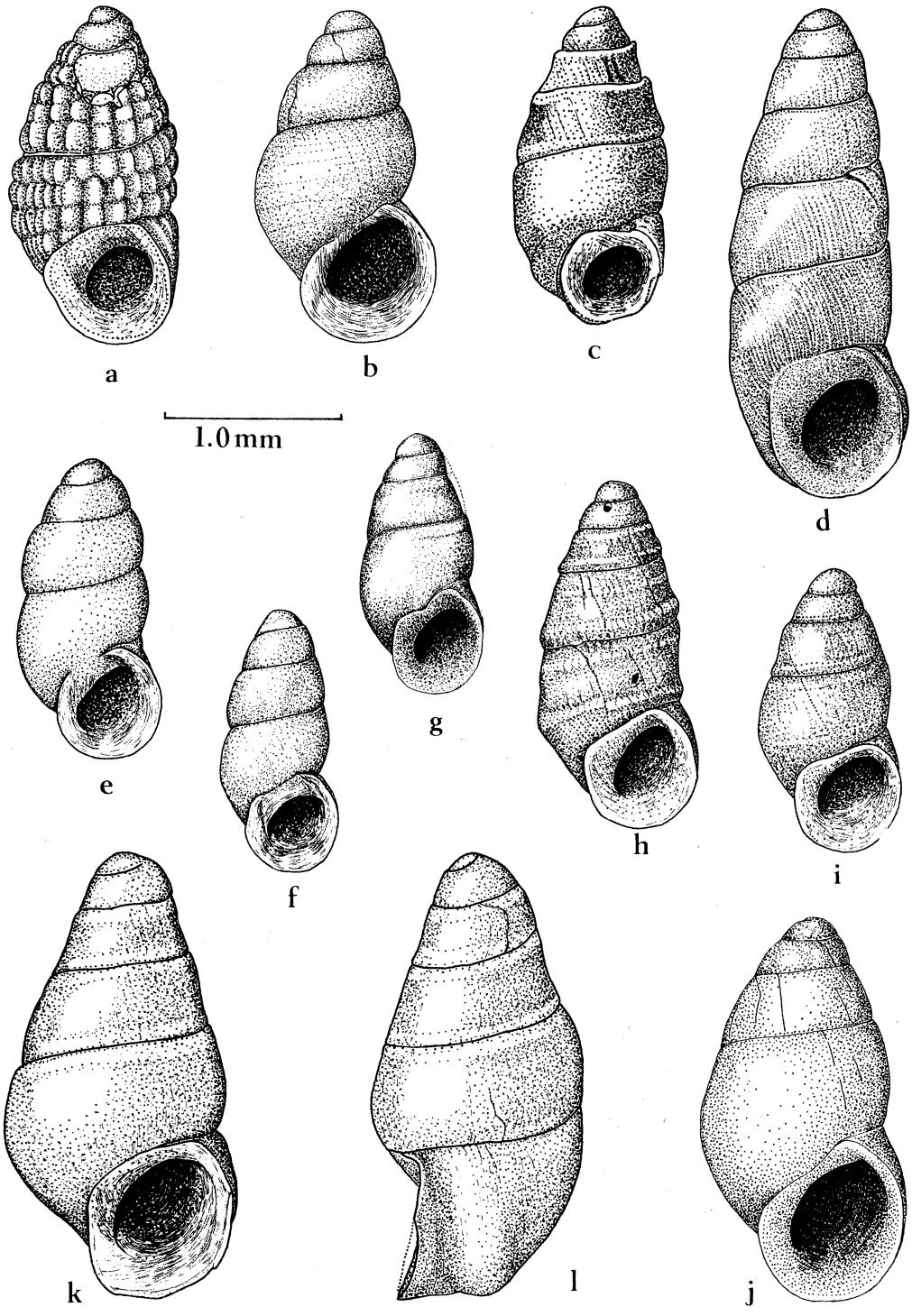

a
b
c
d
1.0mm
e
f
g
h
i
k
l
j

Figure 3. a & b. *Pisinna circumlabra* sp. nov., Pirates Bay, Eaglehawk Neck, S. E. Tasmania, a. holotype, A.M. (C. 95783). 1.82 mm × 0.92 mm. b. paratype, A.M. (C. 95782). 1.62 mm × 0.87 mm. c. *P. albizona* (Laseron), North Harbour, Sydney, N.S.W., A.M. (C. 79210). 2.76 mm × 1.35 mm. d. *P. albizona* (Laseron), Point Halliday, N.S.W., lectotype, A.M. (C. 79208). 2.80 mm × 1.30 mm. e. *P. frenchiensis* (Gatliff & Gabriel), (paratype of *Dardanula difficilis* Gabriel), Elephant Shoal Reef, S.E. of King Is., Bass Strait, Tasmania, A.M. (C. 95048). 2.50 mm × 1.26 mm. f. *P. frenchiensis* (Gatliff & Gabriel), Portsea, Victoria, A.M. (C. 95047). 2.64 mm × 1.32 mm. g. *P. frenchiensis* (Gatliff & Gabriel), Long Bay, Tasmania, lectotype, T.M. (7143/E12, TM5475). 2.85 mm × 1.32 mm. h. *P. frenchiensis* (Gatliff & Gabriel), Lower Bed, Table Cape, Tasmania, Longfordian (Lower Miocene), N.M.V. (P. 33137). 2.30 mm × 1.17 mm. i-l *P. approxima* (Petterd), Pirates Bay, Eaglehawk Neck, S.E. Tasmania, A.M. (C. 95049). i. 1.52 mm × 0.70 mm; j. 1.56 mm × 0.74 mm; k. 1.58 mm × 0.72 mm; l. 1.76 mm × 0.72 mm.

Scale I — a, b, i, j, k, l.
Scale II — c, d, e, f, g, h.

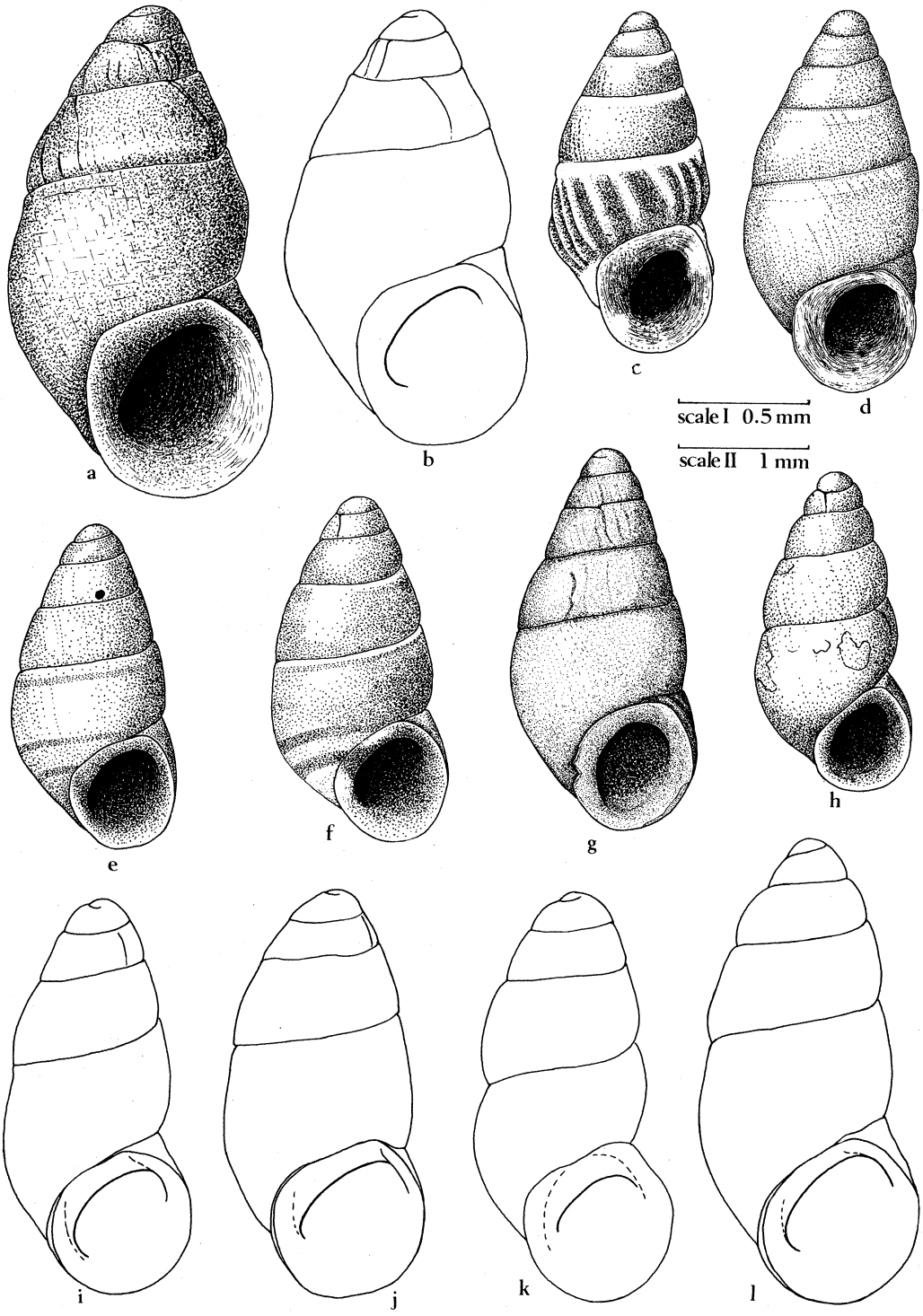

a
b
c
d
scale I 0.5 mm
scale II 1 mm
e
f
g
h
i
j
k
l

Figure 4. a. *Pisinna costata* (Hedley), (paratype of *Estea hoggartae* Gabriel), S.E. of King Is., Bass Strait, Tasmania, N.M.V. (F. 16128). 3.15 mm × 1.45 mm. b. *P. costata* (Hedley), S. of Cape Wiles, S.A. 183 m, holotype A.M. (E. 4253). 3.10 mm × 1.40 mm. c. *P. kershawi* (T. Woods), (holotype of *Estea microcosta* May), E. of Cape Pillar, S.E. Tasmania, 183 m, T.M. (7753/E412, C. 1701). 2.70 mm × 1.17 mm. d. *P. kershawi* (T. Woods), Long Bay, Tasmania, lectotype, N.M.V. (F. 654). 2.58 mm × 1.24 mm. e. *P. frauenfeldi* (Frauenfeld), (lectotype of *Estea narrabeenensis* Laseron), Long Reef, Sydney, N.S.W., A.M. (C. 95571). 3.45 mm × 1.60 mm f. *P. frauenfeldi* (Frauenfeld), (lectotype of *Estea jervisensis* Laseron), Huskisson, Jervis Bay, N.S.W., A.M. (C. 95570). 3.70 mm × 1.82 mm.

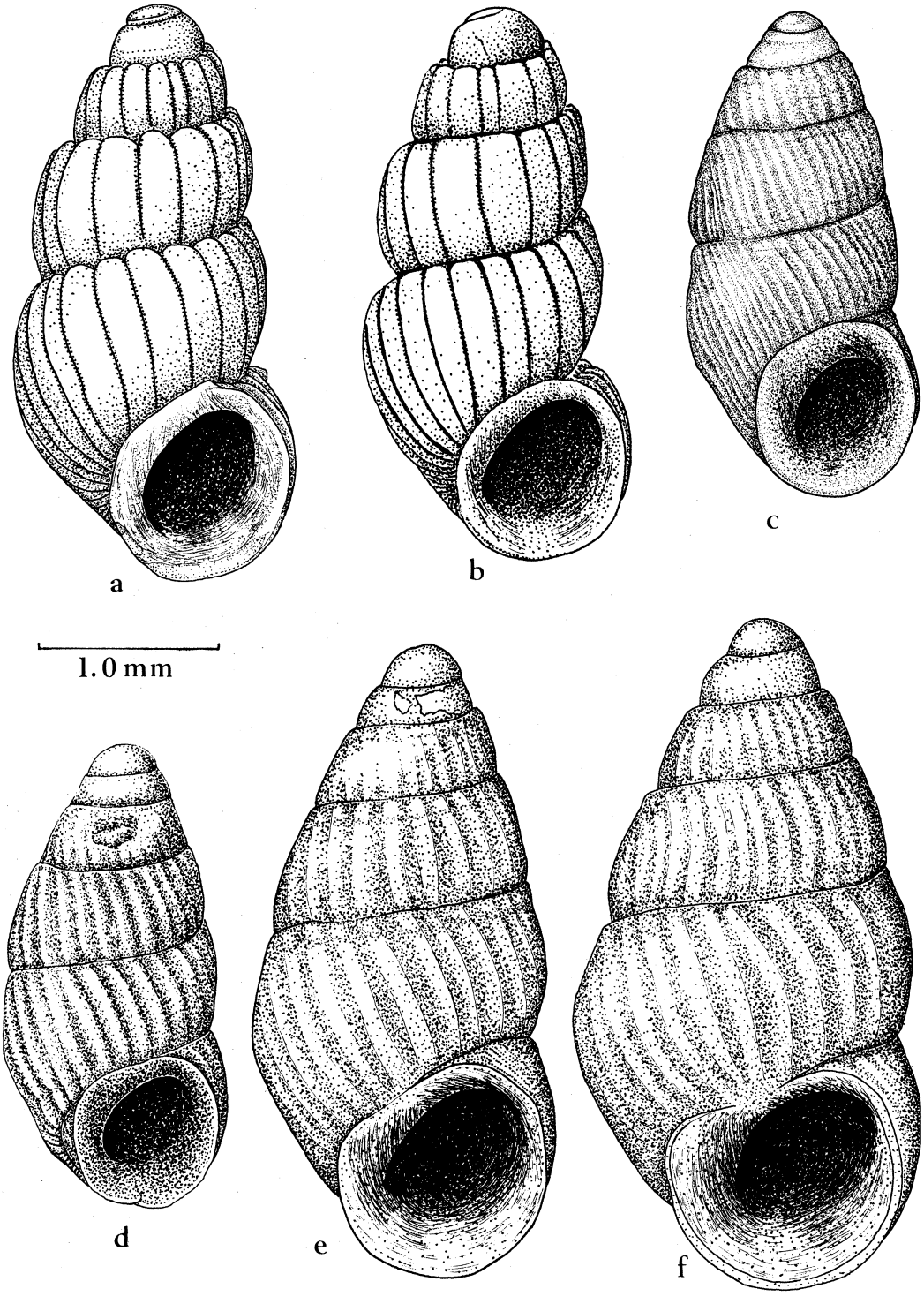

a
b
c
1.0 mm
d
e
f

Figure 5. a. *Pisinna flindersii* (T. Woods), N.W. Tasmania, syntype, T.M. (7747A/E406A, TM5486). 3.45 mm × 1.55 mm. b. *P. salebrosa* (Frauenfeld) S. side of Long Reef, Sydney, N.S.W., A.M. (C. 95050). 2.40 mm × 1.40 mm. c & d. *P. olivacea olivacea* (Frauenfeld), Fairlight, Sydney, N.S.W., A.M. (C. 90352). c. 2.15 mm × 1.15 mm; d. 1.72 mm × 0.93 mm. e. *P. olivacea olivacea* (Frauenfeld), (lectotype of *Rissoa diemenensis* Petterd), "Table Cape and Tamar Heads", Tasmania, T.M. (7145/E14, C. 268). 2.15 mm × 1.08 mm. f. *P. tumida tumida* (T. Woods), Frederick Henry Bay, S.E. Tasmania, neotype, T.M. (7765/E424, C.711). 3.00 mm × 1.34 mm. g. *P. tumida wilsoni* subsp. nov., Off Dunsborough, S.W.A., 16 m, holotype, A.M. (C. 95037). 2.45 mm × 1.20 mm. h. *P. tumida simplicosta* subsp. nov., Cape Moreton, Qld, 128–183 m, A.M. (C. 95041). 2.00 mm × 1.00 mm.

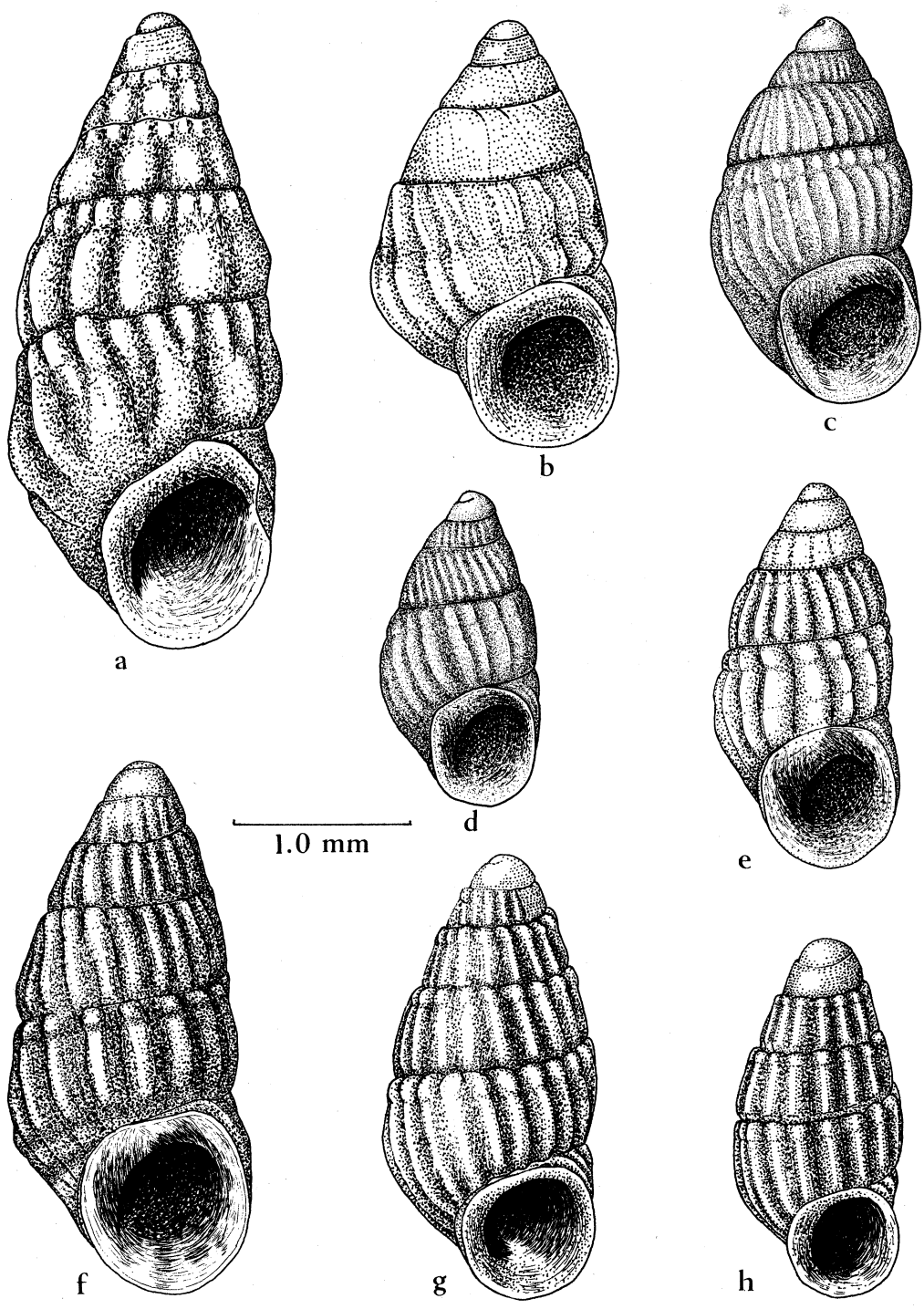

a
b
c
d
e
1.0 mm
f
g
h

Figure 6. a & b. *Pisinna oblata* (Laseron), Noosa Head, Qld, holotype, A.M. (C.79574). 1.46 mm × 0.67 mm. c. *P. oblata* (Laseron), Cronulla, N.S.W., A.M. (C. 95051). 2.30 mm × 1.00 mm. d & e. *P. tasmanica* (T. Woods), Off Crookhaven, N.S.W., 55-64 m, A.M. (C. 95046). d. 2.56 mm × 1.14 mm; e. 2.34 mm × 1.10 mm. f. *P. tasmanica* (T. Woods), Long Bay, Tasmania, holotype, T.M. (7762/E421, TM5428). 2.60 mm × 1.15 mm. g. *P. bicolor* (Petterd), South Tasmania, neotype. T.M. (7745/E404, TM5479). 3.96 mm × 1.80 mm. h & i. *P. nitida* sp. nov. Dredged between Sydney Heads, N.S.W., 27 m, i. holotype, A.M. (C. 95640). 5.20 mm × 2.08 mm; h. paratype, A.M. (C. 95052). 4.40 mm × 1.84 mm.

Scale I — a.
Scale II — others, except h.

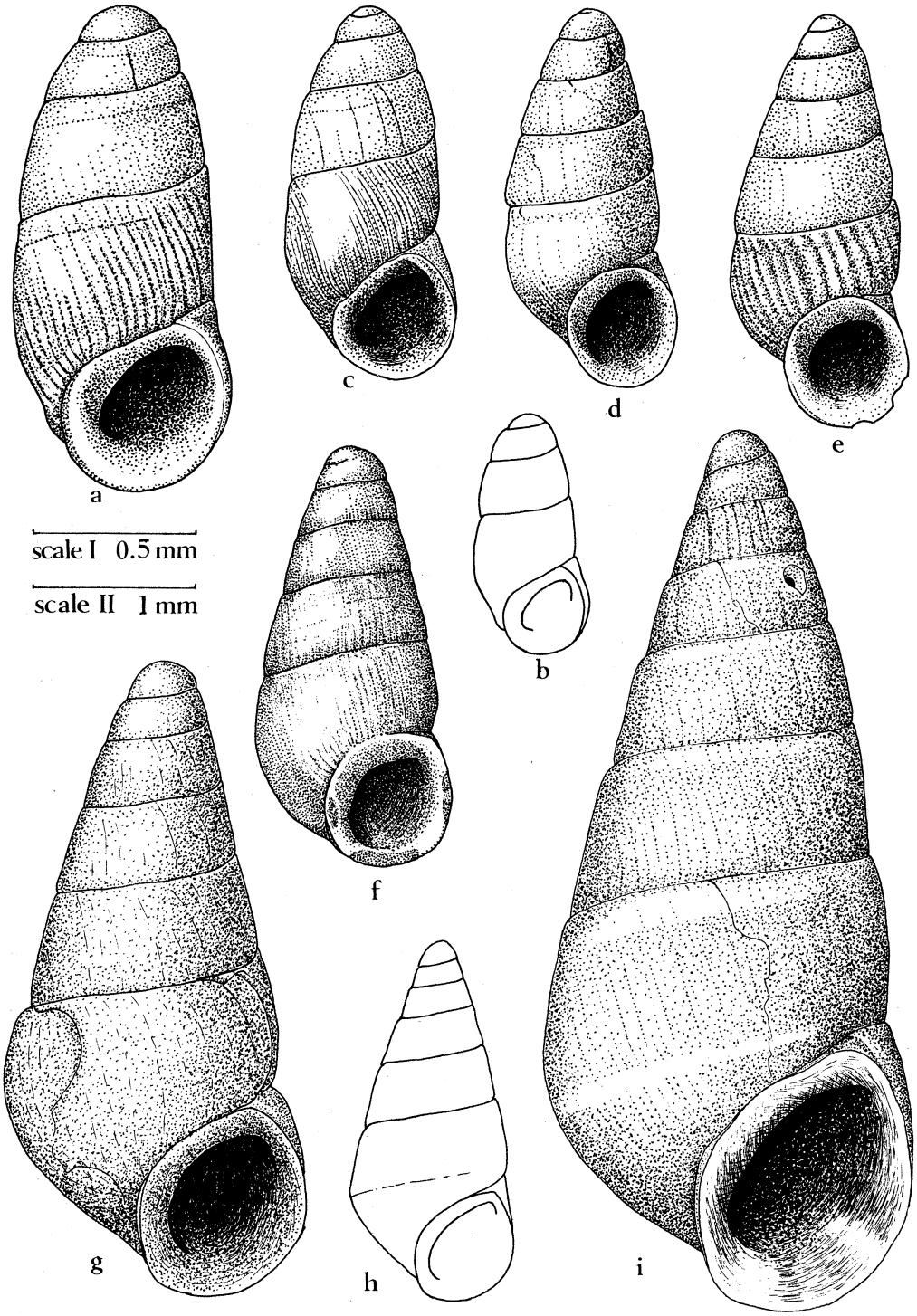

a
c
d
e
scale I 0.5 mm
scale II 1 mm
b
f
g
h
i

Figure 7. a. *Pisinna moretonensis* sp. nov., N.E. of Cape Moreton Lighthouse, Qld, 115 m, holotype, A.M. (C. 95033). 5.40 mm × 2.42 mm. b. *P. voorwindei* sp. nov., E. of Rocky Point, Great Australian Bight, S.A., 77-80 m, holotype, A.M. (C. 90351). 4.10 mm × 1.42 mm. c. *P. varicifera varicifera* (T. Woods), Table Cape, Tasmania, N.M.V. (P. 33138). 4.50 mm × 1.75 mm. d. *P. varicifera relata* (Cotton), Gulf St. Vincent, S.A., holotype, S.A.M. (D. 14186). 3.05 mm × 1.62 mm. e. *P. varicifera relata* (Cotton), E. of Cheyne Bay, W.A., 75 m, A.M. (C. 95797). 3.63 mm × 1.55 mm. f. *P. varicifera relata* (Cotton), Off Port Kembla, N.S.W., 115-137 m, A.M. (C. 16313). 4.58 mm × 1.92 mm. g. *P. varicifera relata* (Cotton), (holotype of *Eusetia laterna* (Cotton), Off Beachport, S.A., S.A.M. (D. 14443). 3.40 mm × 1.70 mm. h. *P. paucirugosa* sp. nov., N.E. of Cape Moreton Lighthouse, Qld, 115 m, holotype, A.M. (C. 95035). 4.40 mm × 2.00 mm.

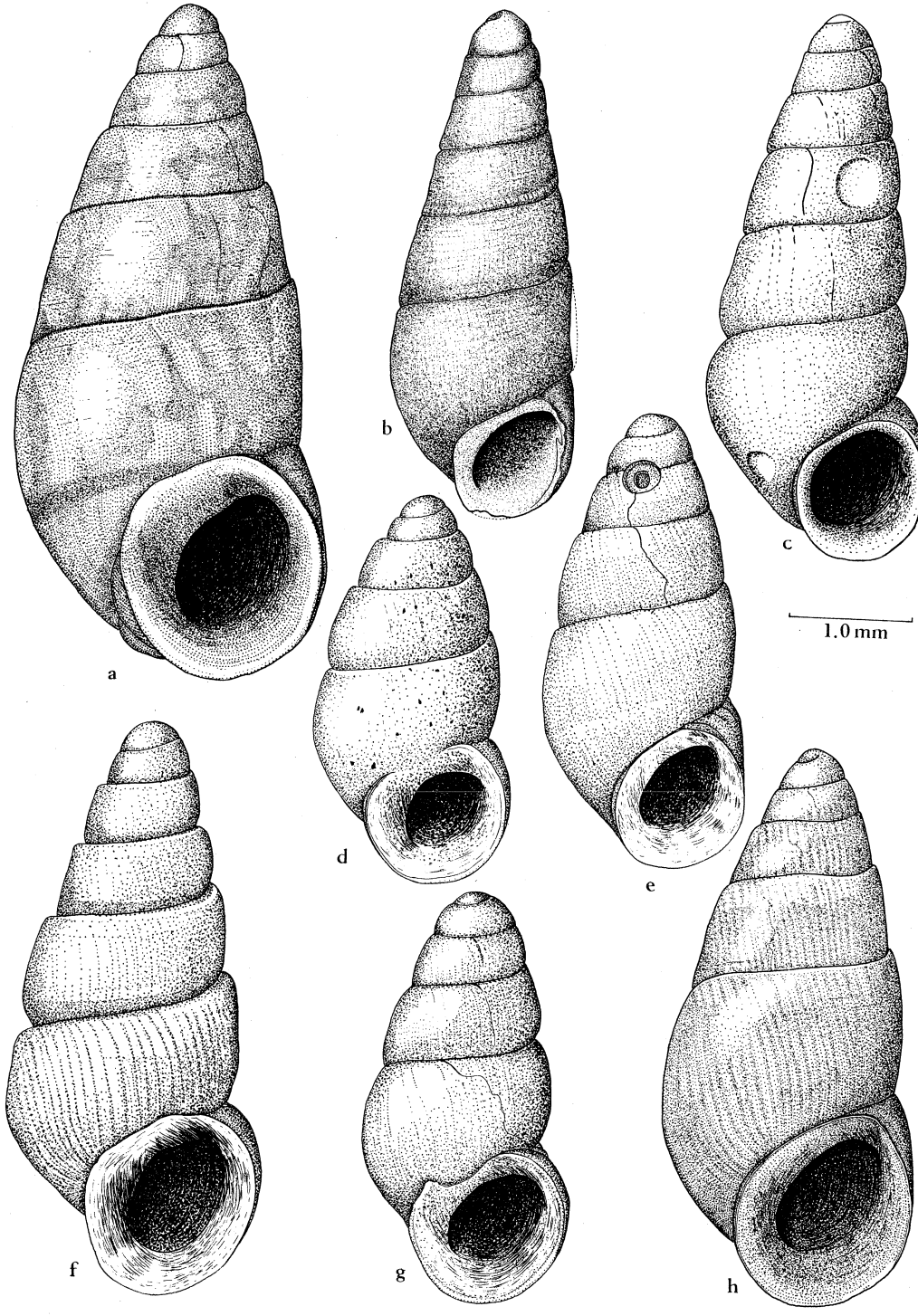

a
b
c
d
e
f
g
h
1.0 mm

Figure 8. a. *Pisinna bikiniensis* (Ladd), Bikini Atoll, Pacific, Early Miocene, paratype, A.M. (C. 77650). 1.78 mm × 0.80 mm. b. *P. angulata* sp. nov., N.W. of Roebuck Bay, N.W.A., 188 m, holotype, A.M. (C. 95020). 3.13 mm × 1.13 mm. c. *P. eurychades* (Watson), Off Raine Is., Cape York, N. Qld, 284 m, syntype, A.M. (C.35006). 3.24 mm × 1.22 mm. d. *P. tropica* (Laseron), Heron Is., Capricorn Group, Qld, holotype, A.M. (C. 95053). 1.26 mm × 0.62 mm. e & f. *P. incipiens* (Laseron), Heron Is., Capricorn Group, Qld, holotype, A.M. (C. 95630). 1.55 mm × 0.70 mm. f. enlarged aperture. g. *P. kis* (Winckworth), Trincomali, Ceylon, 18 m, paratype, B.M.N.H. (197440). 1.60 mm × 0.73 mm. h. *P. microthyra* (Martens), Mauritius, Indian Ocean, paratype, A.M. (C. 95800). 1.60 mm × 0.76 mm.

Scale I — a, f, g, h.
Scale II — b, c, d, e.

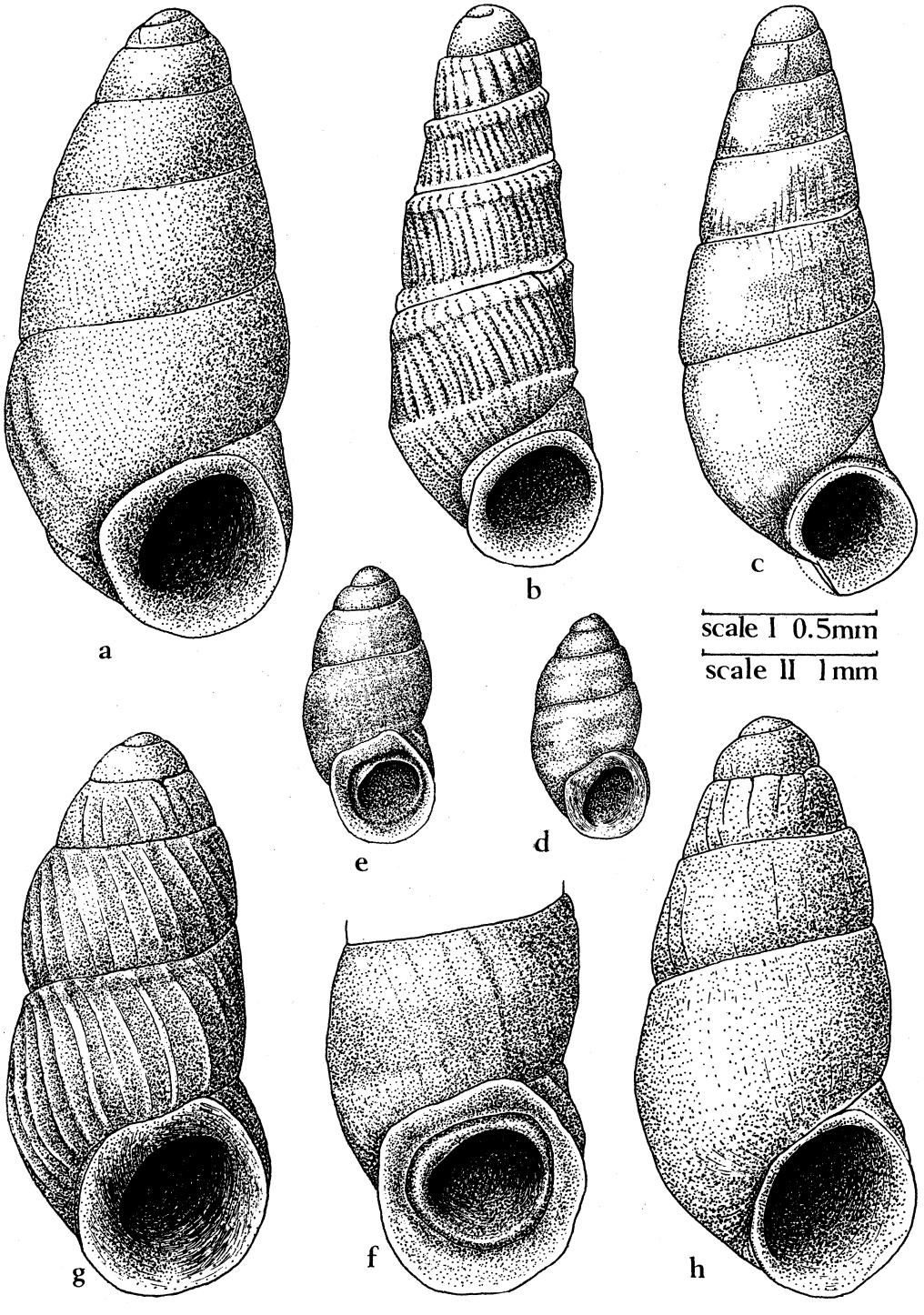

a
b
c
scale I 0.5mm
scale II 1mm
e
d
g
f
h

Figure 9. a. *Pisinna colmani* sp. nov., Near Maryborough, Qld, 56 m, holotype, A.M. (C. 95023). 2.73 mm × 1.25 mm. b. *P. hipkinsi* (Ponder), Spirits Bay, New Zealand, holotype, Auckland Institute and Museum. 2.38 mm × 1.30 mm. c. *P. chasteri* (Melvill & Standen), Lifu, Loyalty Is., A.M. (C. 95799). 2.20 mm × 1.00 mm. d & e. *P. chasteri* (Melvill & Standen), Off Noumea, New Caledonia, 0.2 m, A.M. (C. 95798). d. 2.20 mm ×1.14 mm; e. 1.80 mm × 0.94 mm. f. *P. perdigna* (Laseron), Masthead Is., Capricorn Group, Qld, holotype, A.M. (C. 79575). 2.24 mm × 1.00 mm. g. *P. punctulum* (Philippi), Gulf of Marseilles, France, A.M. (C. 33023). 1.70 mm × 0.80 mm. h. *P. compressa* (Laseron), Michaelmas Cay, Qld, holotype, A.M. (C. 95025). 1.60 mm × 0.77 mm. i. *P. crawfordi* (Smith), Algoa Bay, S. Africa, 36 m, syntype, 4.33 mm × 1.5 mm (from original description). j. *P. cazini* (Velain), Isle St. Paul, Indian Ocean, syntype. 2 mm × 1 mm (from original description).

All same scale except i & j.

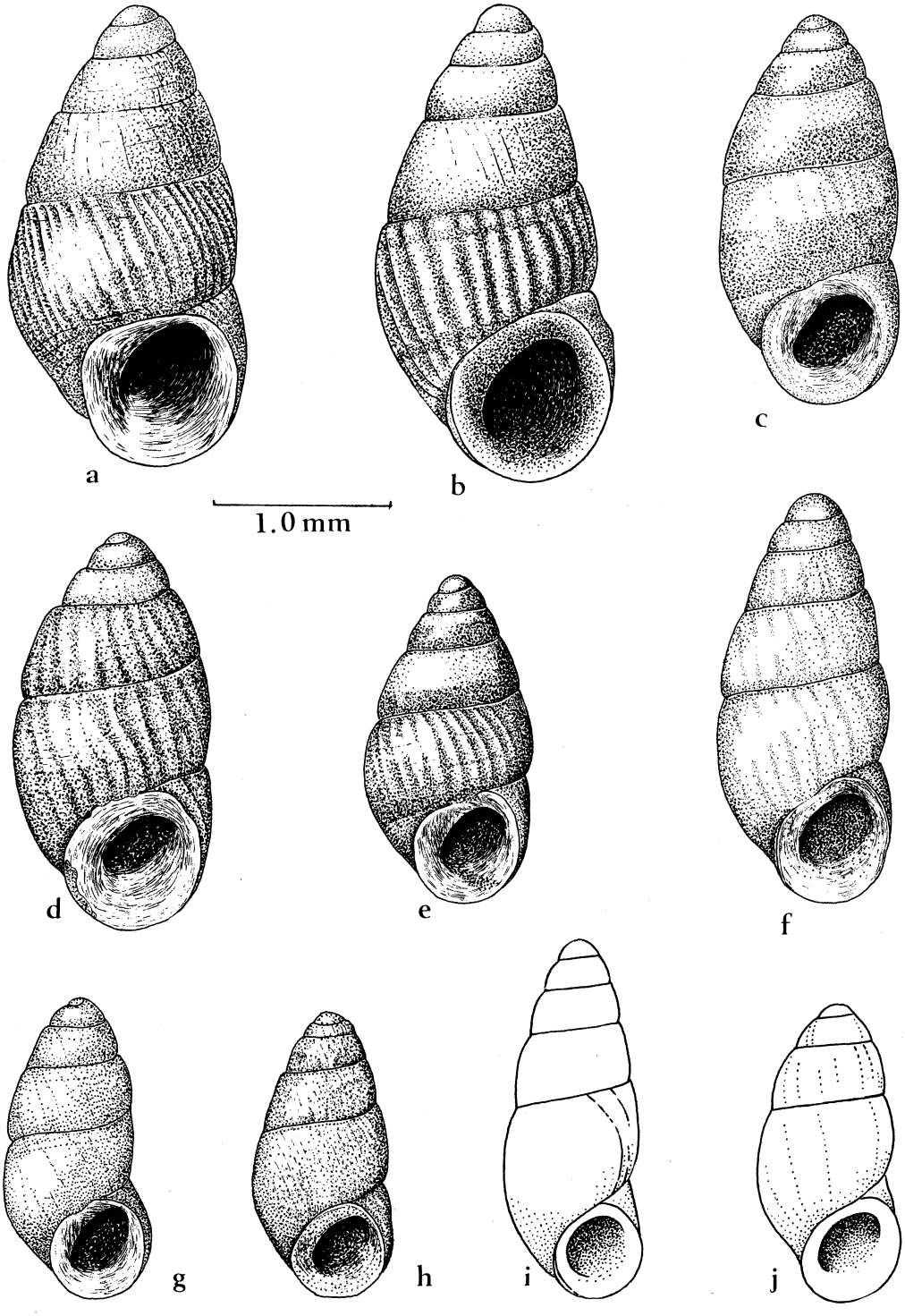
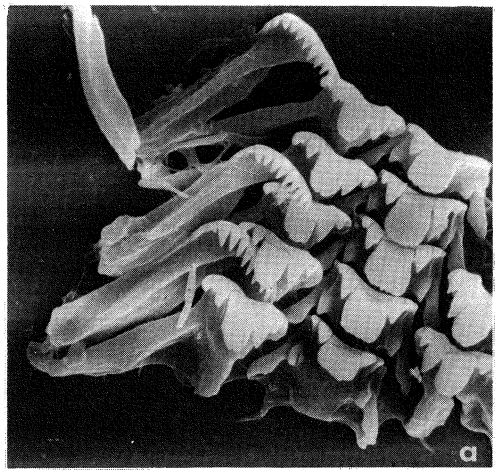
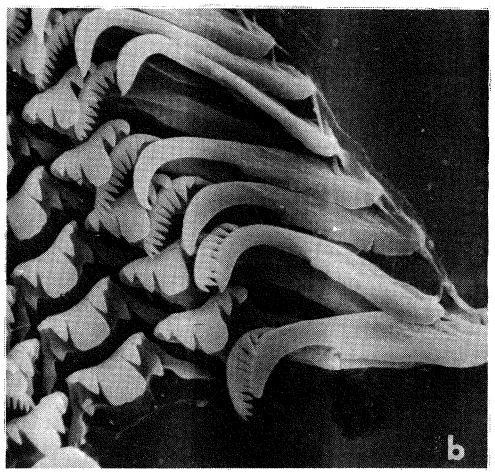
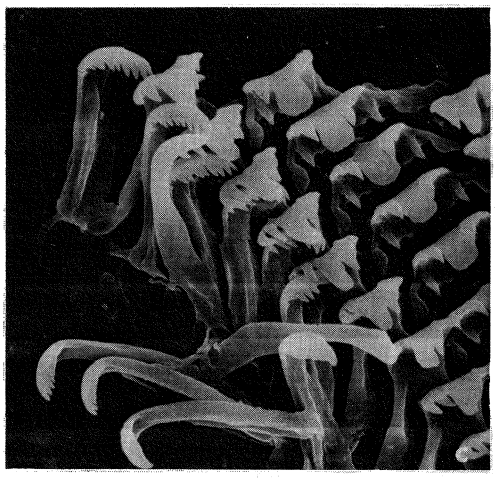
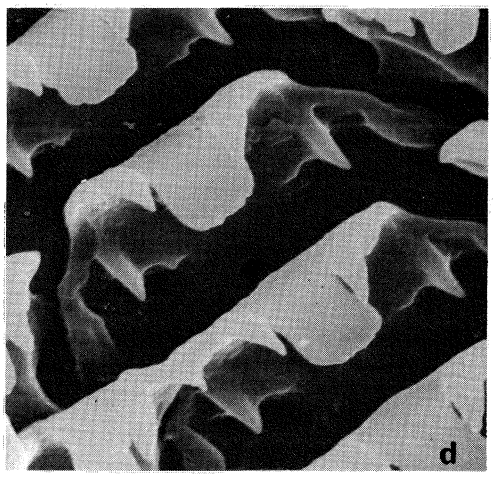

a
b
c
1.0 mm
d
e
f
g
h
i
j

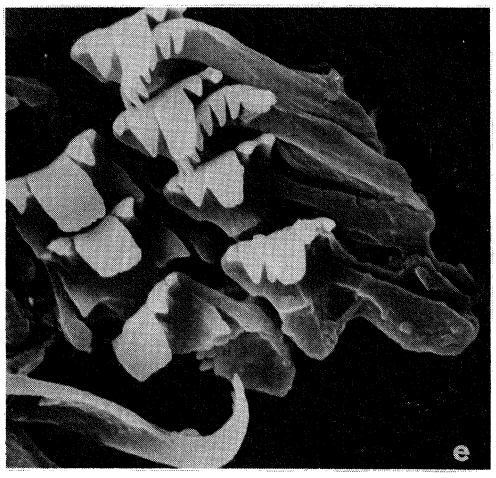
Figure 10. RADULAE: a & b. *Pisinna albizona* (Laseron), Honeymoon Beach, Jervis Bay, N.S.W., in short turf-like red and brown algae, 18 Jan. 1969, coll. W. F. Ponder (S.E.M. Stub No. 37). a. × 1,700, b. × 1,700. c & d. *P. punctulum* (Philippi), Gulf of Marseilles, France (S.E.M. Stub No. 58). c. × 1,680, d. × 4,900. e & f. *P. tropica* (Laseron), S. outer face of One Tree Is., Capricorn Group, Qld, 1.5-4.5 m, 7 Dec. 1966, coll. F. H. Talbot (S.E.M. Stub No. 40). e. × 3,200. f. × 2,100.


a


b




d


e

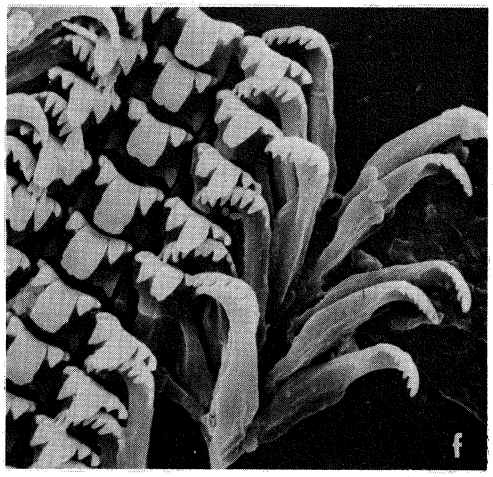

f

Figure 11. RADULAE: a & b. *Pisinna approxima* (Petterd), Pirates Bay, Eaglehawk Neck, S.E. Tasm. under stones, low tide, 30 Mar. 1970, coll. W. F. Ponder (S.E.M. Stub No. 43). a. × 1,680, b. × 3,150. c. *P. megastoma* sp. nov., Pirates Bay, Eaglehawk Neck, S.E. Tasm., on coralline algae, 30 Mar. 1970, coll. W. F. Ponder (S.E.M. Stub No. 65). × 2,600. d. *P. circumlabra* sp. nov., Pirates Bay, Eaglehawk Neck, S.E. Tasm., in *Lessonia* holdfasts, 2 April 1970, coll. W. F. Ponder (S.E.M. Stub No. 63). × 2,700. e. *P. frenchiensis* (Gatliff & Gabriel), Pirates Bay, Eaglehawk Neck, S.E. Tasm., on brown algae, 31 Mar. 1970, coll. W. F. Ponder (S.E.M. Stub No. 66). × 2,100. f. *P. olivacea olivacea* (Frauenfeld), Balmoral, Sydney Harbour, N.S.W., on brown algae, 19 Jan. 1969, coll. W. F. Ponder & J. Voorwinde (S.E.M. Stub No. 38). × 1,600.

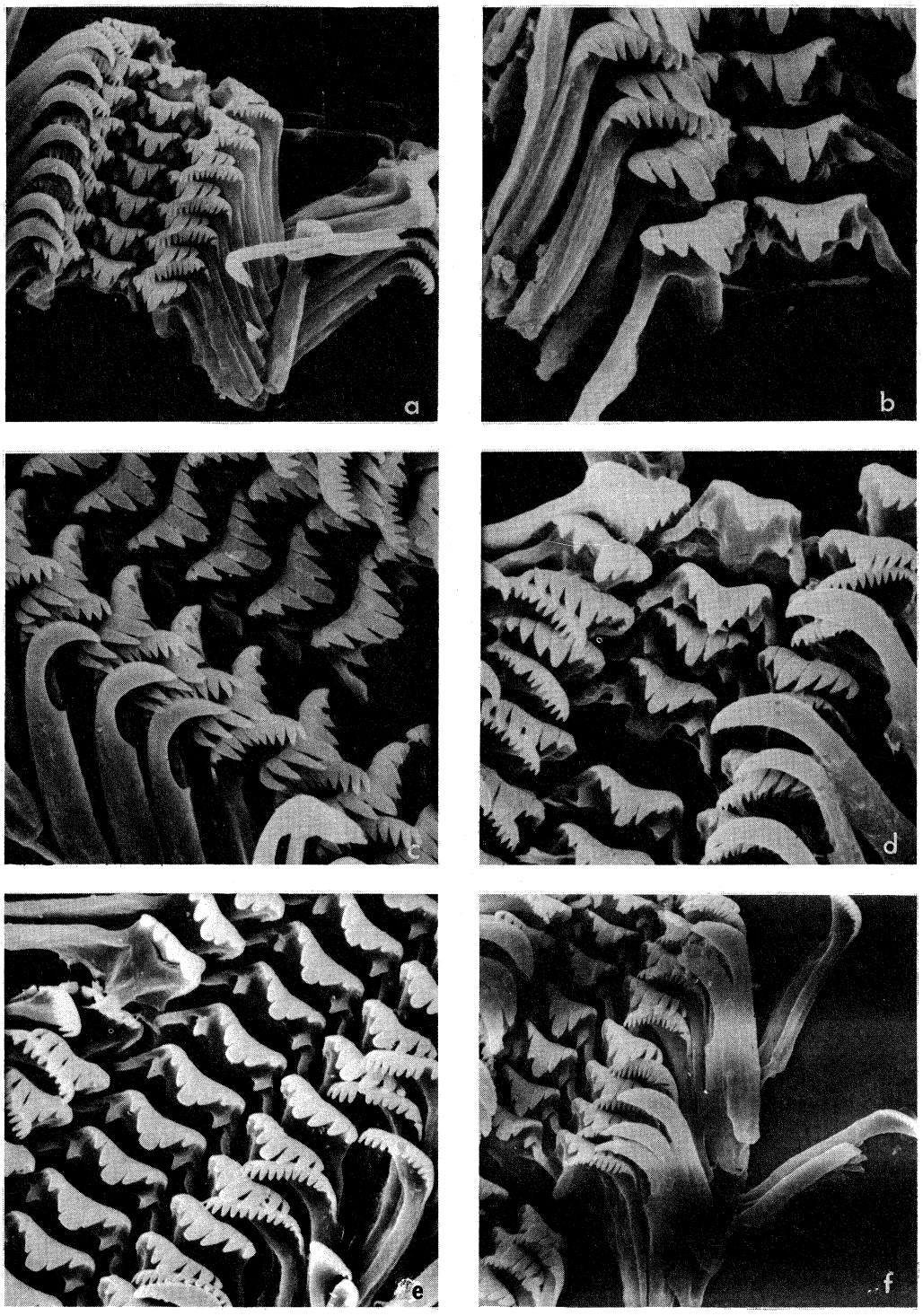

a
b
c
d
e
f

Figure 12. a & b. *Pisinna costata* (Hedley), protoconch. 3.2 km S. of Tasman Head, S. Bruney Is., S.E. Tasm., 73 m (S.E.M. Stub No. 26). a. × 110, b. × 280. c & d. *P. olivacea olivacea* (Frauenfeld), fragment of shell showing inner chitinous shell layer. Ulladulla, N.S.W. (S.E.M. Stub No. 27). c. × 210, d. × 2,100. e & f. *P. olivacea olivacea* (Frauenfeld), protoconch. North Harbour, Sydney, N.S.W. (S.E.M. Stub No. 18). e. × 560, f. × 170. g. *P. punctulum* (Philippi), protoconch. Gulf of Marseilles, France (S.E.M. Stub No. 68). × 150.

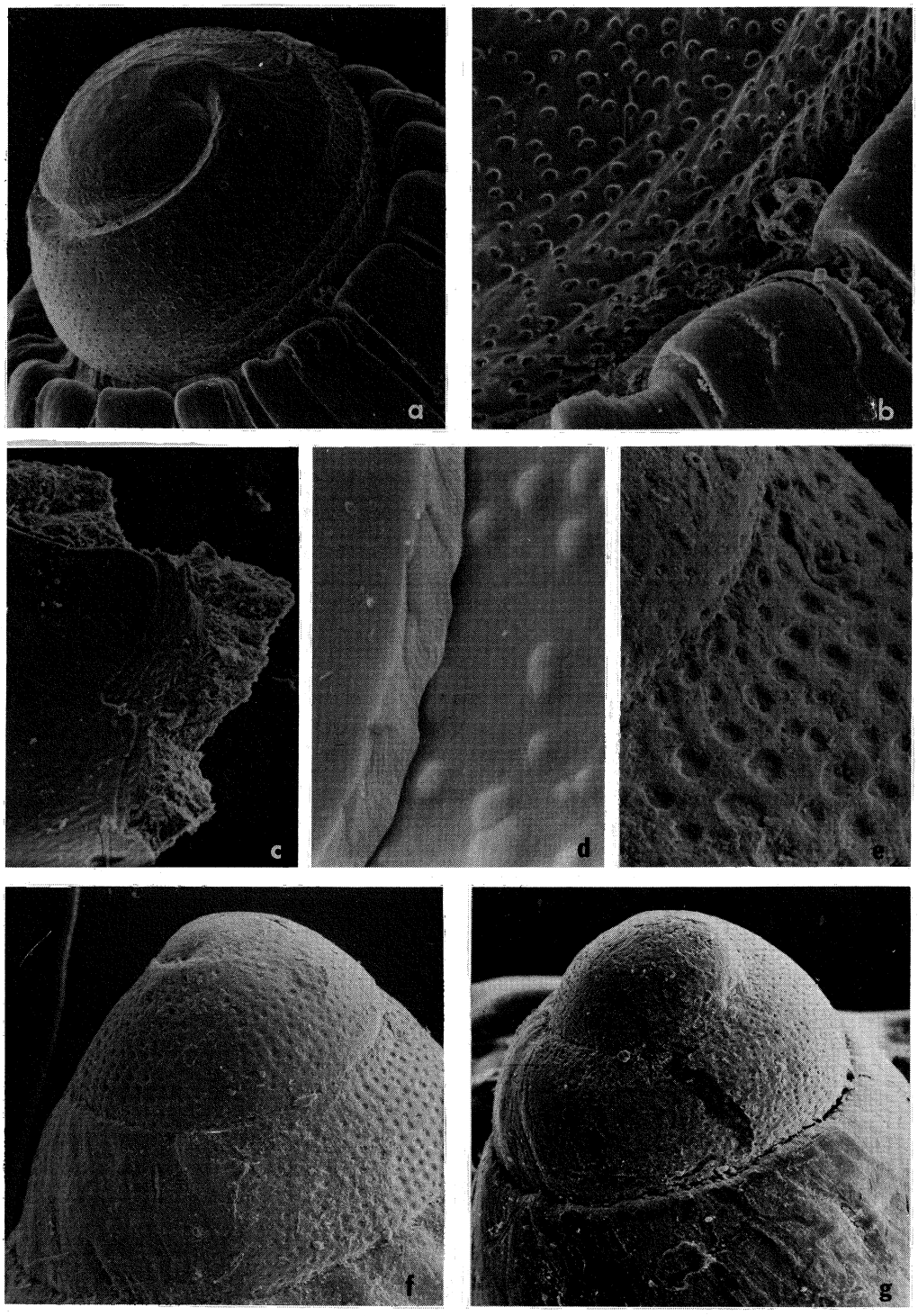
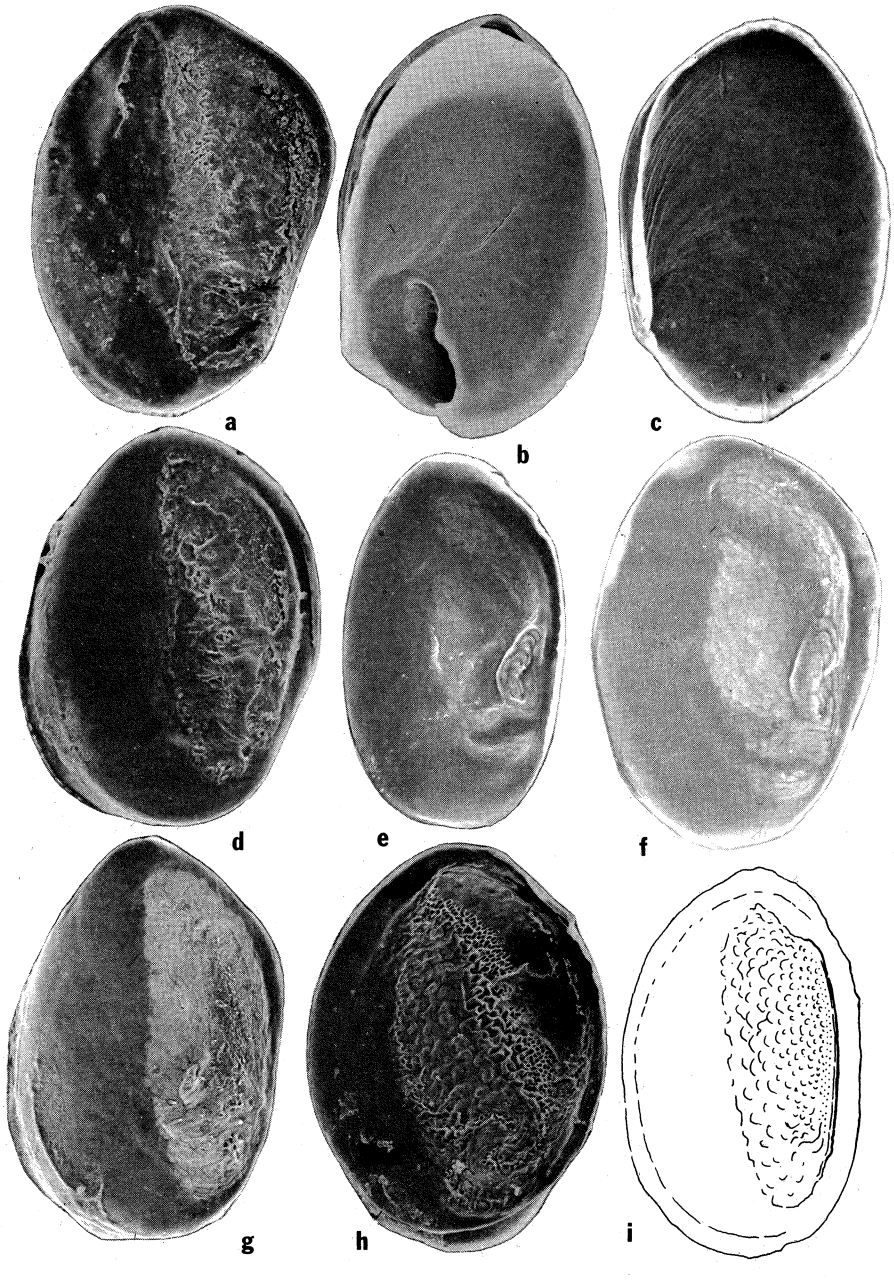

a
b
c
d
e
f
g

Figure 13. OPERCULA: a. *Pisinna albizona* (Laseron), Honeymoon Beach, Jervis Bay, N.S.W., short red and brown algae, 18 Jan. 1969, coll. W. F. Ponder (S.E.M. Stub No. 23). ×130. b. *P. megastoma* sp. nov., Pirates Bay, Eaglehawk Neck, S.E. Tasm., on coralline algae, 30 Mar. 1970, coll. W. F. Ponder (S.E.M. Stub No. 65). ×280. c & d. *P. olivacea olivacea* (Frauenfeld), N. end of Balmoral, Sydney Harbour, N.S.W., 1-2 m, 21 Jan. 1973, coll W. F. Ponder (S.E.M. Stub No. 22). c. ×140, d ×150. e & f. *P. tropica* (Laseron), S. outer face of One Tree Is., Capricorn Group, Qld, 1.5-4.5 m, 7 Dec. 1966, coll. F. H. Talbot (S.E.M. Stub No. 28). e. ×210, f. ×240. g. *P. frenchiensis* (Gatliff & Gabriel), Pirates Bay, Eaglehawk Neck, S.E. Tasm., on brown algae, 31 Mar. 1970, coll. W. F. Ponder (S.E.M. Stub No. 66). ×130. h. *P. frauenfeldi* (Frauenfeld), S. side of Ulladulla, N.S.W., 5 Jan. 1970, coll. W. F. Ponder & P. H. Colman (S.E.M. Stub No. 22). ×80. i. *P. punctulum* (Philippi), Gulf of Marseilles, France (S.E.M. Stub No. 25). ×150.

(figures b and c show the outer side of the operculum, the remainder show the inner side).


a
b
c
d
e
f
g
h
i

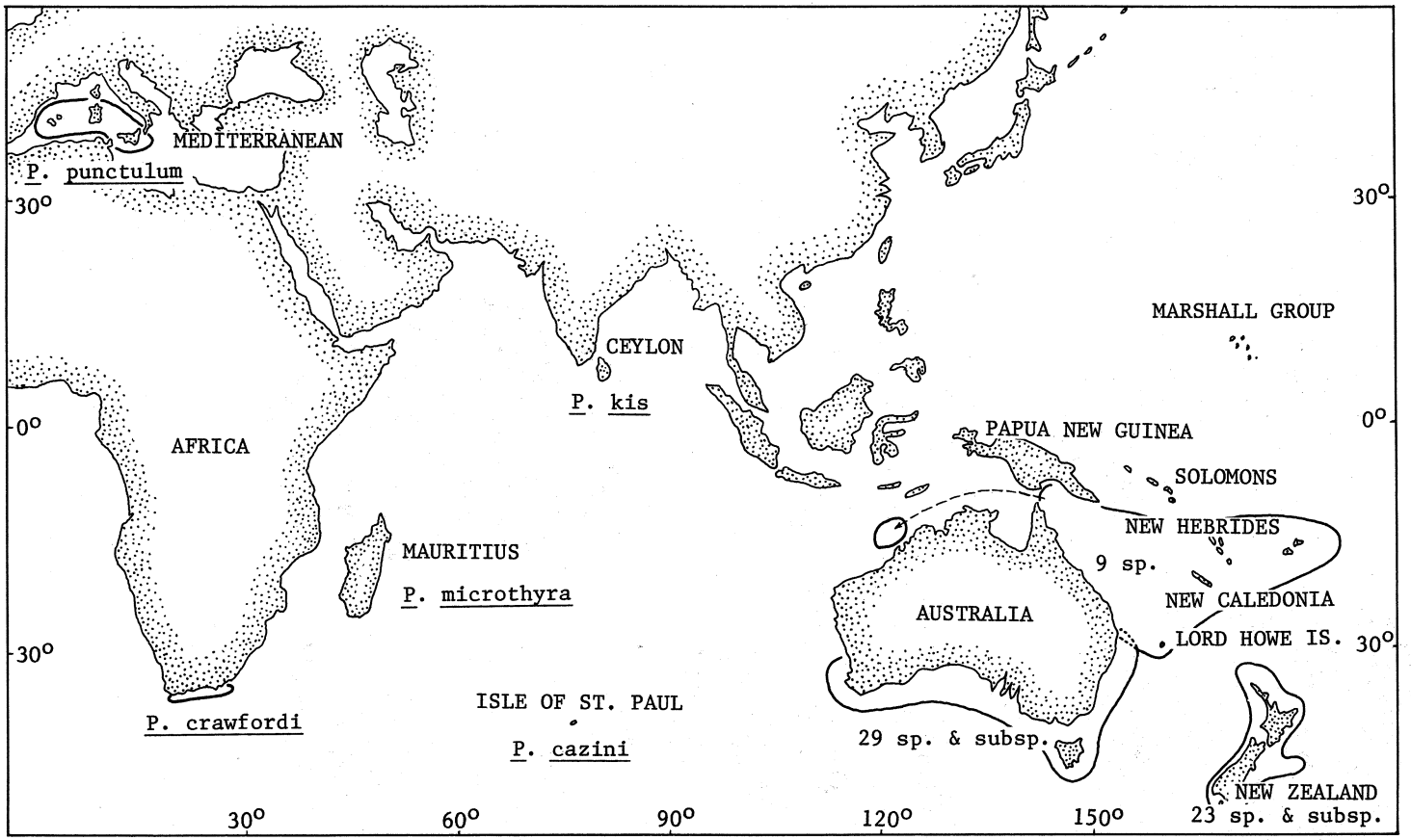


Figure 14. Distribution of the Recent species of *Pisinna*.

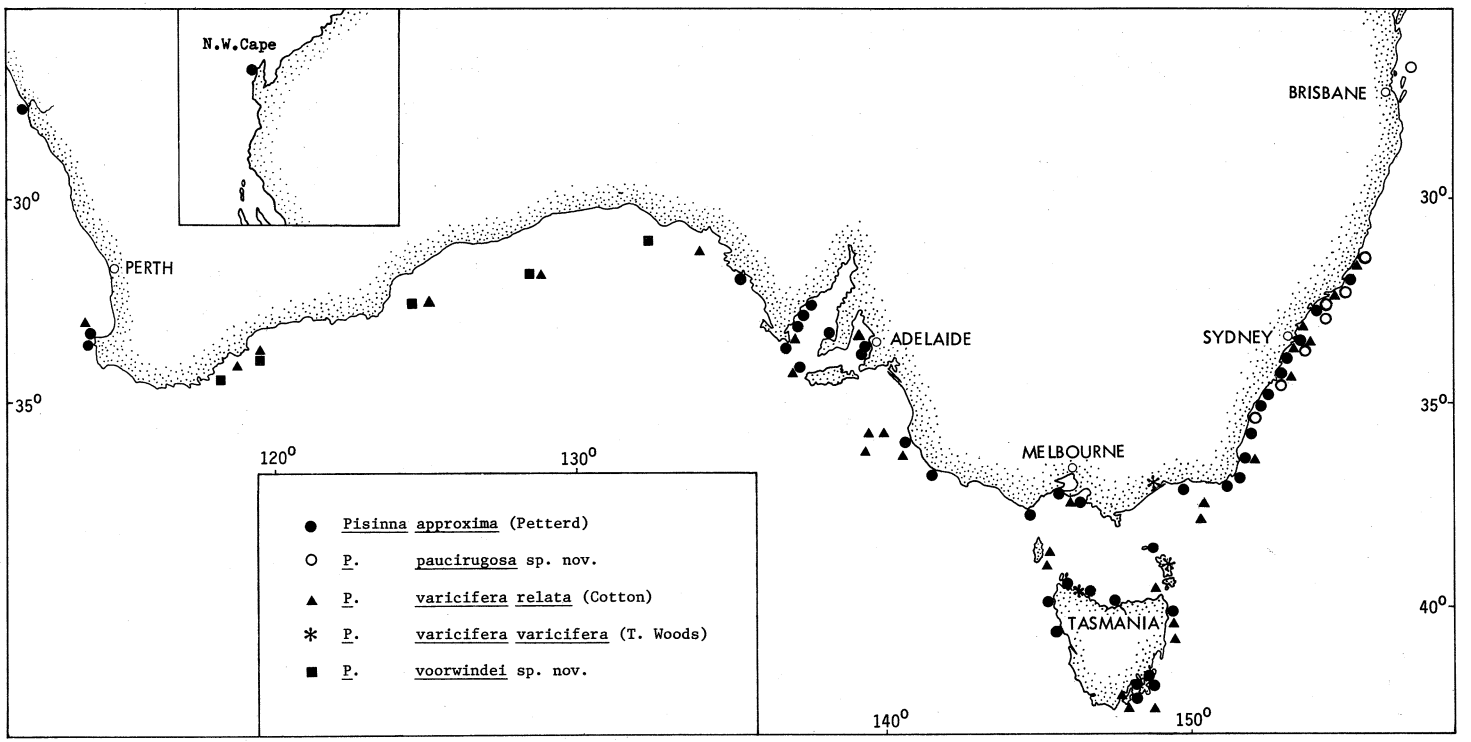


Figure 15. Distribution of the Recent species of *Pisinna*.

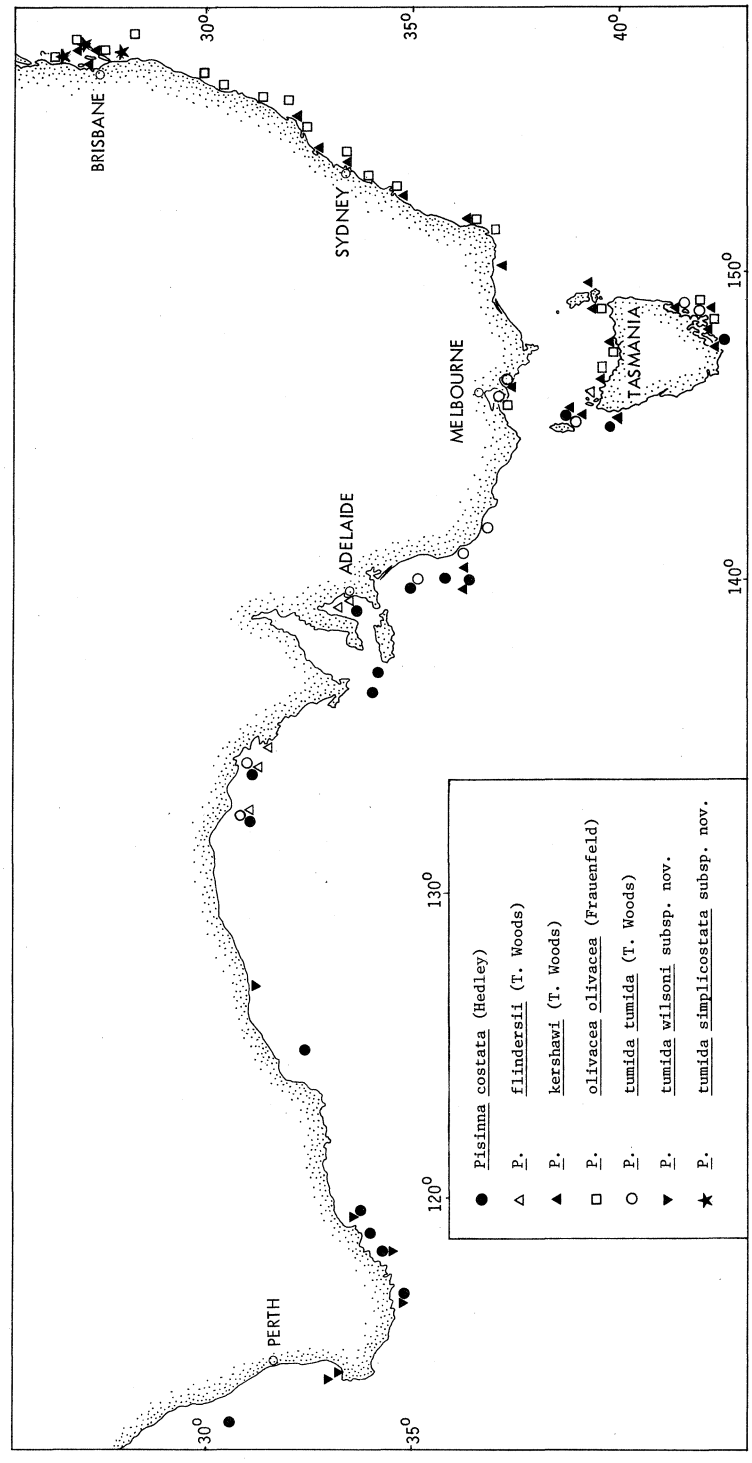


Figure 16. Distribution of the Recent species of *Pisinna*.

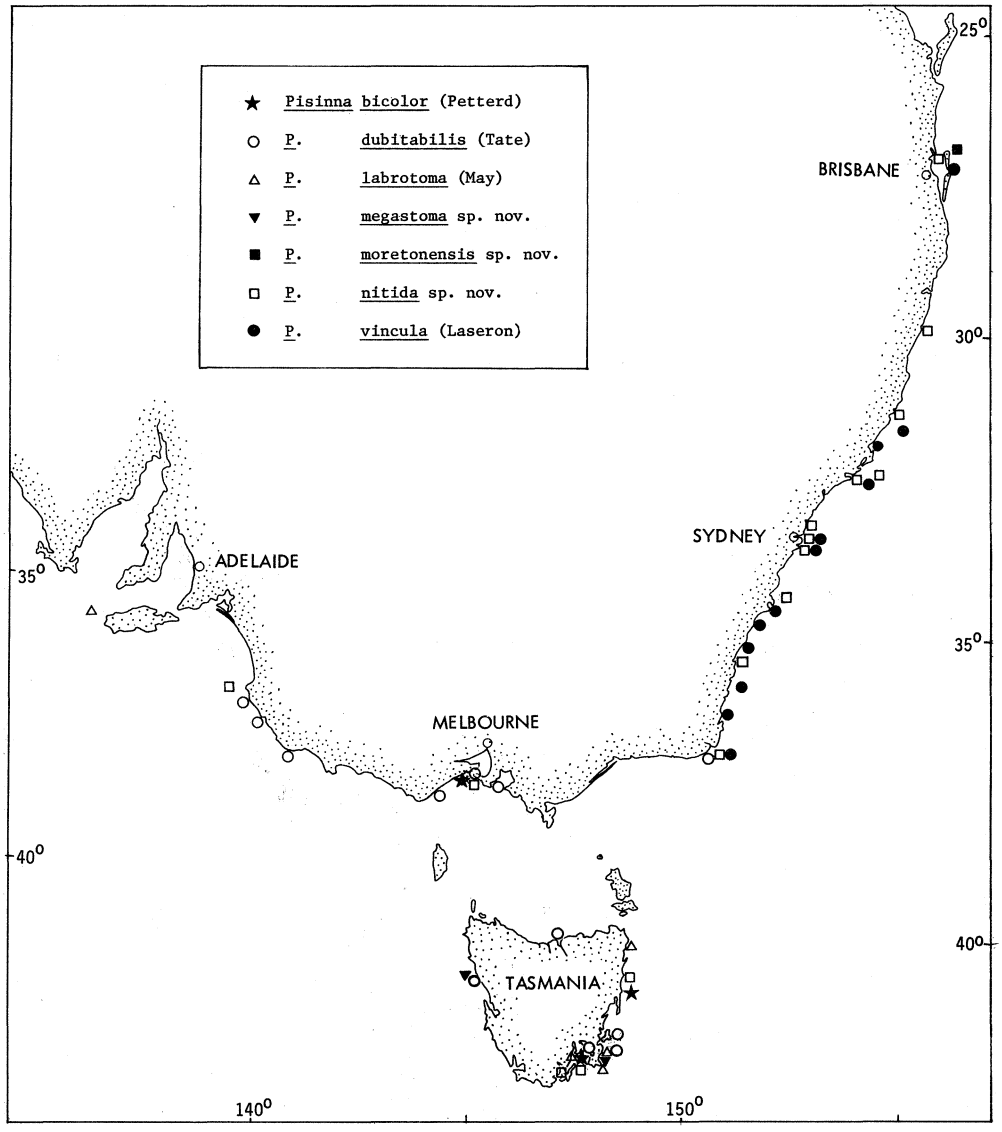


Figure 17. Distribution of the Recent species of *Pisinna*.

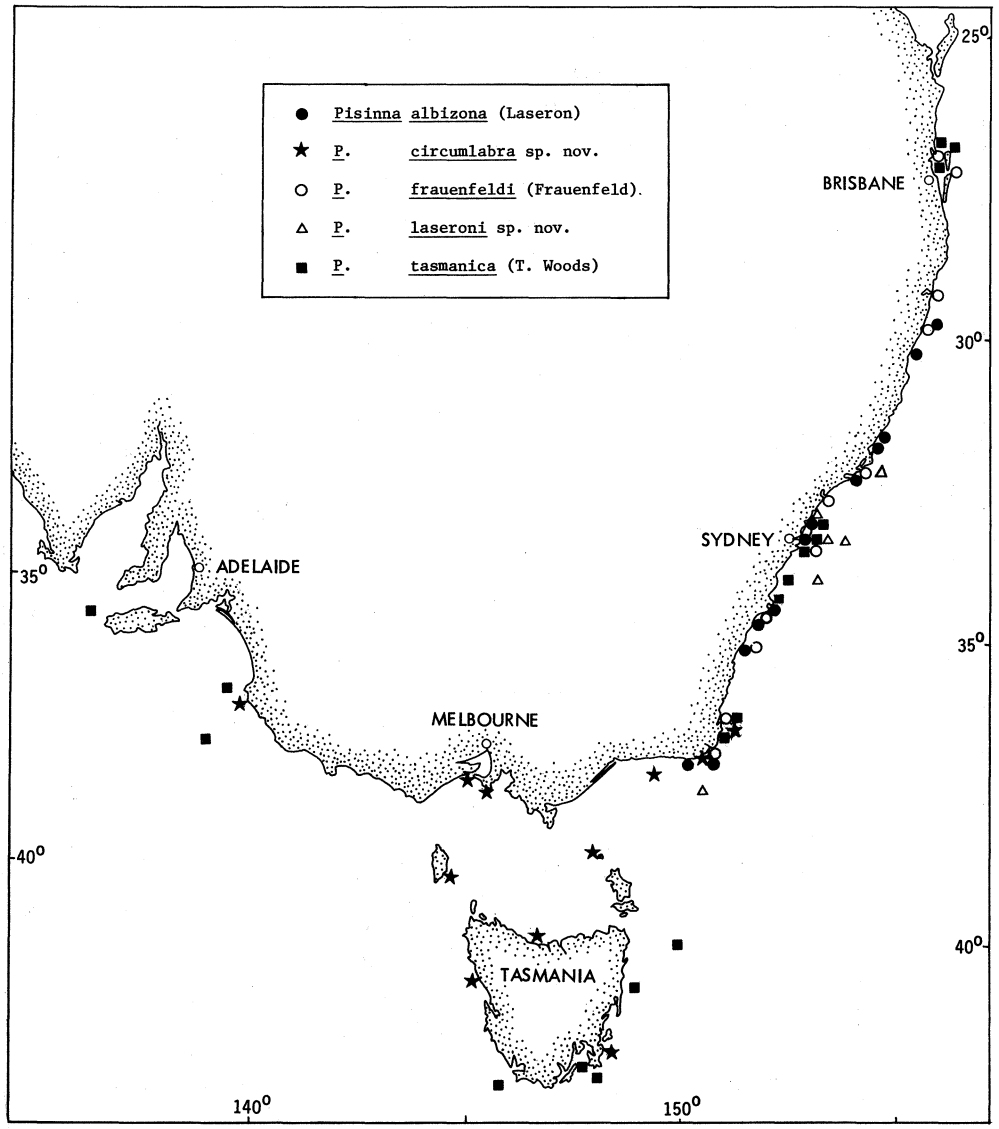


Figure 18. Distribution of the Recent species of *Pisinna*.

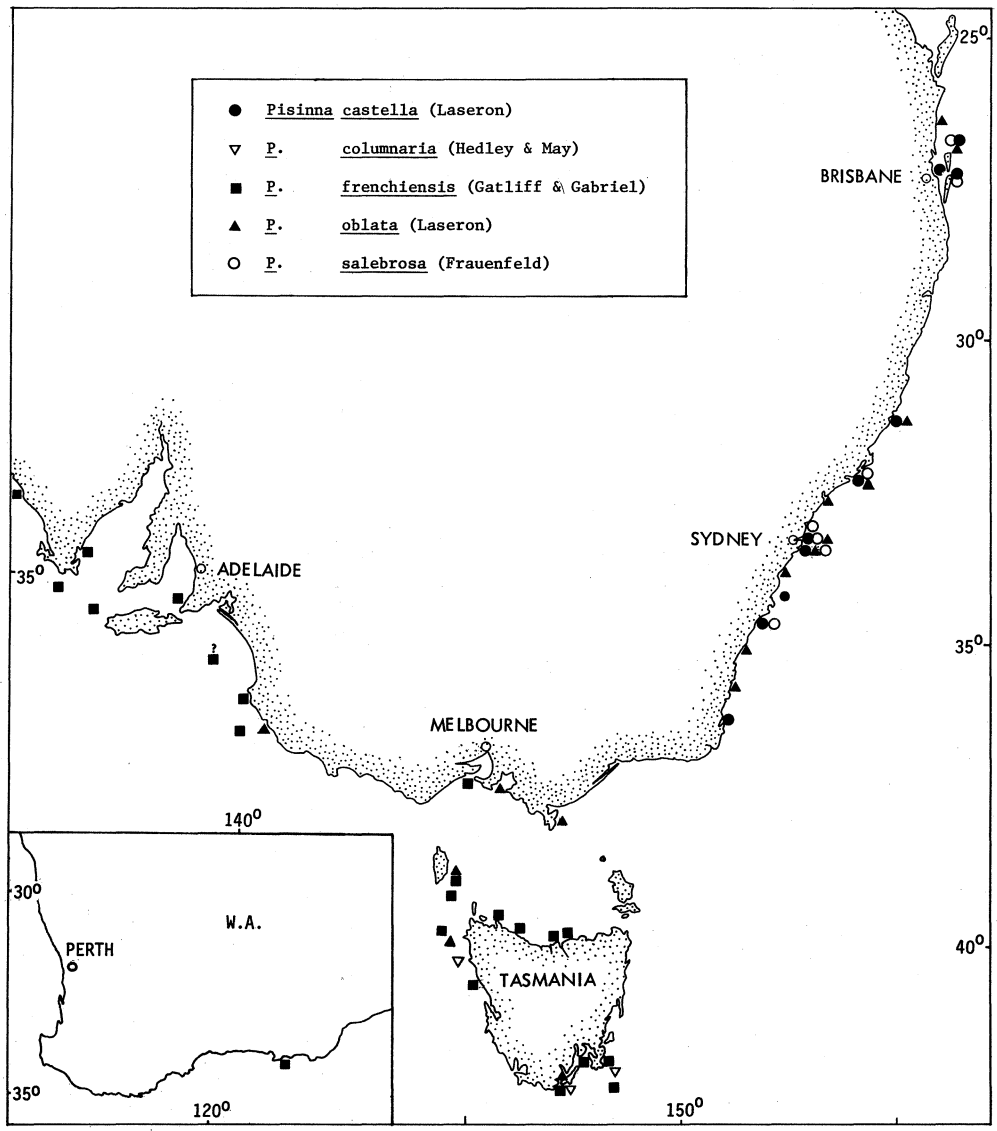


Figure 19. Distribution of the Recent species of *Pisinna*.

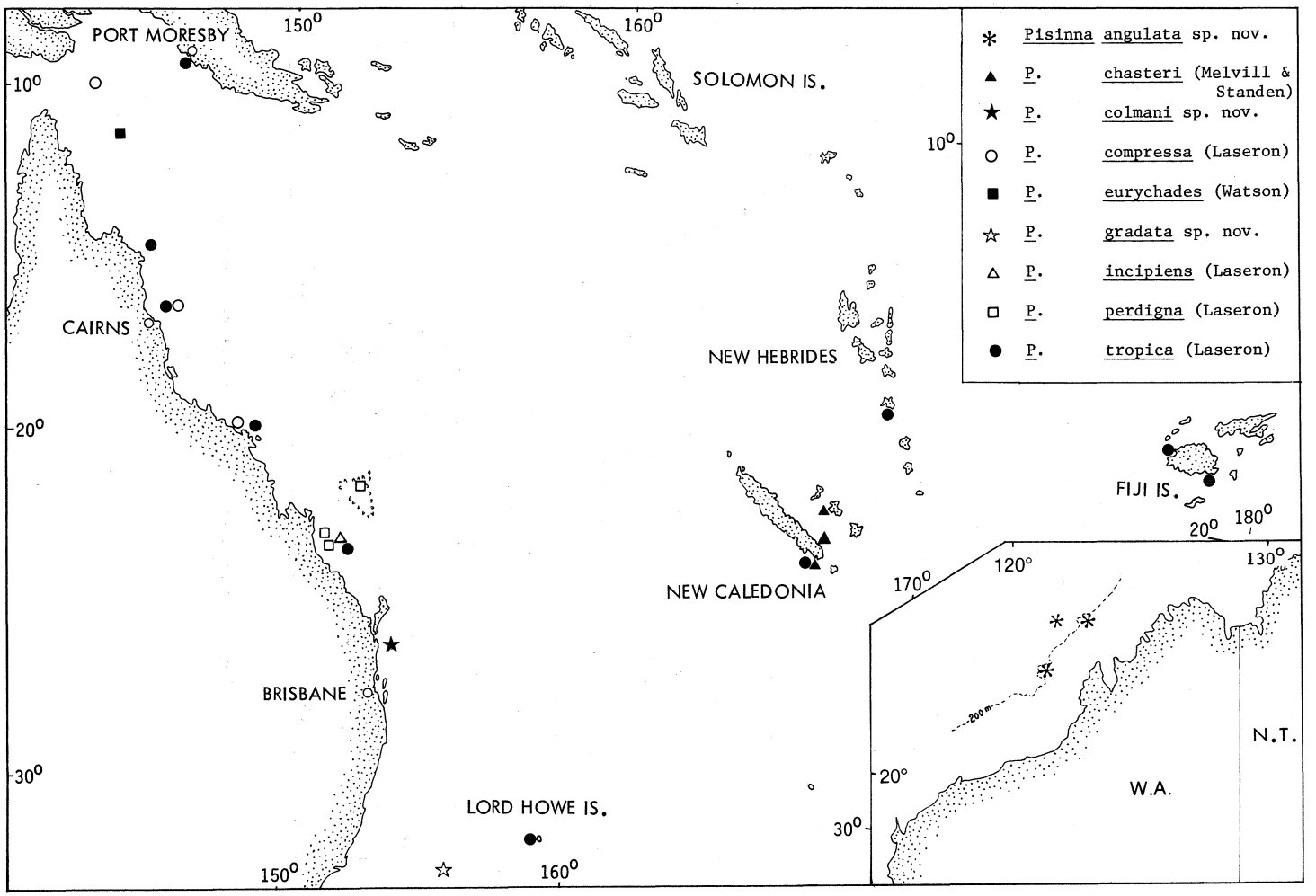


Figure 20. Distribution of the Recent species of *Pisinna*.

AUSTRALIAN MUSEUM MEMOIRS AND RECORDS

Scope

The Australian Museum publishes in its Records and Memoirs the results of original research dealing with material in its collections or with subjects of interest to the Museum, including taxonomic and general zoology, palaeontology, anthropology, mineralogy, and related fields. Contributions of well above average length are published in the Memoirs.

Submission of manuscripts

Manuscripts should be sent to the Editor, Records and Memoirs of the Australian Museum. The original and one copy of the text must be submitted; the author should retain one copy. Original artwork should be retained by the author pending final acceptance of the paper for publication; two copies of the illustrations must be submitted with the text. Alternatively, good-quality photographic reproductions of the original artwork may be submitted. Papers will be reviewed by at least one referee before being considered for final acceptance. They must be in final form for publication so that changes at proof stage will be as few as possible.

The manuscript—including tables, headings, indices, legends to figures, and literature cited—must be clearly and neatly typewritten, double-spaced, on one side of bond or other good quality paper, and with 3 cm margins all round. Pages should be numbered consecutively. Tables and legends to illustrations should be on separate pages at the end of the manuscript. The entire manuscript should be securely fastened together.

Presentation

Papers should be arranged as follows:

(i) The title, which should be concise and specific. The higher classification of the group dealt with should be indicated in the title of zoological papers; in palaeontological papers the position of a local formation in the world scheme should be indicated.

(ii) The author's name and professional address.

(iii) A summary not exceeding either 3 per cent of the text or 200 words and intelligible to the reader without reference to the main text.

(iv) A list of contents may be included if the paper is very long.

(v) Introduction.

(vi) The main text of the paper.

(vii) Acknowledgements.

(viii) References (see below).

(ix) Index (in the case of very long papers).

The approximate position of tables and figures should be indicated in pencil at the left-hand margin.

Only the names of genera and species should be underlined. Unless indicated elsewhere in the text, or where nomenclature follows a generally accepted standard (which should be cited), the authority should be cited when any specific name is used for the first time.

In taxonomic papers the short form (taxon, author, date, page) should be used in synonymies and the full reference taken to the end of the paper. In synonymes a period and dash (.—) should separate the name of the taxon and the name of the author except in the case of the reference to the original description. Where new species are described the location of the type material must be indicated and Article 73 and associated recommendations of the International Code of Zoological Nomenclature should be followed. Dichotomous keys with contrasting parts of couplets adjacent to each other are recommended. In these only the first part of the couplet should be numbered and the beginning of the second indicated with a dash at the left-hand margin. Keys must not use serially indented couplets. Papers not following this form of presentation will be returned to the authors.

Tables should be typed on separate sheets and numbered in arabic numerals. Headings should be self-explanatory. Material in the text should not duplicate that in the tables. Duplications of information in tables and graphs should generally be avoided.

Tables should have the very minimum number of horizontal and vertical lines. Very large or complex tables should be submitted in a form suitable for direct preparation of line blocks; such tables should not exceed 14 cm × 20 cm and numbers and letters should be as large as practicable.

Illustrations

Line drawings, maps, graphs, and photographs are regarded as "figures" and are to be numbered consecutively; these numbers will be used in the final printed copy.

Figures should be drawn in black indian ink on bristol board, good quality paper, tracing linen, or faintly blue-lined graph paper. Related diagrams should be grouped to form a single figure suitable for eventual reduction to a size not exceeding 127 mm × 190 mm. Parts of figures should be labelled a, b, c, etc. (e.g., fig. 1a, 1b). The name(s) of the author(s), the number of the figure and the intended reduction should be clearly marked on the back of the illustration and the orientation of all illustrations indicated.

Photographs should be best-quality, glossy, with moderately high contrast, and mounted on white board.

All legends to illustrations should be submitted on pages separate from the text and not attached to the artwork.

References

These should be arranged alphabetically and chronologically. Titles of journals should be abbreviated according to the World List of Scientific Periodicals (4th ed.). Titles of all references must be given in full. It will be assumed that the list of references has been checked for accuracy by the author. The following examples may be of assistance:

Gibb, J. A., 1966. Tit predation and the abundance of *Ernarmonia conicolana* (Heyl.) on Weeting Heath, Norfolk, 1962–63. *J. Anim. Ecol.* 35: 43–53, 5 tables, 2 figs.

Mayr, E., E. G. Linsley, and R. L. Usinger, 1953. Methods and principles of systematic zoology. McGraw-Hill, New York. Pp. ix, 328, 14 tables, 45 figs.

Schöne, H., 1961. Complex behaviour. In T. H. Waterman (ed.), The physiology of Crustacea. Vol. 2: 465–520, 22 figs. Academic Press, New York.

Proofs

Only page-proofs are sent to authors for correction. Proofs should be returned with the least possible delay, and only essential corrections should be made, using standard proofreaders marks, indicated clearly. Authors are requested to pay particular attention to checking of numerical matter, mathematical symbols, lists of names, and references.

Free copies

Authors receive 50 copies free of charge. Additional copies may be ordered at the time proofs are returned.

Correspondence

All correspondence should be addressed to the Editor, Records and Memoirs, The Australian Museum, P.O. Box A285, Sydney South, N.S.W. 2000, Australia.

OFFSET ALPINE PRINTING PTY. LTD., DULWICH HILL, SYDNEY