J. Malac. Soc. Aust. 4 (4): 167-208 30 June 1980

A revision of the Australian species of *Notoacmea*, *Collisella* and *Patelloida* (Mollusca : Gastropoda : Acmaeidae)

By **W.F. Ponder,**
The Australian Museum,
Sydney
and
R.G. Creese,
School of Biological Sciences,
University of Sydney

ABSTRACT

The Australian species of *Notoacmea*, *Collisella* and *Patelloida* are revised on the basis of shell and radular characters. Six species are recognised in *Notoacmea*, two in *Collisella* and 12, together with two subspecies of an Indian Ocean species, in *Patelloida*. The majority of the species are found in temperate Australia, there being only 6 taxa recognised from tropical Australia. *Patelloida septiformis* Quoy & Gaimard, 1834 and *P. elongata* Quoy Gaimard, 1834 are both rejected from the Australian fauna.

INTRODUCTION

The Australian limpets of the family Acmaeidae have been reviewed by Oliver (1926) and Macpherson (1955), and the South Australian species by Cotton (1959).

Macpherson (1955) ignored a number of species and genera of the Acmaeidae but Oliver's (1926) revision is much more comprehensive.

Recent biological and ecological work on New South Wales limpets of the family Acmaeidae by one of us (R.G.C.) and independent observations by W.F.P. on Australian acmaeids and on type material have indicated that some of the conclusions reached by previous workers are unsatisfactory. No other Australian authors have had the opportunity to examine at first hand most of the type material, with the result that ignorance of the real identity of the types appears to have been the main factor which has given rise to misinterpretation.

The species of the genera *Notoacmea*, *Collisella* and *Patelloida* are revised herein. Another problematic genus, *Asteracmea* Oliver, 1926, a group possibly closely related to *Patelloida*, is not dealt with because of the lack of adequate material but is, nevertheless, greatly in need of revision. Oliver (1926) reviews the species of *Asteracmea* and separates the genus mainly on shell characters from *Patelloida*, the radula of the one species known being like that of *Patelloida*. The species of *Asteracmea*, if it is indeed a useful grouping, are small, often rather conical and usually have pink rays on the shell.

Two recent revisions by Christiaens (1975a, b) have appeared in a malacological society newsletter in which two new Australian subspecies were described and a new subgenus (of *Patelloida*) for an Australian species was proposed. The "publication" in which these names appeared barely meets the requirements of acceptability but nevertheless the two papers are a very useful compilation of information on the Acmaeidae, including as they do, a list of all named taxa. Several nomenclatural changes affecting Australian species are made by Christiaens, with many of which we agree. These are listed in the synonymies for the species included in this revision.

MATERIALS AND METHODS

The taxonomic decisions contained in this paper have been based on an examination of type specimens and other material mostly housed in The Australian Museum, Sydney. Field observations by one of us (R.G.C.) on New South Wales limpets encompass a much greater range of data than presented here, and will be the subject of additional publications.

Radulae were removed from specimens, cleaned in either potassium hydroxide or sodium hypochlorite, rinsed several times in distilled water, and mounted on aluminium stubs using double-sided sticking tape. Usually the radulae of at least two specimens from each lot were examined to check for variability. In most species the radulae of several lots covering the geographic range of the species were examined. When mounted, the radulae were coated with gold and examined under a Scanning Electron Microscope (S.E.M.). Photographs of both top and side views of the teeth were taken from a central region of the radula. All of these mounts, together with the specimens from which the radulae were removed, are located in The Australian Museum. Stub numbers cited refer to The Australian Museum S.E.M. stub collection and registration numbers cited in the figure captions refer, unless otherwise differentiated, to Australian Museum material.

Dimensions given include those for large specimens. This does not indicate the largest specimen seen, but is given as an indication of the upper end of the size range encountered in the species.

ABBREVIATIONS

ANSP Academy of Natural Sciences of Philadelphia, Philadelphia.
AMS The Australian Museum, Sydney.
BMNH British Museum (Natural History), London.
NHMB Museum für Naturkunde, Humboldt Universität, E. Berlin.
NHMP Muséum National d'Histoire Naturelle, Paris.
NMV National Museum of Victoria, Melbourne.
SAM South Australian Museum, Adelaide.
TM Tasmanian Museum, Hobart.

TAXONOMY

Family Acmaeidae Carpenter, 1857 (placed on the Official List of Family Names in Zoology, Opinion 344, ICZN, 1955).

Synonyms: Lottiidae Gray, 1840, *nomen oblitum*, Habe, 1944.
Tecturidae Gray, 1847, *nomen oblitum.*
Patelloididae Oliver, 1926.

Acmaeids can be distinguished from other limpet-like gastropods, by their simple, bilaterally symmetrical shell lacking any accessory apertures or slits, by the presence of a single bipectinate gill in a small anterior mantle cavity and by the radula which lacks any rachidian (central) teeth. Each half row of teeth has only 2* lateral teeth (one bicuspid, the other unicuspid, or with 3 separate teeth), and 0-2 marginal teeth. (See Fig. 1).

Keen (1960) reviewed the genera of the Acmaeidae and reduced all of the Australasian

genera to subgenera of *Acmaea* Eschscholtz, 1833. Oliver (1926) erected a useful classification based on the shell, gills and radula and proposed several new genera and subgenera. Oliver's classification is, we believe, a more meaningful interpretation of the genera of the Acmaeidae than Keen's and this view is supported by the findings of MacClintock (1967) in his study of the shell structure of the Patellacea. He showed that *A. mitra* Eschscholtz, the type species of *Acmaea*, is very distinct from other members of the Acmaeidae, although it resembles them in its radular and gill structure. He recommends restricting the usage of *Acmaea* to this species alone. McLean (1969) and McLean *in* Keen (1971), use several genera for the North American west coast Acmaeidae and other recent generic reviews (Moskalev, 1966, Golikov & Kussakin, 1972 and Christiaens, 1975a, 1975b) advocate the use of several genera.

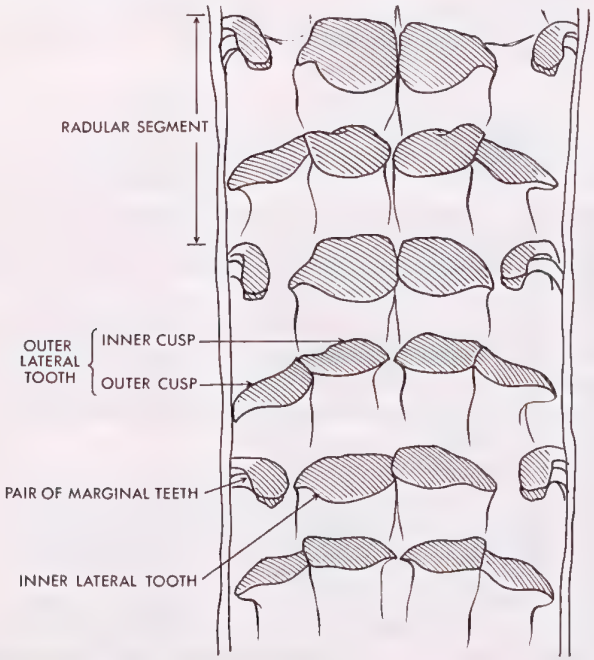

Figure 1. Generalized radula of *Patelloida* sp.

Christiaens (1975a, 1975b) reduces *Notoacmea* Iredale to a subgenus of *Collisella* Dall and also includes as subgenera (of *Collisella*) *Naccula* Iredale, 1924 and *Simplacmaea* Christiaens, 1975 (a). Although we regard *Notoacmea* as a full genus, we concede that the shells of *Collisella* species and *Notoacmea* species are very similar. The same is true, however, for shells of species of *Patelloida* Quoy & Gaimard which Christiaens (1975b) maintains as a distinct genus. The loss of one of the two pairs of marginal teeth seen in *Patelloida* gives rise to the *Collisella* condition and the loss of both pairs of marginal teeth to the condition seen in *Notoacmea*. This reduction phenomenon probably occurred more than once during the evolution of the group. Because of the greatly different shell characters between *Naccula/Simplacmaea* and *Notoacmea*, these groups are not considered here to be congeneric and the similarity in their radular formulae is interpreted as resulting from convergence.

The family names listed in the synonymy above have all been employed by recent

* *Foot note:* Several authors regard the acmaeid lateral teeth as consisting of three teeth in all genera. This is probably true but the two outer teeth are more-or-less fused and are more conveniently regarded as a single tooth in the genera under consideration.

workers. Two are interpreted as *nomina oblita* but this matter probably requires a ruling by the ICZN to achieve stability.

The diagnoses presented for each species attempt to cover the normal range of variation in both shell and radular features but do not allow for the occasional "freak" specimen.

Key to Genera

Radula with 2 marginal teeth
(2-2-0-2-2) ..... *Patelloida*

Radula with 1 marginal tooth
(1-2-0-2-1) ..... *Collisella*

Radula with no marginal teeth
(0-2-0-2-0) ..... *Notoacmea*

Genus **Notoacmea** Iredale, 1915.

Type species (original designation): *Patelloida pileopsis* Quoy & Gaimard, 1834.

Synonyms. *Parvacmea* Iredale, 1915. Type species (original designation): *Acmaea daedala* Suter, 1907. *Conacmea* Oliver, 1926. Type species (original designation): *Acmaea parviconoidea* Suter, 1907. ?*Subacmea* Oliver, 1926. Type species (original designation): *Notoacmea (Subacmea) scopulina* Oliver, 1926.

The Australian species in this genus have previously been reviewed by Oliver (1926) and Macpherson (1955). Oliver (1926) used 4 subgenera (other than the typical subgenus) for the Australasian species of *Notoacmea*. We can see no justification in using subgenera for any of the Australian species as the subgeneric characters utilized by Oliver appear to us to be of specific importance only.

MacClintock (1967) examined the shell structure of *N. pileopsis*, *N. parviconoidea* (Suter) (the type species of *Conacmea* Oliver), *N. fragilis* (Sowerby) (the New Zealand type species of *Atalacmea* Iredale), *N. "subundulata* Angas" (possibly *N. alta* Oliver), and *N. "septiformis* Quoy & Gaimard" (= *N. flammea* (Quoy & Gaimard) herein). These species fall into two closely related groups (MacClintock's groups 4 and 5). *N. scopulina* Oliver, the type species of *Subacmea* Oliver, was placed by MacClintock in his group 1. This may be a result of a misidentification or, possibly, *Subacmea* represents a group separately derived from *Patelloida* (several species of which are represented in MacClintock's group 1) by the loss of the marginal teeth of the radula. The type species of *Radiacmea*, *Acmaea cingulata* Hutton (= *inconspicua* Gray) is also placed in group 1 by MacClintock, suggesting a possible close relationship between *Subacmea* and *Radiacmea* as both groups lack marginal teeth.

Notoacmea alta Oliver, 1926. Pl. 1, figs 1-5, pl. 9, figs 1-4.

Acmaea conoidea. — (?) Angas, 1865: 186; (?) Tate, 1897: 43; Pritchard & Gatliff, 1903: 193 (in part, *non* Quoy & Gaimard, 1834).
Notoacmea (Conacmea) corrosa Oliver, 1926: 578, pl. 99, fig. 5, text fig. G.
Notoacmea (Conacmea) alta Oliver, 1926: 579, pl. 99, fig. 6.
Notoacmea alta. — Macpherson, 1955: 255, fig. in text, pl. 19, figs 3, 4 (radula); Macpherson & Gabriel, 1962: 54, fig. 73.
Collisella (Parvacmea) corrosa. — Christiaens, 1975b: 105.
Collisella (Parvacmea) alta. — Christiaens, 1975b: 105.

Diagnosis. Shell (pl. 1, figs 1-5). Thin, depressed conical to acutely conical, with apex anterior to almost central. Anterior slope straight or slightly convex. Surface of shell almost smooth, with extremely close and fine radial and concentric striae. Colour is generally dark grey/brown to black, sometimes with a variable pattern of white radial markings. Interior of shell is either completely black, or has a dark band around the margin.

Radula (pl. 9, figs 1-4). Inner cusp of outer lateral teeth of approximately same length as those of inner lateral teeth, both rather long and narrowly triangular. Outer cusps of outer lateral teeth slightly less than half size of inner cusps, triangular in shape. Inner lateral teeth have long bases; outer lateral teeth short ones. Radular segment fractionally longer than broad.

Dimensions

	Height	Length	Width
Holotype of *N. alta*	4mm	6mm	5mm
Holotype of *N. corrosa*	5.0	8.5	6.5

Types. N. alta. Holotype, AMS, C105731, South Australia (pl. 1, figs 1-3).
N. corrosa. Holotype, AMS, C.105730. Blackmans Bay, Derwent Estuary, Tasmania (pl. 1, figs 4, 5).

Distribution. Southern Australia from Spencer Gulf, South Australia to Nadgee, southern New South Wales and the east coast of Tasmania. Found in fairly protected areas of the mid-littoral, often on the shells of bivalves (especially *Brachidontes rostratus)* or gastropods.

Remarks. Several of the earlier records of this species were misidentified as *Acmaea conoidea* (Q. & G.). Oliver (1926) realised that the species found in southern Australia and Victoria were not conspecific with *conoidea* and he renamed it *N. alta*, whereas the species referred to as *conoidea* in Tasmania he called *N. corrosa*. Macpherson (1955) recorded *N. alta* from Bass Strait, Victoria and from eastern South Australia but did not mention any Tasmanian records, nor did she refer to *N. corrosa* Oliver or *"Acmaea" conoidea* (Q. & G.).

An examination of the type of *conoidea* from King George Sound showed it to be a distinct species from *alta* (see below) but specimens of *N. corrosa* from Tasmania were identical to *N. alta*. The type of *N. alta* is a shell in good condition but is localised simply as "South Australia" and was the only specimen seen by Oliver. This specimen presumably contained a dried animal because Oliver described the radula. The type of *N. corrosa* is an eroded shell and Oliver provided a figure of the radula. The description of *N. corrosa*, precedes that of *N. alta* but the name *alta* has become established in the literature so, as the first revisers, we select the name *Notoacmea alta* Oliver for this species.

Cotton (1959) places *N. alta* in the synonymy of *Conacmea subundulata* (Angas) because of an apparent misinterpretation of the type material of *subundulata* by Verco. Verco's (1906) records of this species include two sublittoral localities which are an unlikely habitat for this species and appear to refer to a form of *Collisella mixta* (Reeve) or *Notoacmea flammea*, of which *Acmaea subundulata* Angas is a synonym. Material in the AMS presented by Verco with the name *subundulata* from 'St. Vincent Gulf' consists of 2 specimens of a high-spired form of *N. flammea* and 1 specimen of *Collisella* cf. *mixta*. Another lot (ex Verco) in the NMV from Denial Bay, South Australia, is *N. alta*. Cotton's (1959) figure of the radula of *"subundulata"* is a copy of Torr's (1914) figure.

Several temperate Australian species attain a tall, conical shape and are frequently confused. These include *Collisella mixta, Notoacmea flammea, N. corrodenda* (May), *N. conoidea, Patelloida mufria* (Hedley) and *P. insignis* (Menke). It is, unfortunately, often extremely difficult to separate these species on shell characters alone, especially when dealing with eroded specimens.

Notoacmea (?) **conoidea** (Quoy & Gaimard, 1834). Pl. 1, figs 6-11.
Patelloida conoidea Quoy & Gaimard, 1834: 355, pl. 71, figs 5-7.
Chiazacmea flammea conoidea. — Oliver, 1926: 560 (in part).

Diagnosis. Shell (pl. 1, figs 6-11). Of moderate size for family, usually tall-spired (often nearly as high as long) with narrow dark-brown radial lines on a greyish-brown to whitish background. Internal margin with brown spots corresponding to external colour lines.

Radula. Not known from material definitely attributable to this species but small specimens tentatively identified as *N. conoidea* have a radula similar to that of *N. alta.*

Dimensions

	Height	Length	Width
Holotype	11.40mm	13.74mm	11.32mm
Figured specimen (King George Sound)	9.50	13.16	10.05

Holotype. The specimen figured by Quoy & Gaimard, NHMP (pl. 1, figs. 6-8); King George Sound, south Western Australia. Another shell together with the holotype is a specimen of *Collisella onychitis* (Menke), but as Quoy & Gaimard state that they had only one example of their *P. conoidea* this cannot be regarded as part of the type series.

Distribution. Rottnest Island (?) to King George Sound, south Western Australia. Shallow sublittoral (?) in sheltered areas.

Remarks. The holotype of *P. conoidea* is a large, eroded shell lacking a distinct external colour pattern (due to erosion of the surface) but has, on the margin of the shell, numerous brown spots suggesting that the younger shell may have had brown radial bands externally. A few specimens (shells only) from south Western Australia (including King George Sound) agree rather well with this specimen. This species differs from *Patelloida insignis* (Menke), with which it is sympatric, in that specimens are very tall spired, with equally prominent, narrow radial colour bands and finer external radial striae.

Oliver (1926) interpreted *N. conoidea* as a Western Australian subspecies of *flammea* auct. (= *Patelloida insignis* (Menke)) but the radulae of two small specimens, possibly referable to *conoidea*, were examined and found to be similar to that of *Notoacmaea alta.* Unfortunately no topotypic or adult material is available for the examination of radulae, so there does remain a possibility that the lectotype of *conoidea* may be a high-spired variant of *P. insignis* (Menke) and that the other material examined (consisting of specimens smaller than the lectotype) may be a south Western Australian form of *N. alta.*

A few high-spired shells from Rottnest Island, Western Australia, are similar to this species but show a weakly defined "Maltese Cross' marked on the shell and so may be a high-spired form of *Patelloida insignis.*

Notoacmea corrodenda (May, 1920). Pl. 1, figs 12-14, pl. 11, fig. 3.
Patelloida corrodenda May, 1920: 66, pl. 17, fig. 24.
Notoacmea (Subacmea) corrodenda. — Oliver, 1926: 581.
Collisella (Parvacmea) corrodenda. — Christiaens, 1975b: 105.

Diagnosis. Shell (Pl. 1, figs 12-14). Small, rather solid, ovate and usually flattened. Sculptured with several low, narrow ribs. Apex at about anterior 1/3. Posterior slope slightly convex, anterior slope slightly concave. Ribs white or cream in colour, interspaces dark-brown. Interior of shell shows external pattern around margin, remainder dirty white to grey or pale-brown, spatula usually with dark-brown middle area and white border.

Radula (pl. 11, fig. 3). Inner lateral teeth broad, cusps long and pointed with medium-sized bases. Inner cusps of outer lateral teeth broad and approximately ¾ of the length of those of inner lateral teeth; outer cusps small and triangular in shape. Outer lateral teeth have short bases. Radular segment much longer than broad.

Dimensions

	Height	Length	Width
From original description	5mm	14mm	11mm
Lectotype	4.70	15.20	11.65
Paralectotype	4.9	14.3	12.0
Figured paralectotype	4.54	13.57	10.7
Average specimen (South Tasmania)	4.3	13.5	10.4
Large specimen (Frederick Henry Bay, Tasmania, ex May Colln, SAM)	7.52	18.85	14.86

Types. Lectotype (here chosen) and paralectotype, TM, E334/7675, C1709, 2 paralectotypes, AMS, C45952 (pl. 1, figs 12-14), 19 possible paralectotypes, May Collection (No. 363) SAM; western shore of Frederick Henry Bay, Tasmania.

Distribution. Tasmania, Bass trait and western Victoria, on rocks in lower littoral.

Remarks. Macpherson (1955) omitted this species from her revision. The radula indicates that it belongs to the genus *Notoacmea* as shown by Oliver (1926). It is distinguished from all other species of the genus by the prominent, white or pale radial ribs on the dark shell. This species has not previously been recorded from Victoria.

Notoacmea flammea (Quoy & Gaimard, 1834). Pl. 2, figs 1-18, pl. 9, figs 5-10.
Patelloida flammea Quoy & Gaimard, 1834: 354, pl. 71, figs 15-24.
Acmaea scabrilirata Angas, 1865: 154.
?Acmaea subundulata Angas, 1865: 155; Oliver, 1926: 573.
?Patella sp. Maplestone, 1872: 51, pl. 27, fig. 21 (radula).
Acmaea subundulata. — Verco, 1906: 215 (in part); Torr, 1914: 366, pl. 20, fig. 10 (radula).
Acmaea septiformis. — Verco, 1906: 215; Torr, 1914: 366, pl. 20, fig. 9 (radula) (*non* Quoy & Gaimard, 1834).
Notoacmea flammea diminuta Iredale, 1924: 235.
Notoacmea (Notoacmea) septiformis. — Oliver, 1926: 572 (*non* Quoy & Gaimard, 1834).
Notoacmea (Notoacmea) septiformis scabrilirata. — Oliver, 1926: 573.
Notoacmea septiformis scabrilirata. — Macpherson, 1955: 254, fig. in text, pl. 19, figs 1, 2 (radula).
Notoacmea septiformis. — Cotton, 1959: 317, fig. 213.
Notoacmea scabrilirata. — Cotton, 1959: 318, fig. 215; Macpherson and Gabriel, 1962: 54, fig. 72.
Conacmea subundulata. — Cotton, 1959; 319, fig. 215 (in part).

Diagnosis. Shell (pl. 2, figs 1-18). Small, thin and flattened to conical, with apex markedly anterior to slightly anterior. Anterior slope slightly concave, posterior slope gently convex. Surface usually sculptured with rather widely-spaced, minutely-granular, fine radial striae. The colour is cream to black overlain with a variable, reticulate or radial pattern of brown or black. Exterior pattern usually shows through to interior, especially at the margin. Interior usually pale, with white to bluish inside outer rim in adult.

Radula (pl. 9, figs 5-10). Inner lateral teeth and inner cusps of outer lateral teeth both very long, narrow and pointed. Outer cusp of outer lateral teeth very small and triangular. Radular segment longer than broad.

Dimensions

	Height	Length	Width
Lectotype of *P. flammea*	4.00mm	11.25mm	9.60mm
Paralectotypes of *P. flammea*	4.21	11.16	9.39
	2.30	9.20	7.76
	3.12	10.24	8.26
	3.37	9.06	7.00
	3.5 (approx)	10.90(approx)	8.70
Holotype of *A. subundulata*	5.70	14.75	11.70
Large specimen (Port Phillip Bay, Victoria)	5.00	16.96	14.28
Large specimen (Sydney)	4.26	13.85	11.00
Conical specimen (Oyster Cove, Tasmania)	5.95	9.70	8.71
Large specimen (Oyster Cove, Tasmania)	6.50	15.91	14.00

Types. P. flammea. Lectotype (here chosen) (pl. 2, figs 1-3) and 5 paralectotypes (pl. 2, figs 4-12), NHMP. Hobart, Tasmania. *A. scabrilirata.* Not found; "Port Lincoln, Hobsons Bay". Two lots in the BMNH are from New South Wales ex Angas (BMNH, 70.10.26.157; 1900,2.8.19). Neither of these lots are types. *A. subundulata.* Holotype (pl. 2, figs 13-15), BMNH, 71.7.8.9. Port Lincoln, South Australia. *N. flammea diminuta.* Not found; Sydney.

One lot of 17 specimens in the AMS (C.49539) has a note in Iredale's hand giving his name and the word "topotypes". These are from Bottle and Glass Rocks, Sydney, New South Wales and were collected by Iredale in August, 1923 (pl. 2, figs 16-18).

Distribution. Southern Australia from Perth in Western Australia to Sydney in New South Wales and throughout Tasmania. Found in protected areas of the lower littoral, often on the sides of, or underneath, boulders.

Remarks. The 6 specimens here regarded as syntypes of *Patelloida flammea* Quoy & Gaimard prove to be conspecific with the species usually known as *A. scabrilirata*, the shells agreeing in every important character. Specimens in the syntype series agree rather well with Quoy & Gaimard's figures 17-20, but it has not been possible to match precisely the figures with any specimens in the syntype series. The similarities with figures 17-20 are, however, very close and the specimens could include those illustrated. In order to stabilise the name a lectotype has been chosen above from the syntype series.

Iredale (1924) came closest to correctly interpreting *flammea* by regarding it as the "eastern representative of Quoy's own *septiformis*". His subspecies *flammea diminuta*, which is also assumed to be a synonym of *A. scabrilirata*, also indicates that he interpreted Quoy and Gaimard's *flammea* as we have done. Most other Australian authors have, however, misidentified *flammea* as the species here referred to as *Patelloida insignis* (Menke). Hedley (1915) stated that *Patelloida flammea* "is a compound of two species, one of which occurred on the beach at Hobart, and the other at the Island of Guam". He advocates the use of the name *Patella mixta* Reeve for *flammea* auct. and restricts the use of *flammea* to the Guam species. Iredale (1924) and Oliver (1926) disagree with this conclusion, pointing out that Quoy & Gaimard selected the Tasmanian shell as the typical one. Angas described the beaded ribs on the shell of *A. scabrilirata* so that there is little doubt that his species is *flammea* in our sense.

Although usually associated with *N. scabrilirata*, *P. septiformis* Quoy & Gaimard, 1834 is, as shown below, apparently not an Australian species.

The type specimen of *A. subundulata* (pl. 2, figs 13-15) is a whitish, flat, rather thickened shell showing little external or internal colour. Other specimens from South Australia in the BMNH and some from Tasmania in the AMS are very similar and appear to be varieties of *N. flammea* with which they intergrade. Verco's (1906) and Cotton's (1959) interpretations of *subundulata* appear to refer to a compound of *Notoacmea alta*, *N. flammea* and *Collisella* cf *mixta* as indicated above.

High-spired specimens of *N. flammea* have been variously referred to *conoidea*, *alta* etc., but can be distinguished by the characteristic fine, rather widely-spaced, beaded riblets forming the exterior sculpture of *N. flammea*. High-spired shells tend to be more typical of specimens living in the open whereas the typical, flattened form generally lives beneath stones.

Adam & LeLoup (1938) recorded a species of *Patelloida* from New Guinea as *Acmaea flammea*. Their specimens have nothing to do with *N. flammea* and it is unclear as to which species of *Patelloida* their specimens should be assigned.

Notoacmea mayi (May, 1923). Plate 3, figs 1-3.
Acmaea cantharus. — T. Woods, 1877: 45; Iredale, 1915: 429 (*non* Reeve, 1855).
Patelloida mayi (Iredale MS) May, 1923: 100, pl. 22, fig. 33.
Notoacmea mayi. — Iredale, 1924: 235; Singleton, 1937: 390; Macpherson, 1955: 253, figs in text, pl. 18, figs 1, 2 (radula); Macpherson & Gabriel, 1962: 53, fig. 70, a.
Notoacmea (Notoacmea) mayi. — Oliver, 1926: 571.
Collisella (Notoacmea) mayi — Christiaens, 1975b: 103.

Diagnosis. Shell (pl. 3, figs 1-3). Rather thick and of low profile; apex at anterior margin, often extending beyond the margin; anterior slope steep, posterior slope convex; surface lacking radial sculpture. Usually uniform light brown to grey, but may be mottled with

darker greys or browns. Interior dark with spatula white to brown or black, with a band of grey-white inside the black or spotted (black and yellow) margin.

Radula. Inner lateral teeth long and pointed. Outer lateral teeth with inner cusps much larger and more rounded than outer cusps. Both teeth have short bases. Radular segment is considerably longer than broad (after Macpherson, 1955).

Dimensions

	Height	Length	Width
Lectotype	4.55mm	23.10mm	18.75mm
Paralectotypes	4.00	17.17	13.36
	5.50	18.54	14.21
	6.62	26.10	21.16
Large specimen (Port Arthur, Tasmania)	7.7	25.8	21.0

Type. Lectotype (here chosen) (pl. 3, figs 1-3), May Colln (no. 399A), SAM, D16191; with 7 + 5 paralectotypes (399, 399A) SAM, D16192, D16193: Frederick Henry Bay, Tasmania. Originally given as "south of Tasmania, rocks at half tide".

Distribution. Eastern South Australia, western Victoria and Tasmania. Found on rock vertical faces in the upper littoral.

Remarks. This species is one of the most distinctive limpets in Australia, the marginal or submarginal apex being very characteristic. It is closely related to *N. petterdi* with which it overlaps in both range and habitat, but can be distinguished by the position of the apex and the lack of radial sculpture.

The name *cantharus* Reeve was used for this species by early workers but Iredale (1915) considered Reeve's species to be conspecific with *Notoacmea pileopsis* (Quoy & Gaimard) from New Zealand. Christiaens (1975b : 103) has indicated that he believes *cantharus* and *mayi* to be conspecific but we do not concur with his conclusion. One of us (W.F.P.) has examined the types of *Patella cantharus* in the British Museum and agrees with Iredale's conclusion.

When May (1923) introduced Iredale's manuscript name for this species he simply stated in an appendix "From comparison with the type in the British Museum, our shell appears not to be *cantharus*. Iredale proposes to give it the name *mayi*". May refers to a figure and the caption to that figure states "apex at the margin". This descriptive statement together with the figure is sufficient to introduce the name. The phrase "our shell" is here interpreted as the shells that May had before him, although it could be argued that he may have been referring to the Tasmanian "shell" as contrasted with *cantharus* Reeve. Thirteen specimens in 2 lots in the May collection in the SAM bear the name *mayi* Iredale in May's handwriting and are here regarded as syntypes. One of these specimens is here designated as lectotype (pl. 3, figs 1-3). May's illustration is said to be half size which would give the figured shell a total length of 28.4mm. No specimens of *mayi* available to us reach this length.

Notoacmea petterdi (T. Woods, 1876). Pl. 3, figs 4-6, pl. 10, figs 1, 2.
Acmaea petterdi T. Woods, 1876: 155.
Notoacmea (Notoacmea) petterdi. — Oliver, 1926: 574.
Notoacmea petterdi. — Macpherson, 1955: 254, figs in text, pl. 18, figs 3, 4 (radula).
Collisella (Notoacmea) petterdi. — Christiaens, 1975b: 103. (See Macpherson (1955) for full synonymy).

Diagnosis. Shell (pl. 3, figs 4-6). Elliptical, generally flattened, apex anterior, anterior and posterior slopes slightly convex. Concentric growth rings apparent in southern specimens, but usually lacking in northern ones, sculptured with widely-spaced, rounded, smooth radial riblets. Light brown in colour with numerous darker brown radiating bands, although bands often indistinct due to erosion. Interior pale to dark-brown; margin often with lighter bands, usually a white zone inside margin.

Radula (pl. 10, figs 1-2). Inner laterals very long and pointed with long bases. Outer lateral teeth with short bases; inner cusps approximately ½ size of inner lateral teeth and less pointed; outer cusps approximately 2/3 size of inner cusps and rounded. Radular segment longer than broad.

Dimensions

	Height	Length	Width
Holotype (from original description)	7mm	22mm	20mm
Large specimen (Sydney)	7.8	21.0	17.6
Large specimen (south Tasmania)	7.5	23.0	20.0
Large specimen (Victoria, figured)	8.75	22.1	19.55

Type. Holotype, TM, E343/7684; north west coast of Tasmania.

Distribution. Eastern South Australia, Tasmania, Victoria, New South Wales, to Noosa Heads in south Queensland. Found on vertical rock faces in the upper littoral.

Remarks. Juveniles of this species are sometimes confused with darkly-coloured specimens of *N. flammea*. They can, however, be readily separated by their different internal coloration and exterior sculpture. *N. petterdi* is brown internally, whereas *N. flammea*, although variable in colour, is never brown. Externally *N. flammea* is sculptured with fine, widely-spaced, granular riblets whereas *N. petterdi* has coarser, smooth, even more widely-spaced ribs.

There are also differences in habitat. *N. petterdi* is found almost exclusively on vertical rock faces in the upper littoral, whereas *N. flammea* occurs lower on the shore on a wide variety of surfaces.

This species is similar to the New Zealand type species of *Notoacmea, N. pileopsis* (Quoy & Gaimard) but differs in having a radial pattern of pale bands instead of a series of disconnected, irregular, oval, pale spots. The radial sculpture is heavier in the Australian species, consisting of widely-spaced, rounded ribs whereas in *N. pileopsis* the radial ribs are sharp, rather weak and closer together.

Genus **Collisella** Dall, 1871.

Type species (original designation): *Acmaea cassis* Eschscholtz, 1833 = *A. pelta* Eschscholtz, 1833.

Christiaens (1975b) has suggested the use of this genus for several Australian species. He also includes several other genus-group taxa, including *Notoacmea*, as subgenera of *Collisella* as discussed above.

Collisella mixta (Reeve, 1855). Pl. 4, figs 7-15, pl. 11, figs 1, 2.
Patella mixta Reeve, 1855: pl. 39, fig. 129.
Acmaea flammea. — Verco, 1906: 212; Verco, 1907: 101; Pritchard & Gatliff, 1903: 196 (in part, *non* Quoy & Gaimard, 1834).
Chiazacmea flammea conoidea. — Oliver, 1926: 560 (in part, *non* Quoy & Gaimard, 1834).
Chiazacmea flammea mixta. — Oliver, 1926: 560 (in part).
Notoacmea granulosa Macpherson, 1955: 252, fig. in text, pl. 17, figs, 3, 4 (radula).
Chiazacmea conoidea. — Cotton, 1959: 304, fig. 202 (in part, *non* Quoy & Gaimard, 1834).
Chiazacmea mixta. — Cotton, 1959: 306, fig. 203 (in part).
Chiazacmea flammea. — Cotton, 1959: 304, fig. 201 (? in part, *non* Quoy & Gaimard, 1834).
Collisella (Collisella) granulosa. — Christiaens, 1975b: 100.
Collisella (Collisella) mixta. — Christiaens, 1975b: 101.

Diagnosis. Shell (pl. 4, figs 7-15). Rather solid, often tall, with apex at about anterior 1/3. Anterior slope straight; posterior slope convex. Surface with faint to strong irregular radial ribs (usually eroded), sometimes nearly smooth. Grey-brown to yellowish in colour with darker reticulate patterns or dark radial rays. A "Maltese Cross" pattern often evident. Interior with pale to dark-brown blotches on white, margin lined with dark brown.

Radula (pl. 11, figs 1, 2). All lateral teeth short and stout. Inner cusp of outer lateral teeth nearly as long as inner lateral teeth; rounded outer cusps about 2/3 length of inner lateral teeth and wedge-shaped. Marginal teeth very short and curved. Inner lateral teeth with long bases, outer lateral teeth with short bases. Radular segment longer than broad.

Dimensions

	Height	Length	Width
Lectotype of *P. mixta*	6.1mm	16.6mm	12.7mm
Paralectotype of *P. mixta*	6.67	17.50	14.04
Holotype of *N. granulosa*	7.64	14.46	10.20
Large specimen (Robe, South Australia)	7.9	21.3	10.9
Small, tall specimen (Port Fairy, Victoria)	6.1	10.0	7.1

Types. P. mixta. Lectotype (pl. 4, figs 7-9), BMNH (197825) and paralectotype (pl. 4, figs 10-12) (197826); Port Phillip Bay, Victoria, coll. H. Benson, ex Cuming colln. *N. granulosa.* Holotype (pl. 4, figs 13-15), N.M.V. (F. 16131), paratypes (F. 5834); locality not given in original description, Warrnambool, Victoria on label.

Distribution. Southern Australia from Robe in South Australia to Lakes Entrance in Victoria, and Tasmania (uncommon). Lives in the mid to upper littoral of exposed open platforms.

Remarks. Reeve's 2 syntypes include his figured specimen which is here chosen as the lectotype. Macpherson (1955), like most previous authors, regarded *Patella mixta* as a synonym of *Chiazacmea flammea* auct. (= *Patelloida insignis* (Menke) herein). Reeve's types are the species named *Notoacmea granulosa* by Macpherson (1955), although they are more weakly sculptured and the shells less elevated than the type specimen of *granulosa.* The paralectotype of *P. mixta* bears a well developed "Maltese Cross" but the convex postero-dorsal margin, the remnants of a tessellate colour pattern and the weak, granulose sculpture show it also to be the species previously called *granulosa* rather than the superficially similar *P. insignis.*

Cotton's (1959) interpretation of *Chiazacmea mixta* is apparently a compound of *P. insignis* (Menke) and *C. mixta.*

Macpherson gives the height of the holotype of *N. granulosa* as 13mm but it is actually much less than this (7.64mm). A few specimens do, however, develop tall shells and closely resemble *Notoacmea alta* in outline. The flecked, irregular colour pattern of white, yellow and dark brown, the streaks of brown on the spatula and the presence of weak, simple ribbing externally are usually useful recognition characters of such specimens of *C. mixta.* The closely related *C. onychitis* does not seem to develop these high-spired forms.

A few specimens from South Australia (Streaky Bay and Coffin Bay) have almost smooth shells and a moderately elevated profile but the apex is anteriorly placed and the long posterior "slope" rather conspicuously convex. The colour pattern is sometimes tesselate and the specimens resemble, in general appearance, *Notoacmea flammea,* although they differ in sculpture and in the markedly convex posterior slope. Their radulae are the same as those of *C. mixta* and *C. onychitis* and because the shells of these specimens are closest to *C. mixta* they are tentatively included with that species.

Collisella onychitis (Menke, 1843). Pl. 4, figs 1-6, pl. 10, figs 5-7.
Patella onychitis Menke, 1843: 34; Hedley, 1923 : 309.
Acmaea (Notoacmaea) (sic!) *achates.* — Thiele, 1930: 564 (? *non* Reeve, 1855, pl. 38, fig. 123a, b).
Notoacmea onychitis. — Macpherson, 1955: 251, figs in text, pl. 17, figs 1, 2 (radula).
Collisella (Collisella) onychitis. — Christiaens, 1975b: 101.

Diagnosis. Shell (pl. 4, figs 1-6). Ovate, thick, sculptured with approximately twenty weak to strong, rounded, radiating ribs, which are closer together at the anterior end. Margin thin and crenulated. Shell often eroded. Ribs cream in colour, often with elongated,

brown markings. Interspaces between ribs dark brown, often flecked with white. Interior procellaneous and usually whitish; margin showing exterior pattern.

Radula (pl. 10, figs 5-7). As in *C. mixta*.

Dimensions

	Height	Length	Width
Dimensions given in original description (converted to mm using 1 linie = 2.18mm)	6.5mm	24.0mm	20.5mm
Large specimen (Albany)	9.7	22.4	19.6

Type. P. onychitis. Type lost; Western coast (of Australia).

Distribution. Western Australia southwards from Quobba, to Ceduna in western South Australia. On rocks in the lower littoral.

Remarks. This species is related to *C. mixta* which is very common in Victoria but rare in Tasmania and most of South Australia whereas *C. onychitis* is abundant in south Western Australia. Thus there is an apparent separation in the distribution of the two species. The radulae of *C. onychitis* and *C. mixta* are almost identical but they are generally very easily separated on shell characters. *C. onychitis* is a variable species in shape, colour and sculpture of the shell. Two sculptural forms are figured (pl. 4, figs 1-6).

Menke's name and rather brief description almost certainly refers to a specimen of the species described above with which it was first associated by Macpherson (1955). The loss however of most of Menke's type material, including the type of *P. onychitis*, makes this opinion impossible to confirm.

Genus **Patelloida** Quoy & Gaimard, 1834.

Type species (subsequent designation, Gray, 1847): *P. rugosa* Quoy & Gaimard, 1834.

Synonyms: Collisellina Dall, 1871. Type species (original designation): *Patella saccharina* Linné. 1758. *Chiazacmea* Oliver, 1926. Type species (original designation): *Patelloida flammea* auct. = *Acmaea crucis* T. Woods, 1876.

Remarks. Oliver (1926) recognised two subgenera of *Patelloida*, *Patelloida* ss. and *Collisellina* Dall, 1871. These were separated on rather minor shell characters and are not upheld by Moskalev (1966). *Chiazacmea* Oliver, which was given full generic rank by Oliver (1926) and Macpherson (1955), is also reduced to a synonym of *Patelloida* by Moskalev (1966). We can find no good reasons why any of these names should be re-employed.

Unfortunately none of the species previously placed in *Chiazacmea* was examined by MacClintock (1967) so that their shell structure is not known. Moskalev (1966) regards *Chiazacmea* as a synonym of *Patelloida* on the basis of the similarity of the radular features. The Australian species included in *Chiazacmea* by Oliver (1926) and Macpherson (1955) form a group somewhat distinct from "typical" *Patelloida* species in shell characters, as they tend to be rather small with weak or obsolete ribbing. *Chiazacmea heteromorpha* Oliver approaches more typical species of *Patelloida* in size and sculpture, having moderate ribbing, a thick shell and, occasionally, a spotted spatula as in species formerly placed in *Collisellina*. *Acmaea mufria* Hedley, although usually rather small, often has distinct ribbing but has been placed in *Chiazacmea*, being closely related to the type species. Because there is no clear-cut distinction in shell features and because the radular characters of species included in *Chiazacmea* are identical to those in *Patelloida*, *Chiazacmea* is regarded as a synonym of *Patelloida*.

Oliver designated as the type species of his genus *Chiazacmea* "*Patelloida flammea* Q & G. (Hobart) (as herein defined)". There is no doubt that Oliver intended as the type species the species here shown to be *Patelloida insignis* (Menke). The type specimen(s) of *insignis* were taken in Western Australia and Oliver regarded Tasmanian material as typical of his

flammea. Consequently the earliest name for the Tasmanian form of *P. insignis* is taken as the type of the genus but a submission will have to be made to the ICZN to formalise this matter.

Patelloida alticostata (Angas, 1865). Pl. 5, figs 1-6.
Patella alticostata Angas, 1865: 56.
Patella costata. — auct. (*non* Sowerby, 1839).
Patelloida alticostata antelia Iredale, 1924: 234.
Patelloida alticostata complanata Iredale, 1924: 234.
Patelloida alticostata. — Macpherson, 1955: 240, pl. 11, figs 1, 2 (radula); Christiaens, 1975b: 94.

(See Oliver (1926 : 551) and Macpherson (1955 : 240) for full synonymy).

Diagnosis. Shell (pl. 5, figs 1-6). Large, conical, thick and heavy. Apex slightly anterior and usually eroded. Margin thin and scalloped. Surface sculptured with approximately 18 strong, rounded, radiating ribs, which are often closer together at the anterior end. White or grey in colour with darker ribs; interspaces between ribs marked with characteristic fine, black cross lines. Interior porcellaneous and mostly white; margin black, or with black and white spots; remainder of interior white, often with black blotches on the spatula.

Radula. Inner lateral teeth with long, broad cusps and long bases. Outer lateral teeth with very broad and rounded inner cusps; outer cusps approximately ¼ size of inner cusps and more pointed. Marginal teeth large and spoon-shaped. Radular segment square.

Dimensions

	Height	Length	Width
Holotype	11.9mm	36.0mm	29.6mm
Large specimen (Albany, Western Australia)	19.1	52.8	48.0

Types. P. alticostata. Holotype, BMNH, 1870.10.26.163; Port Lincoln, South Australia. *P. alticostata antelia*. Not found. Peronian Province (localities mentioned are Sydney Harbour and Twofold Bay, New South Wales; Lakes Entrance and Melbourne Heads, Victoria). *P. alticostata complanata*. Not found. Sydney, New South Wales, below low water.

Distribution. Occurs from Geraldton in Western Australia, around the southern part of Australia (including Tasmania) to the mid-north coast of New South Wales. Lives on exposed rocks in the lower littoral and shallow sublittoral.

Remarks. Macpherson (1955) discusses the variation in this species which Oliver (1926) treats as two subspecies. This is one of the commonest of the temperate Australian limpets and it exhibits considerable variation, particularly in the strength of the ribbing. Some shells are virtually smooth; others strongly ribbed (cf. pl. 5, figs 2 and 5) but every gradation occurs between these extremes.

The name *costata* Sowerby, 1829 has been used by various authors for *P. alticostata*, most recently by Dance (1974 : 36). Christiaens (1975b : 94) also indicates that they are the same. Tomlin (1924 : 98) has discussed the matter at length and concluded, without doubt, that the type of *Lottia* (?) *costata* Sowerby was *Patella longicosta* Lamarck from South Africa. The holotype (pl. 8, figs 13-15), in the BMNH (1912.2.22.5), is certainly very similar to *P. longicosta* but differs from all of the material available to us of that species in having several small, dark, blotches on the spatula. It does not exactly match any other species in *Patella (Patellanax)*, where it appears to belong, and so we somewhat tentatively concur with Tomlin's opinion.

Patelloida bellatula (Iredale, 1929). Pl. 5, figs 7-9, pl. 11. fig. 4.
Collisellina bellatula Iredale, 1929: 275, pl. 31, fig. 13.

Diagnosis. Shell (pl. 5, figs 7-9). Small, thick, low, apex slightly anterior. Sculpture of irregular, prominent, rounded radial ribs over which run fine radial riblets; interspaces between riblets dark-brown (appear as narrow, brown, radial lines). Remainder of shell white on both exterior and interior surfaces except spatula which is often blotched with pale brown.

Radula (pl. 11, fig. 4). Inner lateral teeth with large, broad cusps. Outer lateral teeth large, with only slightly rounded cusps; outer cusps of approximately same size as inner ones. Both lateral teeth with short bases. Marginal teeth long with very broad, spoon-shaped cusps. Radular segment much broader than long.

Dimensions

	Height	Length	Width
Large paratypes	6.46mm	16.10mm	11.21mm
	4.30	15.36	12.06

Types. Holotype not located. Many paratypes (pl. 5, figs 7-9), AMS, C.53558; Michaelmas Cay, off Cairns, Queensland.

Distribution. Tropical Queensland, on the Barrier Reef Islands north from Palm Islands (off Townsville) to New Guinea. On beach rock, coral and dead shells, usually subtidal.

Remarks. This species was overlooked by Macpherson (1955). It is more elongate and has a paler interior and much more pronounced ribs than *P. rugosa* Quoy & Gaimard. It lives (at Lizard Island, north Queensland) on *Lithothamnion* covered coral and on large shells from the lower littoral to several metres deep. It produces a very pronounced home 'scar' on the substratum and is often covered with *Lithothamnion.*

Christiaens (1975a) erroneously included this species in the synonymy of *P. saccharina* (Linnẽ).

Patelloida cryptalirata (Macpherson, 1955). Pl. 5, figs 10-15, pl. 10, figs 3, 4.
?Acmaea septiformis. — T. Woods, 1880: 111 (*non* Quoy & Gaimard, 1834).
Chiazacmea cryptalirata Macpherson, 1955: 250, figures in text, pl. 16, figs 1, 2 (radula).
Chiazacmea ater Macpherson, 1955: 250, figures in text, pl. 16, figs 3, 4 (radula).
Patelloida cryptalirata. — Christiaens, 1975b : 94.

Diagnosis. Shell (pl. 5, figs 10-15). Thin, ovate and flattened. Apex at about anterior third. Slopes straight or slightly convex. Surface almost smooth. Cream or light brown in colour, overlain with a red-brown, fine reticulate pattern and fine radial lines; sometimes a few broad, dark-brown to black radial bands. Occasional specimens with irregular "Maltese Cross" pattern. Interior with bluish rim around muscle scar; spatula usually brown, margin showing external colour pattern.

Radula (pl. 10, figs 3, 4). Inner lateral teeth with pointed cusps and short bases. Outer lateral teeth with short bases; inner cusps broad, pointed, about equal in length to cusps of inner lateral teeth; outer cusps small, rounded. Marginal teeth long, with curled cusps. Radular segment wider than long.

Dimensions

	Height	Length	Width
C. cryptalirata (from original description)	4mm	12mm	9.5mm
Actual dimensions of specimen labelled as holotype	3.4	10.3	8.9
Dimensions of actual holotype	3.76	12.10	9.25
	Height	Length	Width
C. ater (from original description)	3.5	11	8.5
Actual dimensions of holotype	2.75	11.00	8.70

Types. C. cryptalirata. Holotype NMV, F. 13861 (part), 1 paratype F. 13861 (part); on sheltered rock faces in littoral zone, Point Vernon, "Yeppoon" (= Hevey Bay) Queensland. Paratype (specimen labelled as holotype) Wreck Point, Yeppoon, Queensland (NMV, F.13856) (pl. 5, figs 10-12). *C. ater.* Holotype (pl. 5, figs 13-15), NMV, F.13974, and 1 paratype; on the under-surface of rocks in mid-littoral, Bargara, Queensland.

Distribution. Northern Australia from Hervey Bay in southern Queensland to Broome in north Western Australia and Papua New Guinea. Found in sheltered habitats (e.g. crevices, undersides of boulders) throughout the intertidal zone.

Remarks. Examination of a large range of material from Queensland indicates that Macpherson's two species are extremes of one somewhat variable species. This conclusion was also reached by B.J. Smith in Christiaens (1975b).

The holotype of *C. cryptalirata* so labelled in the NMV shows a different locality (Wreck Point, Yeppoon) from that given by Macpherson but the registered number is the same (misprinted as F.1385b on the label). It is certain that the specimen labelled as such is not the holotype, particularly when the dimensions given by Macpherson differ so widely from those of this specimen. One of the two paratypes from Point Vernon (F.13861) agrees closely with the published dimensions of the holotype of *Cryptalirata* and the locality also coincides. This specimen is here assumed to be the holotype. Macpherson's figure, however, does not agree closely with any of the type specimens.

Patelloida heteromorpha (Oliver, 1926). Pl. 5, figs 16-18, pl. 12, figs 1-3.
Chiazacmea heteromorpha Oliver, 1926: 562, pl. 99, fig. 1, text fig. C; Macpherson, 1955: 249, fig. in text, pl. 15, figs 3, 4 (radula).

Diagnosis. Shell (pl. 5, figs 16-18). Small, thick, rough (but usually without definite ribbing) and often eroded. Apex slightly anterior; slopes straight to lightly convex; margin often irregular. Sculptured with fine radial striae and a few very weak radial ribs sometimes evident. Pale brown to whitish in colour, with several, very dark, irregular, radial bands, which may coalesce and are often not clearly evident on the exterior. Juvenile shells with a dark-brown zig-zag pattern on white. Spatula pale-bluish to dark-brown, sometimes showing a pattern of small dark spots; margin white to pale-brown with black stripes, or completely black.

Radula (pl. 12, figs 1-3). Inner lateral teeth with pointed cusps and with moderately long bases. Outer lateral teeth have short bases; inner cusps very broad and only slightly rounded (often square); outer cusps very small and rounded. Marginal teeth long and curl in behind inner laterals. Radular segment longer than broad.

Dimensions

	Height	Length	Width
Holotype	8.00mm	18.05mm	15.93mm
Large specimen (Cooktown)	5.9	18.6	14.5

Types. Holotype (pl. 5, figs 16-18), AMS, C.105728. Facing Island, Port Curtis, Gladstone, Queensland. Living on rocks between tide marks in the *Ostrea (= Saccostrea) cucculata* (Born) association and above.

Distribution. Queensland, from Hervey Bay in the south to Cooktown in the north. Lives in mid to high littoral habitats usually on sloping surfaces in sheltered, usually silty locations.

Remarks. This species is sympatric with *P. cryptalirata* (Macpherson) over all of its range but can be readily distinguished by its larger, heavier shell, darker interior, more centrally placed apex, external radial sculpture and, when non-eroded, characteristic pattern of white zig-zag lines on the juvenile shell. The spotted spatula is seen in some specimens and is a feature shared by *P. latistrigata* (Angas) and *P. saccharina.* The zig-zag colour pattern on the juvenile shell is similar to the colour pattern of *P. saccharina* but that species attains a

much larger size, has a pale interior and often has a star-shaped outline due to the presence of very strong external ribs. *P. heteromorpha* has very weak ribs which only slightly crenulate the margin of the shell.

Christiaens (1975b) suggests that *P. heteromorpha* may be a subspecies of *P. latistrigata* on the basis of intermediate specimens from Yeppoon and a similar radula. This observation is not upheld because of the considerable sculptural, textural and colour differences between the shells of the two species. The radulae are very similar but *P. heteromorpha* differs from *P. latistrigata* in the inner lateral teeth having relatively shorter bases. We have not seen any "intermediate" specimens despite the examination of large series from Yeppoon and other areas.

Patelloida insignis (Menke, 1843). Pl. 6, figs 1-6, pl. 12, figs 4-6.
Patella insignis — Menke, 1843: 34.
Acmaea crucis — T. Woods, 1876: 52; T. Woods, 1877: 44; Thiele, 1930: 564.
Acmaea cruciata. — Tate & May, 1901: 411 (*non Linné, 1758).*
Acmaea flammea.-Verco, 1906: 212, Verco, 1907: 101; Pritchard & Gatliff, 1903: 196 (in part, *non* Quoy & Gaimard, 1834).
Radiacmea insignis. — Iredale, 1924: 235.
Chiazacmea flammea flammea. — Oliver, 1926: 558; Macpherson, 1955: 247, fig. in text, pl. 14, figs 1, 2 (radula) (*non* Quoy & Gaimard, 1834).
Chiazacmea flammea conoidea. — Oliver, 1926: 560 (in part, *non* Quoy & Gaimard, 1834).
Chiazacmea flammea mixta. — Oliver, 1926: 560 (in part), fig. B.
Chiazacmea mixta. — Cotton, 1959: 306, fig. 203 (in part, *non* Reeve, 1855).
Chiazacmea flammea. — Macpherson & Gabriel, 1962 : 50, fig. 66 (*non* Quoy & Gaimard, 1834).
Patelloida (Patelloida) flammea. — Christiaens, 1975a: 76 (*non* Quoy & Gaimard, 1834).
Collisella (Collisella?) crucis. — Christiaens, 1975b: 96.
Patelloida conoidea insignis. — Christiaens, 1975b: 96.

Diagnosis. Shell (pl. 6, figs 1-6). Of moderate size (generally larger than in *P. mufria* (Hedley)) thick, ovate, sometimes flattened, usually moderately elevated, sometimes high-spired. Apex slightly anterior; slopes straight or with posterior slope slightly convex. Sculptured with numerous fine, simple, radial striae or weak riblets, often becoming obsolete in large specimens, striae usually equal to, or narrower than, the interspaces. White or greyish in colour, with irregular blotches and radial markings of dark brown, often concentrated into a "Maltese Cross". Interior porcellaneous, white and brown, often showing exterior pattern.

Radula (pl. 12, figs 4-6). Inner lateral teeth with rounded cusps and medium-sized bases. Outer lateral teeth with short bases; inner cusps broad and only slightly rounded, almost as long as cusps on inner lateral teeth; outer cusps rounded, about 1/3 size of inner cusps. Marginal teeth long and spoon-shaped. Radular segment broader than long.

Dimensions.

	Height	Length	Width
A. crucis (from original description)	19mm	31mm	31mm
Lectotype of *A. crucis*	17.45	31.10	25.00
Paralectotype of *A. crucis* (AMS)	9.90	21.75	16.35
Largest paralectotype of *A. crucis* (TM)	—	39	—
Large Western Australian specimens (Augusta)	6.66	20.55	14.70
	8.25	20.20	15.30

Types. P. insignis. Lost. *A. crucis.* Lectotype (pl. 6, figs 4-6) (here chosen) AMS, C.105257, and paralectotype C.105257, 3 paralectotypes, TM, E304/7681.

Distribution. Southern and western Australia from Geraldton in Western Australia to

South Australia and in Tasmania. Found subtidally and in the lower littoral regions of sheltered coasts.

Remarks. The type of *Patella insignis* has been lost but Menke's description and his subsequent note on the species (Menke, 1844) leave little doubt as to its identity. Iredale (1924) noted the relationship of *crucis* T. Woods to *insignis*, regarding the latter to be the "Western Australian representative of *crucis*".

This species has had an extremely complex nomenclatural history as briefly outlined in the synonomy, much of the confusion being brought about by a failure of almost every author other than Iredale (1924) to recognise the real identity of *Patelloida flammea* Quoy & Gaimard.

Hedley (1915) states that Iredale informed him that the types of *Acmaea inradiata* Reeve, 1855 were identical with *Acmaea crucis*. Reeve gave no habitat but the type tablet in the BMNH was (later?) marked "Tasmania". Later Iredale (1924) noted that, on closer examination, none of the reputed 3 "types" was the specimen figured by Reeve and he advocates the rejection of *inradiata* from the Australian fauna.

Tate & May (1901) place *flammea* and *crucis* in synonymy with *A. cruciata* (Linné, 1758), a species from the tropical Pacific. This interpretation is correctly rejected by Verco (1906).

The type material of *Patella gealei* Angas, 1865 consists of two corroded "types" one of which, as determined by Iredale (1924 : 237), is *Acmaea "crucis"* (i.e. *P. insignis*) and the other "a *Patella*" (= *Cellana tramoserica* (Holten)). It is the latter species which must be regarded as the type because, as pointed out by Iredale, it was the only specimen in Angas's possession when the species was described.

Patelloida mufria (Hedley) has an almost identical shell but the radula of that species has much broader outer cusps on the outer lateral teeth than does *P. insignis*. The shell of *P. mufria* does not attain the size of *P. insignis*. The two species are contrasted in more detail below (under *P. mufria*).

Adam & LeLoup (1938) record *Acmaea crucis* T. Woods from New Caledonia but Christiaens (1975b) has renamed their specimens *Collisella (Notoacmea) adami*.

Patelloida latistrigata (Angas, 1865). Pl. 7, figs 1-4, pl. 10, figs 8, 9.
Patella latistrigata Angas, 1865 : 154.
Acmaea marmorata T. Woods, 1876 : 156; Henn & Brazier, 1894 : 178; Tate and May, 1901 : 412; Verco, 1906 : 210; Torr, 1914 : 366, pl. 20, fig. 8a, b (radula).
Acmaea marmorata var. *submarmorata* Pilsbry, 1891 : 52, pl. 42, figs 69, 70.
Acmaea gaelie. — Pritchard & Gatliff, 1903 : 198 (*non* Angas, 1865).
Patelloida submarmorata. — Iredale, 1924 : 236; Thornley, 1945 : 26, figs 3a, b.
Patelloida (Collisellina) latistrigata latistrigata. — Oliver, 1926 : 556.
Patelloida (Collisellina) latistrigata submarmorata. — Oliver, 1926 : 558.
Patelloida latistrigata latistrigata. — Macpherson, 1955 : 245, fig. in text, pl. 13, figs 1, 2(radula).
Patelloida latistrigata submarmorata. — Macpherson, 1955 : 245, fig. in text, pl. 13, figs 3, 4 (radula).
Collisellina latistrigata. — Cotton, 1959 : 302, fig. 200.
Collisellina marmorata. — Cotton, 1959 : 303.
Collisellina gealei. — Cotton, 1959 : 303 (*non* Angas, 1865).
Patelloida (Patelloida) latistrigata. — Christiaens, 1975a : 76.

Diagnosis. Shell (pl. 7, figs 1-4). Small, elevated, often pitted and worn. Variable number of irregular rounded ribs, usually more in northern populations than in southern ones. Light greyish-brown in colour where surface eroded, otherwise dark-brown. Interior porcellaneous, grey/brown, with spatula characteristically spotted with blue or brown and often bordered with white. Spotted pattern usually evident on exterior of eroded specimens. Internal marginal area white or yellowish with black or brown stripes or irregular markings; edge usually dark.

Radula (pl. 10, figs 8, 9). Inner lateral teeth with narrow and pointed cusps and with very long bases. Outer lateral teeth stout, with short bases; inner cusps broad and rounded, much larger than outer cusps. Marginal teeth very long and curled in behind inner lateral teeth. Radular segment much longer than broad.

Dimensions.

	Height	Length	Width
Holotype of *P. latistrigata*	6.0mm	17.8mm	11.7mm
Type of *A. marmorata* (from original description)	6	21	15
Lectotype of *A. marmorata* var *submarmorata*	6.30	16.15	13.40
Paralectotype	6.2	15.9	12.9
Large specimen (Lakes Entrance, Victoria)	7.6	23.4	17.5

Types. P. latistrigata. Holotype (pl. 7, figs 1, 2), BMNH, 70.10.26.159; Aldinga Bay, South Australia. *A. marmorata.* 2 probable syntypes, TM, 5595, E336/7677; Tasmania. *A. marmorata* var. *submarmorata.* Lectotype (here chosen) (pl. 7, figs 3, 4) and paralectotype, ANSP, 50046; Port Jackson, New South Wales.

Distribution. Occurs in eastern South Australia, Tasmania, Victoria, New South Wales and southern-most Queensland. Lives on exposed rock surfaces in the mid and upper littoral, usually in association with the barnacle *Tesseropora rosea* (Krauss).

Remarks. The eastern Australian form of *P. latistrigata*, named *submarmorata* by Pilsbry, is smaller, with generally weaker, more even ribbing than the southern form. Iredale (1924) and Cotton (1959) regard *latistrigata* and *submarmorata* as separate species. Oliver (1926) considered them to be subspecies, an interpretation which we see as unnecessary because of the large numbers of intermediate specimens encountered, particularly in the Bass Strait area.

Cotton (1959) used the name *marmorata* T. Woods for the southern Tasmanian form of *P. latistrigata* which he separates as a distinct species. The same author used *gealei* Pritchard & Gatliff, 1903 (*non* Angas) for the Victorian "species". These interpretations appear to be completely unjustified, Victorian, South Australian and Tasmanian shells all being virtually identical and showing no radular differences.

A shell in the AMS identified as the holotype of *A. marmorata* (C. 5202) and said to come from Manly, New South Wales, is a specimen of *P. saccharina stella* (Lesson). This specimen has no type status as it disagrees with the original description, dimensions and locality. The 2 "syntypes" in the Tasmanian Museum are also questionably types as Hardy (1915 : 67) states that there is no documentation with the specimens to indicate that they are authentic.

Macpherson (1955) records this species from Queensland but specimens in the NMV identified as *P. latistrigata submarmorata* from Elliot River Head, Bargara and Yeppoon are *P. heteromorpha.* No specimens of *P. latistrigata* north of Coolangatta, southern-most Queensland, are known to the authors.

Patelloida mimula (Iredale, 1924). Pl. 6, figs 7-16, pl. 11, figs 5-8.
Patella jacksoniensis Reeve, 1855: pl. 39, fig. 127 (*non Patella jacksoniensis* Lesson, 1830).
Acmaea mixta. — Hedley, 1915: 713 (in part, *non* Reeve, 1855).
Notoacmea mixta mimula Iredale, 1924: 235 (*nom. nov. pro Patella jacksoniensis* Reeve, 1855, *non* Lesson, 1830); Thornley, 1945: 26, figs 4a, 4b.
Chiazacmea flammea queenslandiae Oliver, 1926: 561; Macpherson, 1955: 247, fig. in text, pl. 14, figs 3, 4 (radula).
Chiazacmaea (sic.) *flammea.* — Anderson, 1965: 109, figs 9-13 (*non* Quoy & Gaimard, 1834).
Patelloida flammea marrowi Christiaens, 1975a: 76, pl. 2, fig. 7; Christiaens, 1975b: 95.
Patelloida flammea mimula. — Christiaens, 1975b: 95.

Diagnosis. Shell (pl. 6, figs 7-16). Small, thin smooth and conical. Apex only slightly anterior. Slopes straight. Brown or greenish in colour, with irregular dark-brown radial marks often forming a "Maltese Cross" pattern. Interior light brown or cream, and showing exterior pattern especially at the margin.

Radula (pl. 11, figs 5-8). Inner lateral teeth have short bases; cusps stout, relatively short and pointed. Outer lateral teeth have short bases; inner cusps rounded; outer cusps very small, closely abutting on to inner cusps but slightly more rounded. Marginal teeth long with large spoon-shaped cusps. Radular segment broader than long.

Dimensions

	Height	Length	Width
Lectotype of *P. jacksoniensis* Reeve	7.3mm	19.5mm	14.3mm
Paralectotypes of *P. jacksoniensis*	6.9	19.6	13.4
	6.20	18.85	14.15
	5.35	15.10	11.55
Holotype of *C. flammea queenslandiae*	5.40	13.73	10.01
Holotype of *P. flammea marrowi*	4.7	9.5	7.6
Large specimen (Sydney)	7.50	19.05	14.65

Types. N. mixta mimula nom. nov. pro P. jacksoniensis Reeve. Lectotype (pl. 6, figs 7, 8) (here chosen) BMNH, 197829 and 3 paralectotypes (pl. 6, figs 9, 10), BMNH, 197830; New South Wales. *C. flammea queenslandiae.* Holotype (pl. 6, figs 11-13), AMS, C.105729; Port Curtis, Gladstone, Queensland, living on rocks between tides in the *Ostrea* (= *Saccostrea*) *cucculata* association. *P. flammea marrowi.* Holotype (pl. 6, figs 14-16), NMV, F29550. Paratypes in NHMP. Wallal Downs, Eighty Mile Beach, north Western Australia.

Distribution. From Lakes Entrance in eastern Victoria, through New South Wales and Queensland, the Northern Territory and north Western Australia. Lives in sheltered habitats in estuaries, usually in association with the oyster *Saccostrea.*

Remarks. Iredale's name was introduced as a replacement for *Patella jacksoniensis* Reeve *non* Lesson, a fact overlooked by Macpherson (1955) who includes *P. jacksoniensis* in the synonomy of *Chiazacmea flammea queenslandiae.* Macpherson's *Chiazacmea flammea mimula* is, at least in part, *Patelloida mufria.*

This species extends continuously along the entire east, north and north-western coasts of Australia. It has been given a separate name in north Western Australia (*marrowi* Christiaens) but the differences exhibited by northern and northwestern specimens (mainly smaller size) appear to be clinal. There are no significant differences in the radulae of tropical and temperate populations nor between those on the northern, north-western and south-eastern coasts.

The radula of this species is similar to that of *P. insignis* in most respects but differs in having relatively larger marginal teeth. The colour of the foot is a useful means of distinguishing *P. mimula* and *P. mufria,* which are sympatric in New South Wales, *P. mimula* having an orange foot and *P. mufria* a grey foot.

Patelloida mufria (Hedley, 1915). Pl. 7, figs 5-13, pl. 13, figs 1-4.
Acmaea subundulata. — Whitelegge, 1889: 272 (in part ?, *non* Angas, 1865).
Acmaea inradiata. — Hedley, 1915: 712 (*non* Reeve, 1855).
Acmaea mufria Hedley, 1915: 713, pl. 81, figs 50-52.
Radiacmea insignis cavilla Iredale, 1924: 235; Thornley, 1945: 27, figs 12 a-d.
Radiacmea mufria. — Iredale, 1924: 235. Thornley, 1945: 27, figs 11a-d.
Chiazacmea mufria. — Oliver, 1926: 562.
Chiazacmea flammea cavilla. — Oliver, 1926: 561.
Notoacmea (unnamed) Thornley, 1945: 27, figs 8a-b.
Chiazacmea flammea mimula. — Macpherson, 1955: 248, figure in text, pl. 15, figs 1, 2 (radula) (in part, *non* Iredale, 1924).
Patelloida (Patelloida) mufria. — Christiaens, 1975a: 76.
Patelloida cavilla. — Christiaens, 1975b: 96.

Diagnosis. Shell (pl. 7, figs 5-13). Small, usually thin, ovate, generally moderately elevated (but specimens may be very elevated or very flattened depending on the environment). Sculptured with numerous fine to rather strong, smooth radial lirae, usually wider than the spaces between. Apex slightly anterior. Anterior slope straight, posterior slope straight or convex. Whitish in colour, overlain with a variable pattern of dark brown flecks and radial markings often in the form of a "Maltese Cross". Interior porcellaneous, and often showing exterior pattern.

Radula (pl. 13, figs 1-4). Inner lateral teeth with medium-sized, pointed cusps and rather short bases. Outer lateral teeth with short bases; inner cusps narrow, rounded and about 2/3 size of cusps of inner lateral teeth; outer cusps very broad and nearly as long as inner ones, rounded with a characteristic sloping or slightly convex edge on outer side. Marginal teeth long with small spoon-shaped cusps. Radular segment approximately square.

Dimensions

	Height	Length	Width
Lectotype of *A. mufria*	2.80mm	5.54mm	3.37mm
Large specimen (Sydney)	4.90	11.75	8.70

Types. A. mufria. Lectotype (pl. 7, figs 5-7), AMS, C.112908, and many paralectotypes AMS, C32440, C22531; Balmoral Beach, Middle Harbour, Sydney, New South Wales (lectotype and paralectotypes, (C.32440); Wreck Bay, New South Wales (paralectotypes, C.22531). *P..insignis cavilla.* Types not found; Sydney, New South Wales.

Distribution. Ballina in New South Wales south to Victoria and occasional records from South Australia and south Western Australia. Found subtidally or intertidally in sheltered to moderately exposed habitats, often on the shells of other gastropods.

Remarks. This species is extremely difficult to satisfactorily distinguish from *P. insignis* on shell characters, although the radulae of the two species are fairly distinct, especially in the relative width of the outer cusps of the outer lateral teeth. Both species are sympatric on the south coast (south Western Australia, South Australia and possibly Victoria), but *P. mufria* is apparently uncommon everywhere except New South Wales. The shell of *P. mufria* can be distinguished from adult *P. insignis* by its smaller size, usually coarser radial sculpture and fewer radial, dark-colour markings. We have, however, not been able to confidently distinguish small specimens of *P. mufria* and *P. insignis* on shell characters, their identity having to be confirmed by an examination of the radula.

The shell is variable, some specimens, like the lectotype, being minute, narrow and often tall, and are found living compressed between the ribs of *Thais orbita* (Gmelin) or amongst *Galeolaria* tubes. The larger, flatter specimens are found on smooth surfaces and, no doubt, conform to Iredale's *R. insignis cavilla.* Intermediate shapes are common and the radulae of the two forms are identical.

Further field work is required to more clearly delineate the ranges of both *insignis* and *mufria* and their ecological requirements in areas where they are sympatric.

Macpherson (1955) called this species Chiazacmea flammea mimula. Most of the material in the NMV identified by her is *P. mufria* but two lots are *P. mimula* (F.8403, F14451).

Patelloida nigrosulcata (Reeve, 1855). Pl. 7, figs 14-16, pl. 12, figs 7, 8.
Patella nigrosulcata Reeve, 1855: pl. 30, fig. 84.
Acmaea patellavecta Verco, 1912: 195, pl. 15, figs 5-7.
Patelloida nigrosulcata. — Oliver, 1926: 550; Macpherson, 1955: 241, fig. in text, pl. 11, figs 3, 4 (radula).
Patelloida (Patelloida) nigrosulcata. — Christiaens, 1975a: 76.

Diagnosis. Shell (pl. 7, figs 14-16). Ovate, thick and moderately to slightly elevated, of moderate size. Numerous flat, rather narrow, radial ribs with very narrow interspaces

causing margin to be minutely scalloped. White or cream, often tinged with light brown especially between ribs. Interior creamy white, porcellaneous, sometimes with a few brown blotches.

Radula (pl. 12, figs 7, 8). Lateral teeth stout with short bases. Inner lateral teeth, broad, with short, pointed cusps. Inner cusps of outer lateral teeth small and rounded; outer cusps large, very broad, with straight cutting edges. Marginal teeth long with large, spoon-shaped cusps. Radular segment much broader than long.

Dimensions

	Height	Length	Width
Holotype of *A. patellavecta* (from original description)	14mm	31.5mm	23mm
Lectotype of *P. nigrosulcata*	8.9	28.6	20.7
Paralectotypes of *P. nigrosulcata*	21.6	39.0	31.0
	15.40	29.15	24.90
Large specimen (Recherche Bay, south Western Australia)	15.4	37.1	29.5

Types. P. nigrosulcata. Lectotype (pl. 7, fig. 16) (here chosen), BMNH, 197828, and 2 paralectotypes (pl. 7, figs 14, 15) BMNH, 197829; described from unknown habitat. *A. patellavecta.* Holotype, SAM, D13373; Cape Naturaliste, south Western Australia.

Distribution. South and mid Western Australia from Geraldton to Esperance. Generally found attached to the shells of other gastropods notably *Patella (Patellanax) laticostata* Blainville, which occurs in the lower littoral and subtidally.

Remarks. Macpherson (1955) records this species from western South Australia but Cotton (1959) does not. The only lot that could be located in the NMV from South Australia is from Robe in eastern South Australia and is almost certainly mislocalised.

This species has a very wide outer cusp on each outer lateral tooth and is very similar to *P. mufria* in this respect, although it differs considerably in shell characters, particularly in its much larger size.

Patelloida profunda calamus (Crosse & Fischer, 1864). Pl. 8, figs 1-5, pl. 13, figs 5-7.
Patella calamus Crosse & Fischer, 1864: 348; Crosse & Fischer, 1865: 42, pl. 3, figs 7, 8.
Acmaea calamus. — Verco, 1906: 211.
Acmaea calamus polyactina Verco, 1912: 199.
Patelloida calamus. — Hedley, 1916: 184.
Radiacmea calamus. — Iredale, 1924: 235.
Actinoleuca calamus. — Oliver, 1926: 567; Thornley, 1945: 27; Cotton, 1959: 314, fig. 211; Macpherson & Gabriel, 1962: 51, fig. 68.
Actinoleuca polyactina. — Cotton, 1959: 315, fig. 212.
Patelloida (Patelloida) calamus. — Christiaens, 1975a: 76.
Collisella (Parvacmea) polyactina. — Christiaens, 1975b: 105.

Diagnosis. Shell (pl. 8, figs 1-5). Small to moderate in size, rather thin, ovate and elevated. Apex slightly anterior, slopes straight. Sculptured with numerous fine, unequal, radiating ribs. Dull white or yellow in colour with irregular brown to purplish markings. Interior white and often tinted with pink; exterior pattern often visible on interior.

Radula (pl. 13, figs 5-7). Inner lateral teeth with medium-sized bases; cusps relatively short, stout. Outer lateral teeth with short bases; inner cusps narrow and pointed, outer cusps broader and more pointed. Marginal teeth small. Radular segment approximately square.

Dimensions

	Height	Length	Width
Holotype of *P. calamus*	5.75mm	12.15mm	9.95mm
Specimen of *A. calamus* var. *polyactina* (? type) (from original description)	7	21	17

Types. P. calamus. Holotype (pl. 8, figs 1, 2), BMNH, 70.10.26.156; St. Vincent Gulf, South Australia is given as the locality in the original description but the type is labelled "Port Lincoln, South Australia". *A. calamus* var. *polyactina.* Holotype, SAM, D.13379; Gulf St. Vincent, Sceales Bay and Wallaroo Bay, South Australia, 15 fathoms.

Distribution. Temperate Western Australia along the south coast to southern New South Wales, and in Tasmania. Apparently usually living in the sublittoral.

Remarks. Christiaens (1975b: 93) suggested that *P. calamus* may be related to *P. profunda* (Deshayes, 1863) from the Island of Reunion, in the Indian Ocean. This relationship is here upheld as there is little in the radular or shell characters that would sharply differentiate *P. calamus* from the *P. profunda* series as recognised by Christiaens (1975b). Comparison with the radula and shell of *P. profunda profunda* has not been possible but examination of *P. profunda mauritiana* (Pilsbry, 1891) and *P. profunda albonotata* Smith, 1901 (pl. 13, fig. 9) show them to have similar radulae.

The fine, evenly-spaced radial sculpture distinguishes this subspecies from the next which occurs in north Western Australia.

Patelloida profunda ivani Christiaens, 1975. Pl. 7, figs 17-19, pl. 13, fig. 8.
Patelloida profunda ivani Christiaens, 1975b: 93, pl. 3, fig. 4.

Diagnosis. Shell (pl. 7, figs 17-19). Small, apex at about anterior 1/3, with about 8 moderately strong, widely-spaced radial ribs, each pair with about 4-6 weaker ribs between. Exterior yellowish-orange, primary ribs white. Interior yellowish-white, white spots on margin correspond to ends of primary ribs and short orange-pink lines between these correspond to interspaces between secondary radials. Spatula pale orange, with dark brown spots at edge and a pair of dark brown blotches laterally (description taken from holotype).

Radula (pl. 13, fig. 8). Lateral teeth with short bases and stout, pointed cusps. Cusps of outer and inner lateral teeth approximately equal in size and of similar shape. Marginal teeth short, with very long, spoon-shaped cusps. Radular segment approximately square.

Dimensions

	Height	Length	Width
Holotype	2.65mm	6.9mm (appr.)	5.45mm
Paratype (from original description)	3	7.5	5

Type. Holotype, NMV, F.29551 (pl. 7, figs 17-19), paratypes in Christiaens colln and I. Marrow colln; Dampier, north Western Australia. Part of anterior end of holotype broken.

Distribution. North Western Australia.
Remarks. Only the holotype and topotypes have been available for examination. Christiaens (1975b) regarded this taxon as a subspecies of *P. profunda* (Deshayes, 1863) and, although firm evidence has yet to be advanced to uphold this relationship, the radular characters of *ivani* and the other subspecies of *P. profunda* are certainly similar.

A form of *Collisella onychitis* from Quobba, Western Australia is superficially similar to *P. profunda ivani* in shell characters but has a radula typical of *C. onychitis* (pl. 10, figs 5, 6).

Patelloida saccharina stella (Lesson, 1830). Pl. 8, figs 6-8.
Patella stella Lesson, 1830: 421.
Patella stellaris Quoy & Gaimard, 1834: 356, pl. 71, figs 1-4 *(non Patella stellaris* Röding, 1798, a synonym of *P. saccharina* Linné).
Collisellina paropsis Iredale, 1929: 275; Rippingale & McMichael, 1961, pl. 3, fig. 12.
Patelloida saccharina stella. — Macpherson, 1955: 243; figs in text, pl. 12, figs 3, 4 (radula) (see for more detailed synonymy).
Patelloida (Patelloida) saccharina. — Christiaens, 1975a: 77 (in part, *non* Linne, 1758).

Diagnosis. Shell (pl. 8, figs 6-8). Ovate, thick, rather large, with several very strong ribs, of

which eight are usually more prominent than others. Apex only slightly anterior and usually eroded. Margin very irregular. Grey or white in colour, with interspaces between the ribs flecked with brown or black, often in a zig-zag pattern. Interior porcellaneous, and grey or white in colour. Spatula usually spotted with characteristic blue or brown. Margin black with white stripes corresponding to external ribs.

Radula. Inner lateral teeth with rounded cusps and medium-sized bases. Outer lateral teeth with very short bases; inner cusps broad and slightly smaller than cusps of inner lateral teeth; outer cusps very small. Marginal teeth long, narrow and curled. Radular segment approximately square.

Dimensions.

	Height	Length	Width
Holotype of *C. paropsis*	8.02mm	29.40mm	22.06mm
Large specimen (Yeppoon, Queensland)	15.0	43.2	37.5

Types. P. stella. Types probably in NHMP; New Zealand (error). *P. stellaris.* Types probably in NHMP; New Ireland. *C. paropsis.* Holotype (pl. 8, figs 6-8), AMS, C.53573; Michaelmas Cay, off Cairns, North Queensland.

Distribution. Northern Australia, from Exmouth in Western Australia to Maroochydore in southern Queensland. Lives in the mid to lower littoral on open rock platforms.

Remarks. Macpherson overlooked *Collisellina paropsis* Iredale, 1929 as an additional synonym of this species. The type is figured here for the first time (pl. 8, figs 6-8).

P. saccharina ranges around tropical Australia to Mauritius and the Andaman Islands, to Papua New Guinea, Indonesia, the Solomon Islands, Fiji, Samoa, New Caledonia, the Philippines, South East Asia and southern Japan. At least three "subspecies" are sometimes recognised. The typical form described from the Philippines ranges through the Central Indo-Pacific region including Indonesia, the Solomons and Fiji. It differs from the "subspecies" *stella* which occurs in Australia, New Caledonia and Papua New Guinea in having very strong primary ribs and very weak or absent secondary ribs. Another "subspecies", *lanx* (Reeve 1855), from southern Japan is sometimes recognised. The Australian form is usually broader than the typical form, usually has the secondary ribs well developed and there are 7-9 primary ribs. The forms *P. saccharina saccharina* (Linné, 1758) and *P. saccharina stella* certainly appear to intergrade, shells from northern Australia often being intermediate or *saccharina*-like. We doubt if the subspecific names will be validated on examination of a larger range of material than is available to us, although it is reasonably clear that there is some, often inconsistent, geographic differentiation.

The Lady Julia Percy Island (Victoria) record cited by Macpherson is clearly based on a mislocalized specimen (the material in the NMV certainly being *P. saccharina stella*). The same author cites a record from northern New South Wales but a single specimen from Nambucca Heads is the only New South Wales specimen that can be located in the NMV (there are none in the AMS collections). It is possible that occasional specimens do occur in northern New South Wales but confirmation is needed.

Patelloida victoriana (Singleton, 1937). Pl. 8, figs 9-12.
Patella hepatica Pritchard & Gatliff, 1903: 194 (*nom. nov. pro Acmaea striata* Pilsbry, 1891: 47, pl. 35, figs. 27-29, (*non* Quoy & Gaimard, 1834); Iredale, 1924: 240 (in part).
Patella victoriae Gatliff & Gabriel, 1922: 152, *nom. nov. pro Patella hepatica* Pritchard & Gatliff, 1903 (*non* Gmelin, 1791).
Patella victoriana Singleton, 1937: 391, pl. 23, fig. 1.
Patelloida victoriana. — Macpherson, 1955: 242, figs in text, pl. 12, figs 1-2 (radula).
Patelloida (Patelloida) victoriana. — Christiaens, 1975a: 77.

Diagnosis. Shell (pl. 8, figs. 9-12). Moderately large, ovate, moderately elevated, usually eroded or covered wtih encrusting algae. Apex at about anterior third. Anterior and posterior slopes convex. Sculptured with numerous, irregular, fine riblets which finely but

sharply crenulate margin. Dark or greenish-brown in colour, usually with a white patch at apex due to erosion. Interior white to pale-grey, margin brown.

Radula. Cusp of inner lateral teeth and inner cusps of outer lateral teeth stout, rounded and approximately same size. Outer cusps of outer lateral teeth small and broad with almost straight cutting edges. Bases of both lateral teeth short. Marginal teeth large and hooked. Radular segment broader than long (after Macpherson).

Dimensions

	Height	Length	Width
Holotype (from original description)	7.7mm	23.5mm	17.7mm
Paratype (from original description)	8.5	23.7	18.9
Large specimen (Eagle Hawk Neck, Tasmania)	13.0	31.8	25.6

Types. Holotype, NMV, 70069 and paratype, NMV, 70070; Victoria.

Distribution. Found from Spencer Gulf in South Australia, to Wilson's Promontory in Victoria, and in Tasmania. Lives amongst algae in the sublittoral fringe on exposed coastal platforms.

Remarks. The taxonomic confusion surrounding this species is discussed by Singleton (1937) and Macpherson (1955). Iredale (1924) considered it to be related to *Patellanax peronii* (Blainville) (Patellidae), a conclusion apparently adopted by Oliver (1926) who did not include it in his revision of the "Patelloididae" (= Acmaeidae).

List of recognised taxa and a summary of the major nomenclatural changes in the Australian Acmaeidae

Notoacmea Iredale, 1915 (= *Parvacmea* Iredale, 1915; *Conacmea* Oliver, 1926 and ? *Subacmea* Oliver, 1926)
alta Oliver, 1926 (= *corrosa* Oliver, 1926; *subundulata* auct. (*non* Angas, 1865). Southern Australia.
conoidea (Quoy & Gaimard, 1834). South Western Australia.
corrodenda (May, 1920). Tasmania and Victoria.
flammea (Quoy & Gaimard, 1834) (= *scabrilirata* Angas, 1865; *subundulata* Angas, 1865 flammea diminuta Iredale, 1924; *septiformis* auct. (*non* Quoy & Gaimard, 1834)). Temperate Australia.
mayi (May, 1923). Southern Australia.
petterdi (T. Woods, 1876). Tasmania, south eastern and temperature eastern Australia.

Collisella Dall, 1871
mixta (Reeve, 1855) (= *granulosa* Macpherson, 1955) Eastern South Australia, Victoria and Tasmania.
onychitis (Menke, 1843). Temperate Western Australia.

Patelloida Quoy & Gaimard, 1834 (= *Collisellina* Dall, 1871; *Chiazacmea* Oliver, 1926).
alticostata (Angas, 1865). Temperate Australia.
bellatula (Iredale, 1929). North Queensland.
cryptalirata (Macpherson, 1955) (= *ater* Macpherson, 1955). Tropical eastern Australia and northern Australia.
heteromorpha (Oliver, 1926). Queensland.
insignis (Menke, 1843). (= *crucis* T. Woods, 1876; *flammea* auct. (in part) (*non* Quoy & Gaimard, 1834)). South Western Australia to South Australia and Tasmania.
latistrigata (Angas, 1865) (= *marmorata T. Woods, 1876; submarmorata* Pilsbry, 1891). South-eastern and eastern temperate Australia including Tasmania.
mimula (Iredale, 1924) (= *flammea queenslandiae* Oliver, 1926; *flammea marrowi* Christiaens, 1975). Tropical Australia and temperate eastern Australia.
mufria (Hedley, 1915) (= *insignis cavilla* Iredale, 1924). Temperate eastern Australia and the south coast.
nigrosulcata (Reeve, 1855) (= *patellavecta* Verco, 1912). South Western Australia.
saccharina stella (Lesson, 1830) (= *paropsis* Iredale, 1929). Tropical eastern and northern Australia.
profunda calamus (Crosse & Fischer, 1864) (= *polyactina* Verco, 1912). Southern and south Western Australia.
profunda ivani Christiaens, 1975. North Western Australia.
victoriana (Singleton, 1937). Southern Australia including Tasmania.

N.B. Species included in the genus group taxa *Asteracmea, Naccula* and *Simplacmaea* are not included in this revision.

ADDITIONAL TAXONOMIC NOTES

Collisella (?) septiformis (Quoy & Gaimard, 1834). Pl. 3, figs 7-15.
Patelloida septiformis Quoy & Gaimard, 1834: 362, pl. 71, figs 43-44.
Notoacmea (Notoacmea) septiformis septiformis. — Oliver, 1926: 572 (in part).
Collisella (Notoacmea) septiformis. — Christiaens, 1975b: 103.

Dimensions

	Height	Length	Width
Possible syntypes	3.80mm	16.00mm	12.75mm
	4.40	16.10	12.08
	4.70 (approx)	15.53	12.75
	4.25	17.50	14.36
	4.54	13.86	11.87
	4.9 (approx)	17.90	14.48

Types. Possible syntypes (9) (pl. 3, figs 7-15) NHMP; "King George Sound" (? = Tonga).

Remarks. None of the 9 presumed syntypes agrees exactly with the original illustration but the one which is closest is marked "Tonga". Two others are also marked but the writing is indecipherable. The label gives the locality as King George Sound but no specimens seen from that locality, or from any other Australian locality, agree with this species. All the specimens appear to be a single species with fine, distinct radial lirae externally which are alternately weak and strong. Both the primary and secondary lirae are very finely scabrous. The interior is white to bluish-white with a white to brown centre. The internal margins are variable with narrow, dark markings from the exterior colour showing through. The exterior coloration is also variable; narrow to broad rays of brown with a reticulate or lace-like pattern usually predominating over most of the shell.

A search of several museums (NMV, AMS, BMNH and several European museums) has failed to locate any comparable specimens or any similar material from Tonga. The most similar Australian species is *Notoacmea flammea* which differs in its finer, lace-like markings, the less distinct radial markings, more opaque-white interior, more distinctly separated spatula, usually slightly thinner shell, and different external sculpture. In *N. flammea* the external striae are approximately equal in strength and are nodulose rather than scabrose.

The species here taken to be *Patelloida septiformis* is probably a species of *Collisella* but confirmation of its generic position will have to await the location of living material.

Notoacmea elongata (Quoy & Gaimard, 1834). Pl. 3, figs 16-19.
Patelloida elongata Quoy & Gaimard, 1834: 358, pl. 71, figs 12-14; Oliver, 1926: 573.
Acmaea daedala Suter, 1907: 328, pl. 27, figs 30-32.
Notoacmea (Parvacmea) daedala. — Oliver, 1926: 576, text fig. F.
Collisella (Parvacmea) daedala. — Christiaens, 1975b: 105.

Dimensions

	Height	Length	Width
Syntypes	1.66mm	6.15mm	4.7mm
	—	5.9	4.1
	1.4	4.8	3.5
	1.15	4.64	2.8 (approx.)

Types. 4 syntypes, NHMP (pl. 3, figs 16-19) "King George Sound" — error for New Zealand.

Remarks. The 4 syntypes of *P. elongata* agree in every particular with *N. daedala* (Suter) from New Zealand. Suter's species is the type species of Iredale's subgenus *Parvacmea*. Both *N. elongata* and *N. helmsi* (Smith), another New Zealand species, appear to be closely related to *N. flammea* which Oliver (1926) considered to be a typical *Notoacmea* (as *N.*

septiformis). Juvenile *N. flammea* differ from *N. elongata* in having rather widely spaced, distinctly granulose radial threads instead of fine radial striae and *N. flammea* has a different, coarser colour pattern.

Acmaea transparens Test, 1945: 96.

Types. Two syntypes, NHMB; "Australia".

Remarks. The two broken types are specimens of *Naccula punctata* (Quoy & Gaimard, 1834) (Acmaeidae; see Oliver, 1926 : 566), as suggested by Christiaens (1975b : 106).

Acmaea eccentrica Test, 1945 : 95.

Types. Specimens labelled 'holotype' and 9 'paratypes' have been examined. 14 syntypes were cited in the original description. NHMB; "Sydney and Port Jackson Australia. 'Rosto de Caô'". The 'holotype' is labelled 'Sydney'. Because a holotype was not designated in the original description the specimen labelled as the holotype is here designated the lectotype.

Dimensions. Lectotype. Height 1.5mm; length 3mm; width 2.1mm.

Remarks. The lectotype and 8 of the paralectotypes are a species of *Cocculina* (Cocculinidae) and one paralectotype is *Pugillaria stowae* (Verco) (Siphonariidae). This latter specimen is the only one with the golden "freckles" noted in the description. Christiaens (1975b : 106) has erroneously suggested that *A. eccentrica* is *Simplacmaea stowae* (Verco).

ACKNOWLEDGEMENTS

We wish to acknowledge the assistance of the following museum curators for the loan of type and other material used in this study:— Mrs. E. Aves, TM, Dr. P. Bouchet, NHMP, Dr. R. Kilias, NHMB, Mrs. S. Slack-Smith, Western Australia Museum, Dr. B. Smith, NMV, Mrs. K. Way, BMNH and Mr. W. Zeidler, South Australian Museum. Mr. I. Marrow kindly presented us with some topotypic specimens of *P. profunda ivani* and *P. flammea marrowi*. We are extremely grateful to Mr. P. Cameron and Mr. E.K. Yoo for assistance with operating the SEM and, in the case of Mr. Yoo, for the preparation of many of the radulae. This work was assisted by grants to one of us (R.G.C.) from the Australian Museum Trust and from the University of Sydney. It was also supported in part by an Australian Research Grants Committee grant (No. D1-70/17338) to W.F.P. Overseas travel for W.F.P. was assisted by The Australian Museum Trust, the Science and Industry Endowment Fund, the Australian Research Grants Committee and the British Council. Mrs. J. Ponder assisted during visits to overseas museums by measuring and photographing specimens. Other photography of shells was done by Mr. G. Millen and Mr. J. Fields of the Australian Museum. Mr. J. Christiaens, Mrs S.M. Slack-Smith, Mrs. J. Kerslake and Dr. A.J. Underwood kindly made valuable comments on the ms.

REFERENCES

Adam, W. & LeLoup, E., 1938. Prosobranchia et Opisthobranchia. *Mém. Mus. R. Hist. Nat. Belg.*, 2 (19): 1-209, 8 plts.

Anderson, D.T., 1965. The reproduction and early life histories of the gastropods *Notoacmaea petterdi* (Ten.-Woods). *Chiazacmaea flammea* (Quoy & Gaimard) and *Patelloida alticostata* (Angas) (Family Acmaeidae). *Proc. Linn. Soc. N.S.W.*, 90 (1): 106-114.

Angas, G.F., 1865. On the marine molluscan fauna of the Province of South Australia, with a list of all the species known up to the present time, together with remarks on their habitats and distribution, etc. *Proc. Zool. Soc. Lond.*, 1865: 155-"180" (= 190).

Christiaens, J., 1975a. Revision provisoire des Mollusques marins recents de la famille des Acmaeide. *Inform. Soc. Belge Malac.*, 4 (1): 3-20.

_____ 1975b. Revision provisoire des Mollusques marins recents de la famille des Acmaeidae (seconde partie). *Inform. Soc. Belge Malac.*, 4 (4): 91-116.

Cotton, B.C., 1959. *South Australian Mollusca. Archaeogastropoda.* Govt. Printer, Adelaide, 449 pp.

Crosse, H., & P. Fischer, 1864. Diagnoses Molluscorum Australiae méridionalis. *J. Conch., Paris,* 12: 346-350.

_____1865. Description d'espéces nouvelles de l'Australie meridionale. *J. Conch., Paris,* 13: 38-55, plts 1-3.

Dance, S.P., 1974. *The Collectors Encyclopedia of Shells.* McGraw Hill, New York, 288 pp.

Gatliff, J.H. & C.J. Gabriel, 1922. Additions to and alterations in the Catalogue of Victorian marine Mollusca. *Proc. R. Soc. Vict.*, (n.s.) 34 (2): 128-161.

Golikov, A.N. & O.G. Kussakin, 1972. Sur la biologie de la reproduction des patelles de la family Tecturidae (Gastropoda : Docoglossa) et sur la position systématique de ses subdivisions. *Malacologia,* 11 (2) : 287-294.

Hardy, G.H., 1915. List of the Tenison Woods types of Recent Mollusca in the Tasmanian Museum. *Pap. Proc. R. Soc. Tasm.*, 1915: 61-73.

Hedley, C., 1915. Studies on Australian Mollusca. Part 12. *Proc. Linn. Soc. N.S.W.*, 39 : 695-755, plates 77-85.

_____ 1916. A preliminary index of the Mollusca of Western Australia. *J. Proc. R. Soc. West. Aust.*, 1: 152-226.

_____ 1923. Studies on Australian Mollusca. Part 14. *Proc. Linn. Soc. N.S.W.*, 48 : 301-316, plts 30-33.

Henn, A.U. & J. Brazier, 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, pl. 14.

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

_____ 1924. Results from Roy Bell's Molluscan collections. *Proc. Linn. Soc. N.S.W.*, 49 : 179- 278.

_____ 1929. Queensland molluscan notes, No. 1. *Mem. Qld Museum,* 9 : 261-297.

Keen, A.M. 1960. Superfamily Patellacea. *In. Treatise on Invert. Paleont.*, Pt. I, Mollusca 1 : 1231-1236 (Edit. R.C. Moore).

_____ 1971. *Sea Shells of tropical West America. Marine molluscks from Baja California to Peru.* Stanford Univ. Press, Stanford, California. I-XIV, 1-1064 pp.

Lesson, R.P., 1829-1830. In: Duperry, L.J.; *Voyage autour du monde, exécuté par ordre du Roi, sur la corvette de S.M. La Coquille, pendant les années 1822-25.* Paris, 1828 pp.

MacClintock, C., 1967. Shell structure of patelloid and bellerophontoid gastropods (Mollusca). *Bull. Peabody Mus. Nat. Hist.*, 22 : I-VIV, 1-140, 32 plts.

Macpherson, J.H. 1955. Preliminary revision of the families Patellidae and Acmaeidae in Australia. *Proc. R. Soc. Vict.*, 67 (2): 229-256, plts. 8-19.

Macpherson, J.H., & C.J. Gabriel, 1962. *Marine molluscs of Victoria.* Melbourne Univ. Press. I-XV, 1-475 pp.

Maplestone, C.M., 1872. Notes on Victorian Mollusca and their palates. *Monthly Micros. J.*, 8 : 45-54.

May, W.L., 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.

_____ 1923. *An illustrated index of Tasmanian shells.* Govt. Printer, Hobart, Tasmania. 100 pp. (incl. 47 plts).

McLean, J.H., 1969. Marine shells of Southern California. *Los. Ang. Co. Mus. Sci. Ser.* 24, *Zool.* 11 : 1-104.

Menke, C.T., 1843. *Molluscorum Novae Hollandiae.* Hannova, 46 pp.

_____ 1844. Molluscorum Novae Hollandiae specimen, quod ad celebrandum diem iubilaeum XXVI. m. Febr. anni MDCCCXLIII, quo per XXV annos professoris muneri in ill. gymn. acad. hamburg. praefuit vir doctiss. clariss. J.G. Chr. Lehmann, Med. et Phil. Dr. *Z. Malak.*, 1844 : 52- 64.

Moskalev, L.I., 1966. On the generic classification in the family Acmaeidae (Gastropoda, Prosobranchia) based on the radula (in Russian). *Zool. Zh.*, 45 (12): 1767-1772.

Oliver, W.R.B., 1926. Australasian Patelloididae. *Trans. N.Z. Inst.*, 56 : 547-582.

Pilsbry, H., 1891. Acmaeidae, Lepetidae, Patellidae, Titiscaniidae. *Man. Conch.*, 13 : 1-195, 74 plts.
Pritchard, G.B., & Gatliff, J.H., 1903. Catalogue of the marine shells of Victoria. Part VI. *Proc. R. Soc. Vict.*, (n.s.), 15 (2): 176-223.

Quoy, J.R.C. & J.P. Gaimard, 1832-1835. *Voyages de découvertes de l'Astrolabe,...sous le commandement de M.J. Dumont d'Urville. Zoologie : Mollusca.* Vol. 3, 454 pp., atlas 2, 93 plts. Paris.

Reeve, L.R., 1854-1855. Monograph of the genus *Patella. Conch. Icon.*, 8, plts 1-27.

Rippingale, O.H. & D.F. McMichael, 1961. *Queensland and Great Barrier Reef shells.* Jacaranda Press, Brisbane, 210pp, 29plts

Singleton, F.A., 1937. Lady Julia Percy Island. 1935 Expedition. Mollusca. *Proc. R. Soc. Vict.*, 49 : 387-396.

Suter, H., 1907. Review of the New Zealand Acmaeidae, with descriptions of new species and subspecies. *Proc. Malac. Soc. Lond.*, 7 : 315-326, pl. 27.

Tate, R., 1897. Critical remarks on some Australian Mollusca. *Trans. R. Soc. S. Aust.*, 1897 : 40- 49.

Tate, R., & W.L. May, 1901. A revised census of the marine Mollusca of Tasmania. *Proc. Linn. Soc. N.S.W.*, 26 : 344-471.

Test, A.R., 1945. Description of new species of *Acmaea. Nautilus*, 58 (3) : 92-96.

Thiele, J., 1930. Gastropoda und Bivalvia, *in : Die Fauna Südwest-australiens*, 5 : 561-596; ed. W. Michaelsen & R. Hartmeyer. Gustav Fischer, Jena.

Thornley, G., 1945. Limpets of New South Wales. *Proc. R. Zool. Soc. N.S.W.* 1944-45 (1945) : 22-30.

Tomlin, J.R. le B., 1924. Note on the identity of *Lottia (?) costata*, Sowerby. *Proc. Malac. Soc. Lond.* 16:98.

Torr, C.M., 1914. Radulae of some South Australian Gastropoda. *Trans. R. Soc. S. Aust.*, 38 : 362- 368.

Verco, J.C., 1906. Notes on South Australian marine Mollusca with descriptions of new species, Part IV. *Trans. R. Soc. S. Aust.*, 30 : 205-224.

_____ 1907. Notes on South Australian marine Mollusca with descriptions of new species, Part V. *Trans. R. Soc. S. Aust.*, 31 : 99-110.

_____ 1912. Notes on the marine shells of Western Australia, Part II. *Trans. R. Soc. S. Aust.*, 36 : 192-205.

Whitelegge, T., 1889. *List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood.* Royal Society of New South Wales, 161 pp.

Woods, J.E. Tenison, 1876a. On some Tasmanian Patellidae. *Pap. Proc. R. Soc. Tasm.*, 1876 : 43-58.

_____ 1876b. On some new Tasmanian marine shells. *Pap. Proc. R. Soc. Tasm.*, 1876 : 131-159.

_____ 1877. Census, with brief descriptions of the marine shells of Tasmania and the adjacent Islands. *Pap. Proc. R. Soc. Tasm.*, 1877 : 26-57.

_____ 1880. On some of the littoral marine fauna of north-east Australia. *Proc. Linn. Soc. N.S.W.* 5: 106-131.

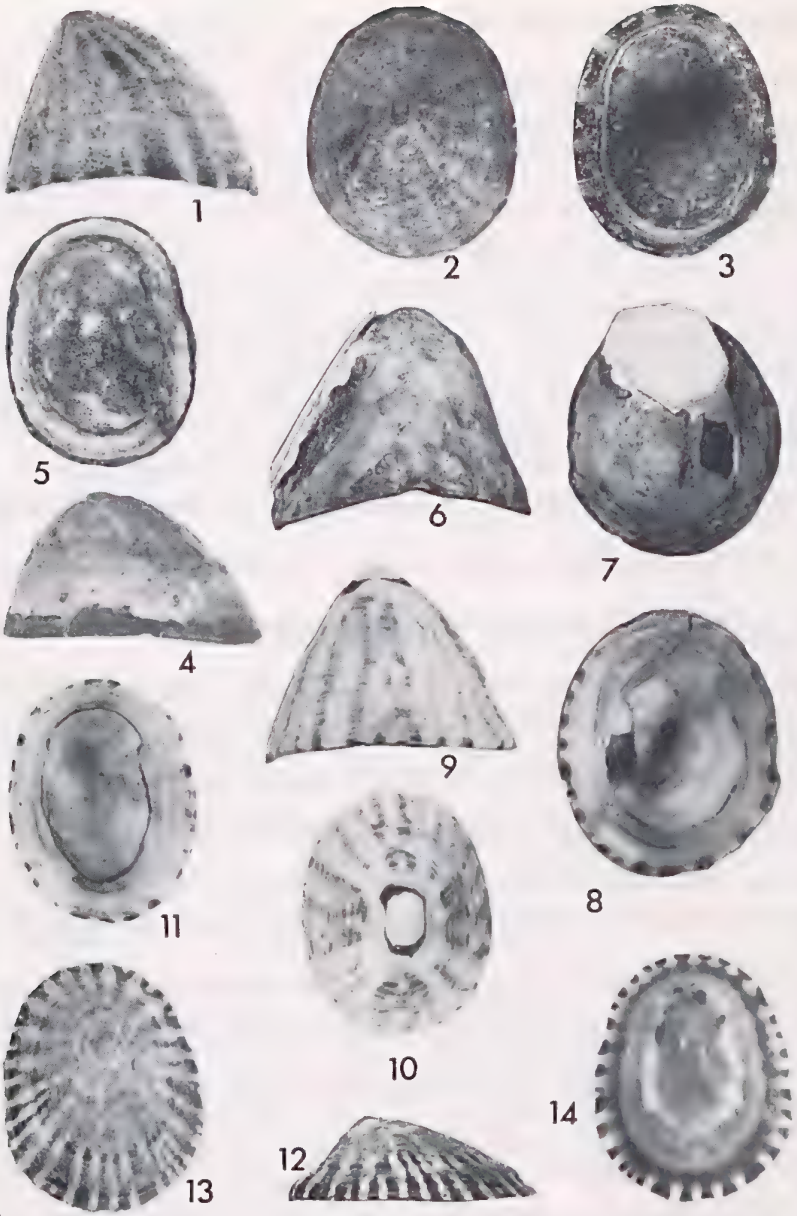

Plate 1.

1-5. *Notoacmea alta* Oliver. 1-3. Holotype. Height 4mm, length 6mm, width 5mm. 4, 5. Holotype of *N. corrosa* Oliver. Height 5mm, length 8.5mm, width 6.5mm

6-11. *Notoacmea conoidea* (Quoy & Gaimard). 6-8. Holotype. Height 11.4mm, length 13.74mm, width 11.32mm. 9-11. Albany, south Western Australia (AMS, C.96705). Height 9.5mm, length 13.16mm, width 10.05mm.

12-14. *Notoacmea corrodenda* (May). Paralectotype (AMS, C.45952). Height 4.54mm, length 13.57mm, width 10.7mm.

Plate 2.

1-18. Notoacmea flammea (Quoy & Gaimard). 1-3. Lectotype. Height 4.0mm, length 11.25mm, width 9.6mm. 4-12. Paralectotypes, 4-6. Height 3.12mm, length 10.24mm, width 8.26mm. 7-9. Height 3.5mm, length 10.9mm, width 8.7mm. 10-12. Height 4.21mm, length 11.16mm, width 9.39mm. 13-15. Holotype of *Acmaea subundulata* Angas. Height 5.7mm, length 14.75mm, width 11.7mm. 16-18. Topotype of *Notoacmea flammea diminuta* Iredale, Bottle and Glass Rocks, Sydney Harbour, New South Wales (AMS, C.49539). Height 3.22mm, length 10.7mm, width 8.75mm.

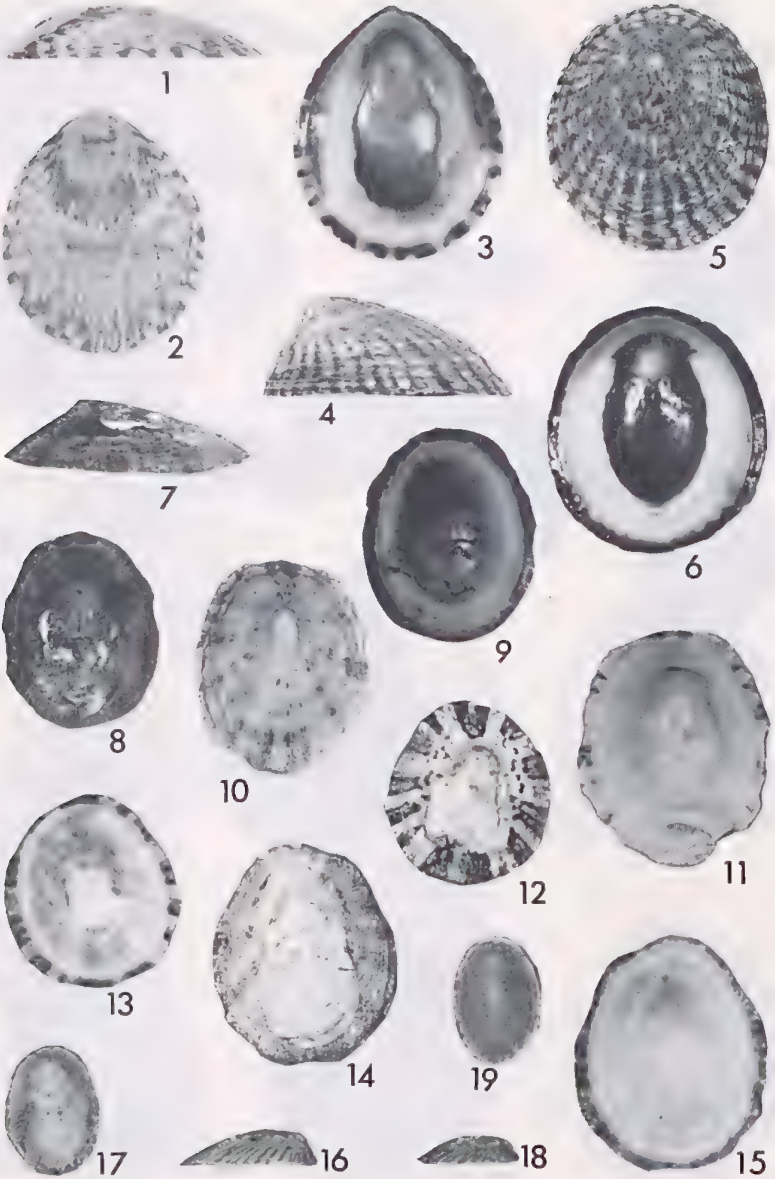

Plate 3.

1-3 *Notoacmea mayi* (May) Lectotype. Height 4.55mm, length 23.1mm, width 18.75mm 4-6. *Notoacmea petterdi* (I. Woods). Lakes Entrance, Victoria (AMS, C.112760), Height 8.75mm, length 22.1mm, width 19.55mm.
7-15. *Collisella (?) septiformis* (Quoy & Gaimard). Possible syntypes, NHMP 7-9. Height 3.8mm, length 16.0mm, width 12.75mm, 10, 11. Height 4.25mm, length 17.5mm, width 14.36mm, 12-13. Height c.4.7mm, length 15.53mm, width 12.75mm. 14, 15. Height c.4.9mm, length 17.9mm, width 14.48mm. 16-19. *Notoacmea elongata* (Quoy & Gaimard). Syntypes. 16, 17. Height 1.66mm, length 6.15mm, width 4.7mm. 18, 19. Length 5.9mm, width 4.1mm.

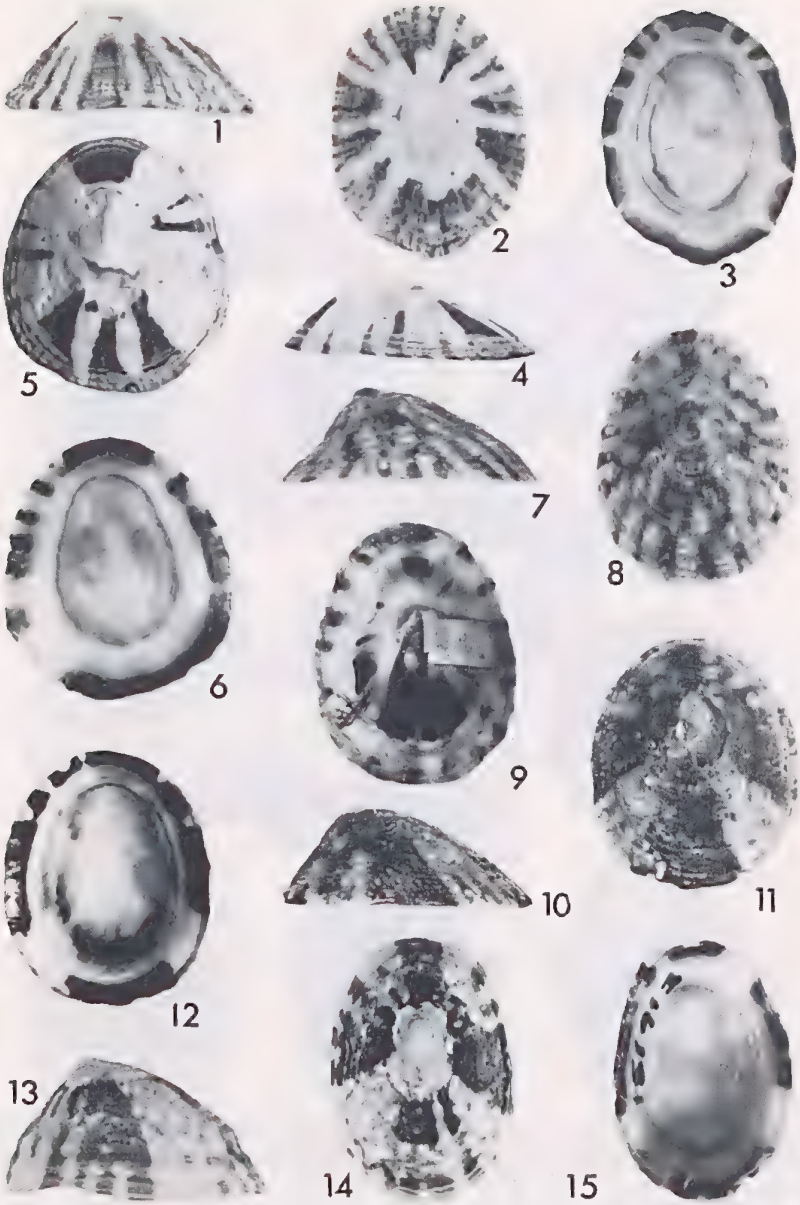

Plate 4.

1-6. *Collisella onychitis* (Menke). 1-3. Thomson Bay, Rottnest Island, Western Australia (AMS, C.112758). Height 8.37mm, length 21.3mm, width 15.96mm. 4-6. Cape Riche, south Western Australia (AMS, C.112757). Height 3.9mm, length 13.3mm, width 11.8mm.

7-15. *Collisella mixta* (Reeve). 7-9. Lectotype. Height 6.1mm, length 16.6mm, width 12.7mm. 10-12. Paralectotype. Height 6.67mm, length 17.5mm, width 14.04mm. 13-15. Holotype of *Notoacmea granulosa* Macpherson. Height 7.64mm, length 14.46mm, width 10.2mm.

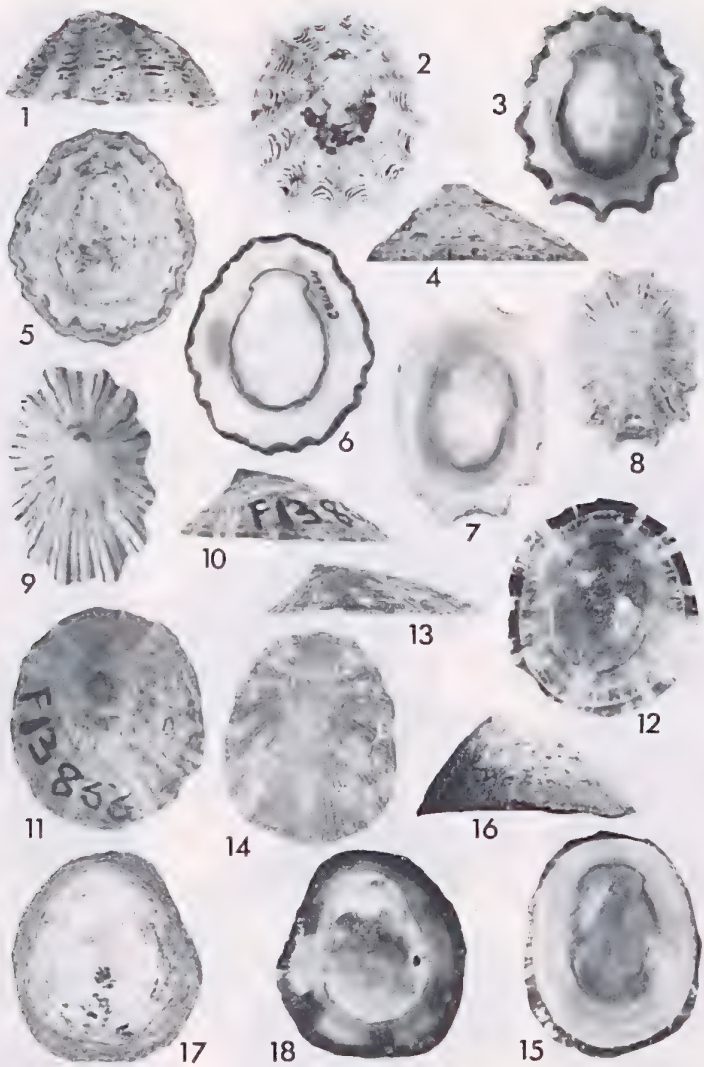

Plate 5.

1-6. *Patelloida alticostata* (Angas). 1-3. Portsea, Victoria (AMS C.90737). Height 11.9mm, length 28.9mm, width 23.5mm. 4-6. Boat Harbour, near Cronulla, New South Wales (AMS, C.84424). Height 14mm, length 40.1mm, width 34.85mm.

7-9. *Patelloida bellatula* (Iredale). Paratypes. 7. Height 5.3mm, length 15.24mm, width 10.95mm. 8. Height 4.1mm, length 12.7mm, width 9.35mm, 9. Height 2mm, length 8.02mm, width 5.5mm.

10-15. *Patelloida cryptalirata* (Macpherson). 10-12. Paratype. Height 3.4mm, length 10.3mm, width 8.9mm. 13-15. Holotype of *Chiazacmea ater* Macpherson. Height 2.75mm, length 11mm, width 8.7mm.

16-18. *Patelloida heteromorpha* (Oliver). Holotype. Height 8mm, length 18.05mm, width 15.93mm.

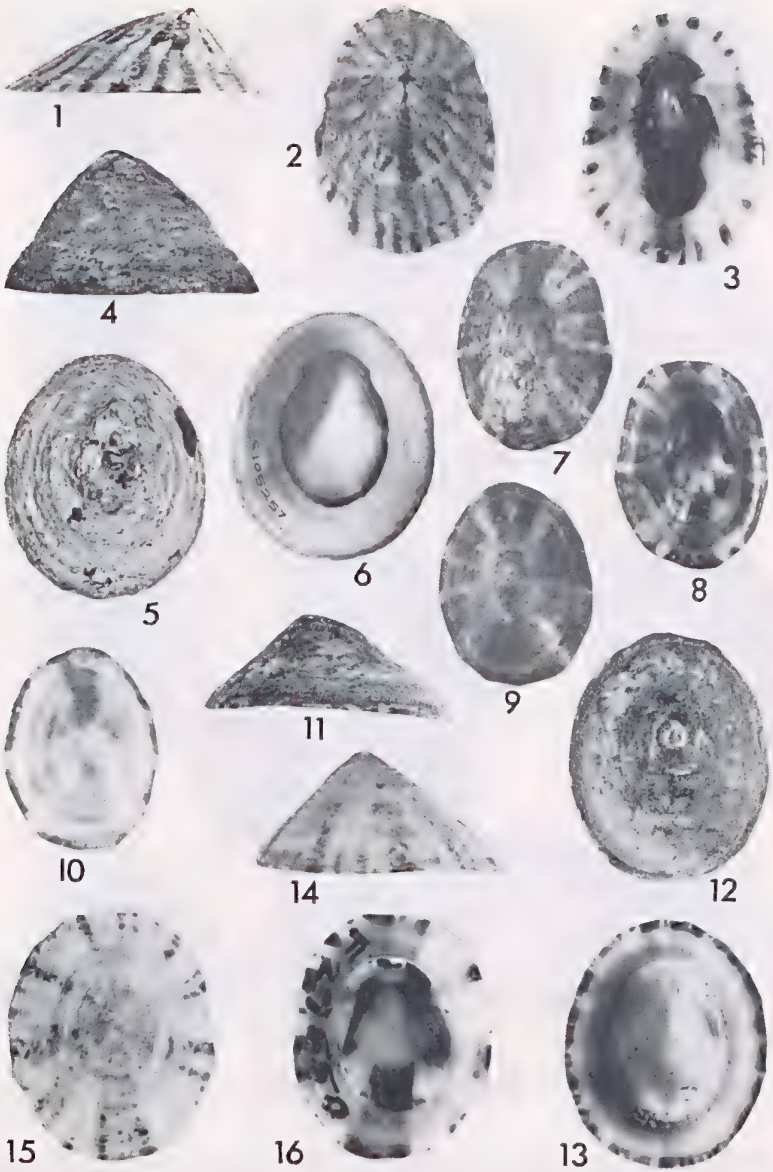

Plate 6.

1-6. *Patelloida insignis* (Menke). 1-3. Augusta, south Western Australia (AMS, C.112761). Height 8.25mm, length 20.2mm, width 15.3mm. 4-6. Lectotype of *Acmaea crucis* T. Woods. Height 17.45mm, length 31.1mm, width 25mm.

7-16. *Patelloida mimula* (Iredale). 7, 8. Lectotype of *Patella jacksoniensis* Reeve *non* Lesson = *Notoacmea mixta mimula* Iredale. Height 7.3mm, length 19.5mm, width 14.3mm. 9, 10. Paralectotype of *P. jacksoniensis* Reeve. Height 6.2mm, length 18.85mm, width 14.15mm. 11-13. Holotype of *Chiazacmea flammea queenslandiae* Oliver. Height 5.4mm, length 13.73mm, width 10.01mm. 14-16. Holotype of *Patelloida flammea marrowi* Christiaens. Height 4.7mm, length 9.5mm, width 7.6mm.

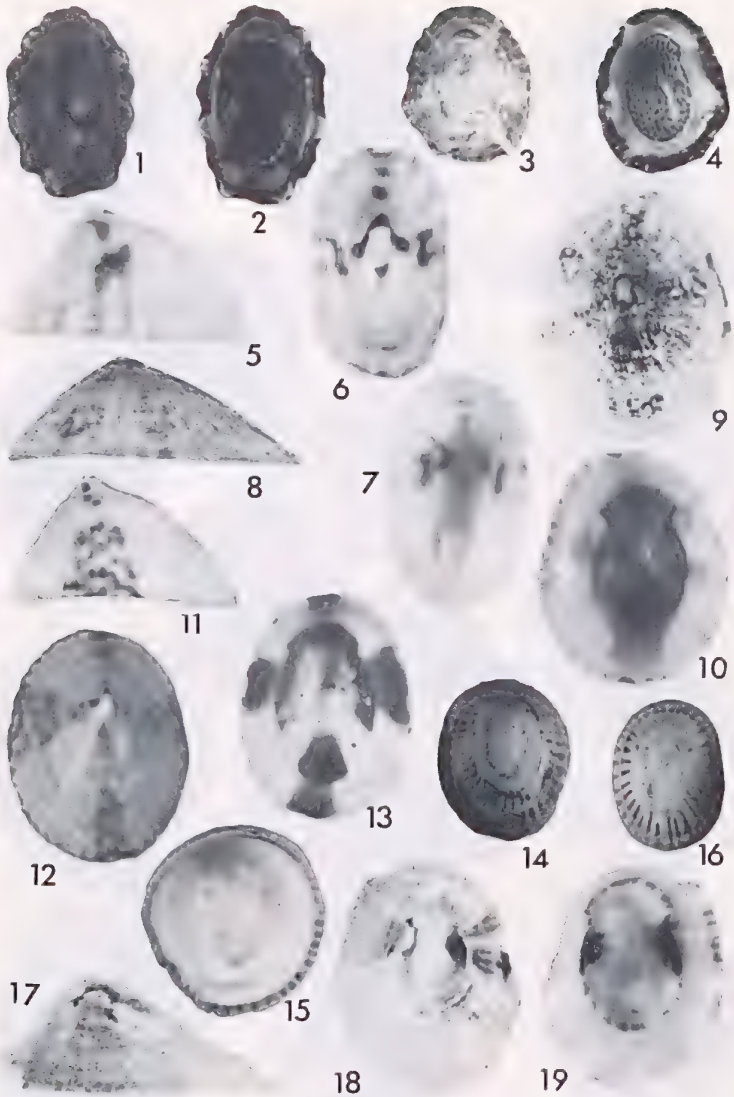

Plate 7.

1-4. *Patelloida latistrigata* (Angas). 1, 2. Holotype. Height 6.0mm, length 17.8mm, width 11.7mm. 3, 4. Lectotype of *Acmaea marmorata* var. *submarmorata* Pilsbry. Height 6.3mm, length 16.15mm, width 13.4mm.

5-13. *Patelloida mufria* (Hedley). 5-7. Lectotype. Height 2.8mm, length 5.54mm, width 3.37mm. 8-13. Long Reef, Collaroy, New South Wales (AMS, C.112762). 11-13. Height 4.55mm, length 12.56mm, width 10mm. 7-9. Height 4.27mm, length 7.6mm, width 6mm.

14-16. *Patelloida nigrosulcata* (Reeve). 14, 15. Paralectotypes. 14. Height 15.4mm, length 29.15mm, width 24.9mm. 15. Height 21.6mm, length 39mm, width 31mm, 16. Lectotype. Height 8.9mm, length 28.6mm, width 20.7mm

17-19. *Patelloida profunda ivani* Christiaens. Holotype. Height 2.65mm, Length c.6.9mm, width 5.45mm.

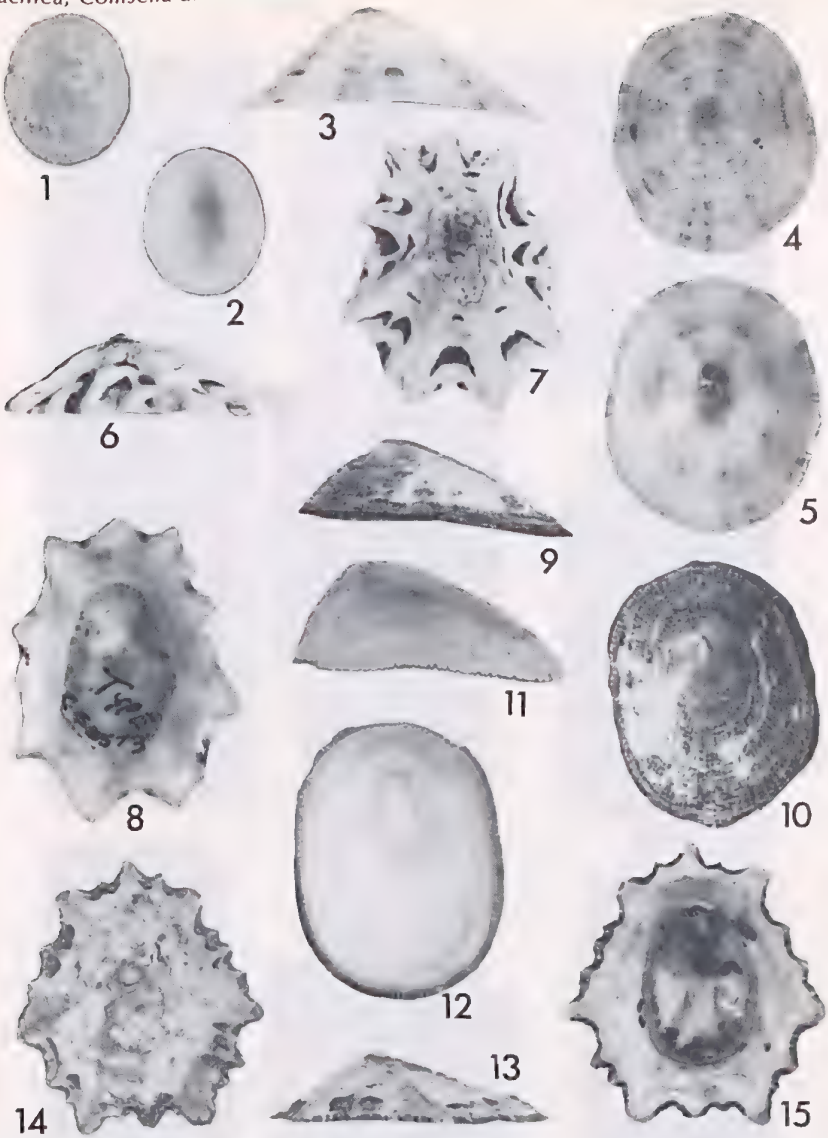

Plate 8.

1-5 *Patelloida profunda calamus* (Crosse & Fischer). 1,2. Holotype. Height 5.75mm, length 12.15mm, width 9.95mm. 3-5. Windy Harbour, south Western Australia (AMS, C.112763); a large specimen resembling the type of *A. calamus* var. *polyactina* Verco. Height 5.6mm, length 15.7mm, width 13.07mm.

6-8. *Patelloida saccharina stella* (Lesson). Holotype of *Collisellina paropsis* Iredale. Height 8.02mm, length 29.4mm, width 22.06mm.

9-12. *Patelloida victoriana* (Singleton). 9, 10. Tullaberga Island, Mallacoota Inlet, Victoria (AMS, C.93397). Height 6.2mm, length 21.2mm, width 15.85mm. 11-12. Cape Sorell, west coast, Tasmania (AMS, C.112759). Height 11.87mm, length 29.72mm, width 22.13mm.

13-15. *Lottia (?) costata* Holotype. Height 8.5mm, length 35.5mm, width 31.84mm.

Plate 9.

1-4. *Notoacmea alta* (Oliver). 1, 2. Port Lonsdale, Victoria. Small black form on shells of *Brachidontes* (Stub No. 643, C.112970) x 310. 3, 4. Eaglehawk Neck, south Tasmania. (Stub No. 644, C.112971) x 370.

5-10. *Notoacmea flammea* (Quoy & Gaimard). 5, 6. Two Peoples Bay, south Western Australia (Stub No. 679, C.112972) x 310. 7, 8. Vaucluse, Sydney, New South Wales. Flattened shells from sheltered shore (Stub No. 714, C.112973) x 310. 9, 10. Eaglehawk Neck, south east Tasmania (Stub No. 715, C.112990) x 240.

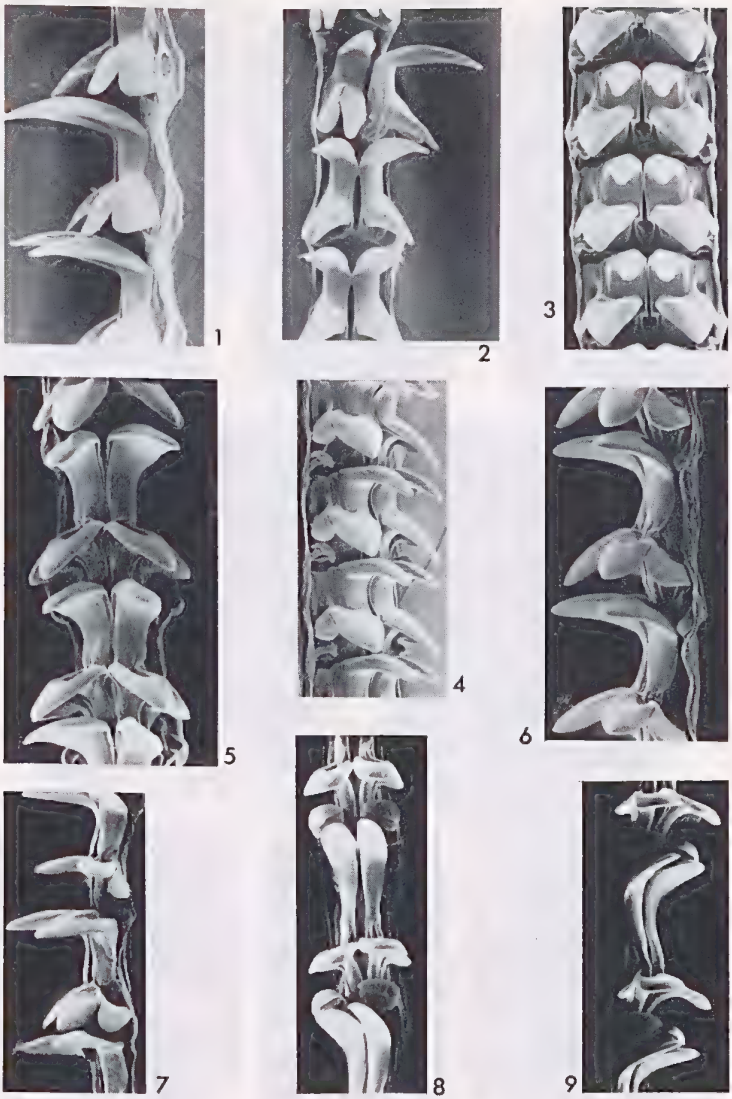

Plate 10.

1, 2. *Notoacmea petterdi* (T. Woods). Vaucluse, Sydney, New South Wales (Stub. No. 31, C.112974) x 180 (fig. 1), x 160 (fig. 2).

3, 4. *Patelloida cryptalirata* (Macpherson). Mossman, north Queensland (Stub No. 910, C.113556) x 160.

5-7. *Collisella onychitis* (Menke). 5, 6. Point Quobba, Western Australia (Stub No. 912, C.113567) x 180. 7. Dunsborough, south Western Australia (Stub No. 656, C.112975) x 120.

8, 9. *Patelloida latistrigata* (Angas). Frederick Henry Bay, south east Tasmania (Stub No. 717, C.112980) x 160.

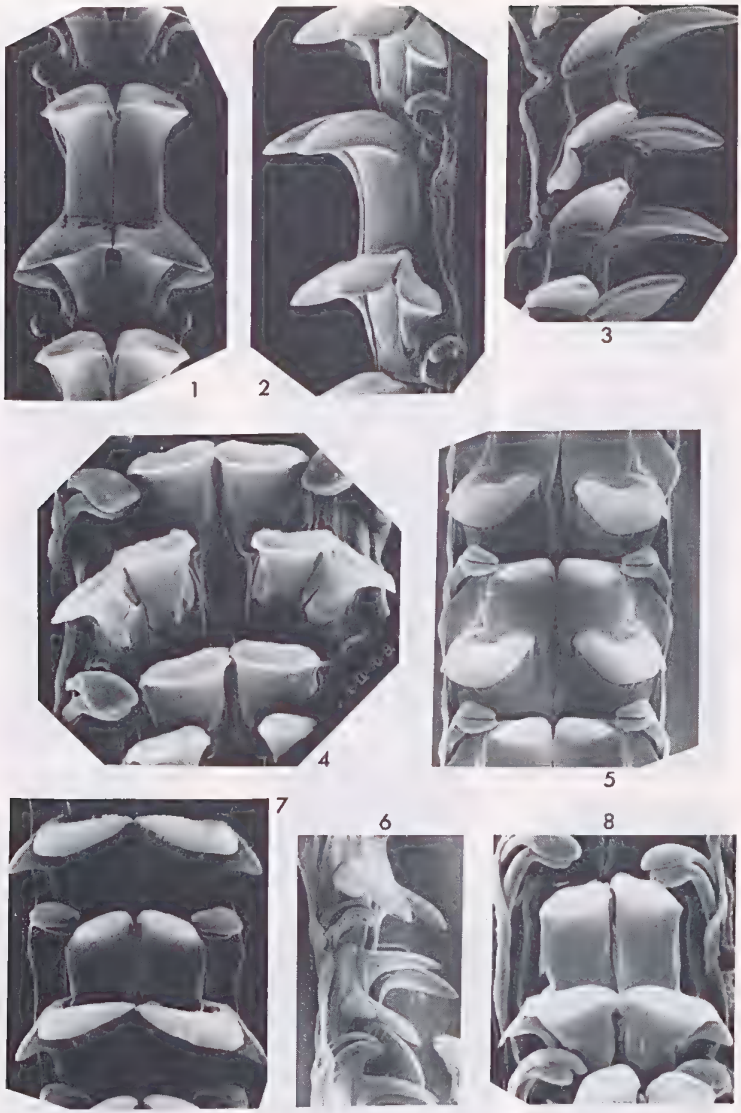

Plate 11.

1, 2. *Collisella mixta* (Reeve). Port Campbell, Victoria (Stub No. 684, C.112976) x 210.

3. *Notoacmea corrodenda* (May). Eaglehawk Neck, south east Tasmania (Stub No. 649, C.112978) x 210.

4. *Patelloida bellatula* (Iredale). Yonge Reef (east of Lizard Island), north Queensland (Stub No. 640, C.112977) x 360.

5-8. *Patelloida mimula* (Iredale). 5, 6. Tambourine Bay, Sydney Harbour, New South Wales (Stub No. 29, C.112981) x 170. 7, Maningrida, Northern Territory (Stub No. 677, C.112982) x 200. 8. Dampier, north western Australia (Stub No. 636, C.112983) x 280.

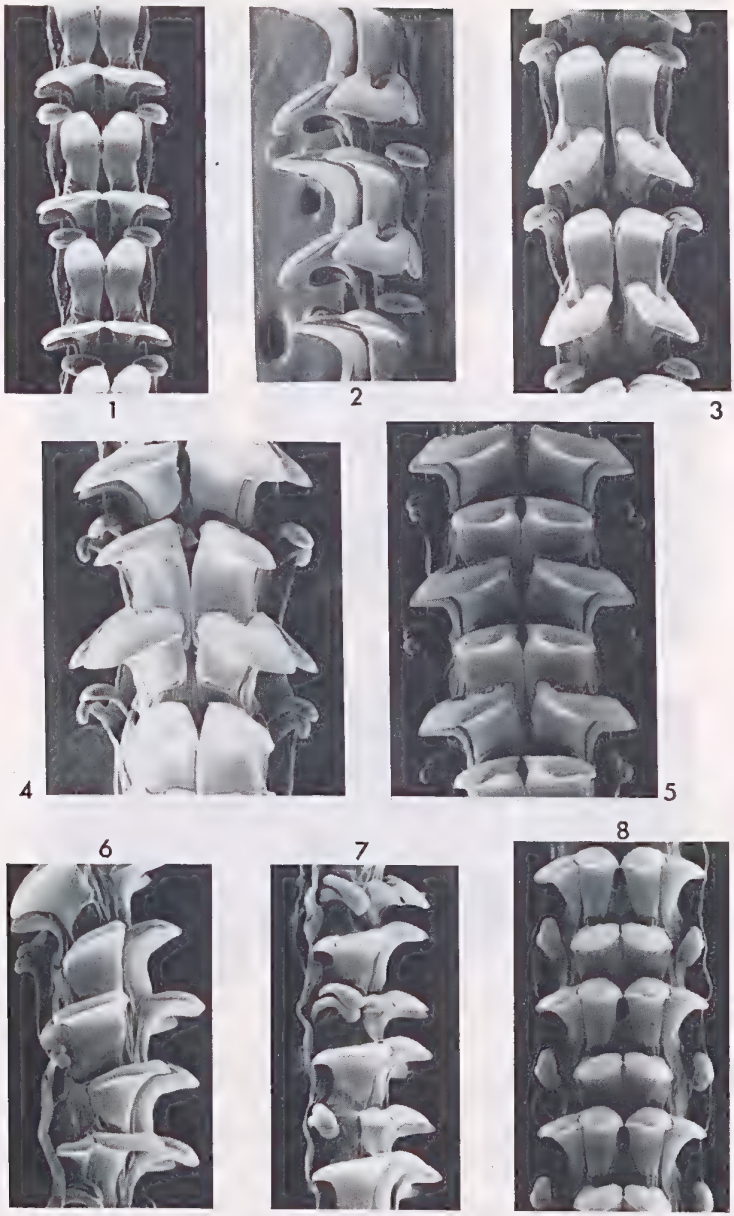

Plate 12.

1-3. *Patelloida heteromorpha* (Oliver). 1. Tannum Sands, near Gladstone, Queensland (Stub No. 907, C.113553) x 160. 2, 3. Mossman, North Queensland (Stub No. 908, C.113554) x 160. 4-6. *Patelloida insignis* (Menke). 4. Cape Naturaliste, south Western Australia (Stub No. 909, C.113555) x 190. 5, 6. Eaglehawk Neck, south Tasmania (Stub No. 655, C.112979) x 100. 7, 8. *Patelloida nigrosulcata* (Reeve). Fremantle, Western Australia (Stub No. 662, C.112985) x 100.

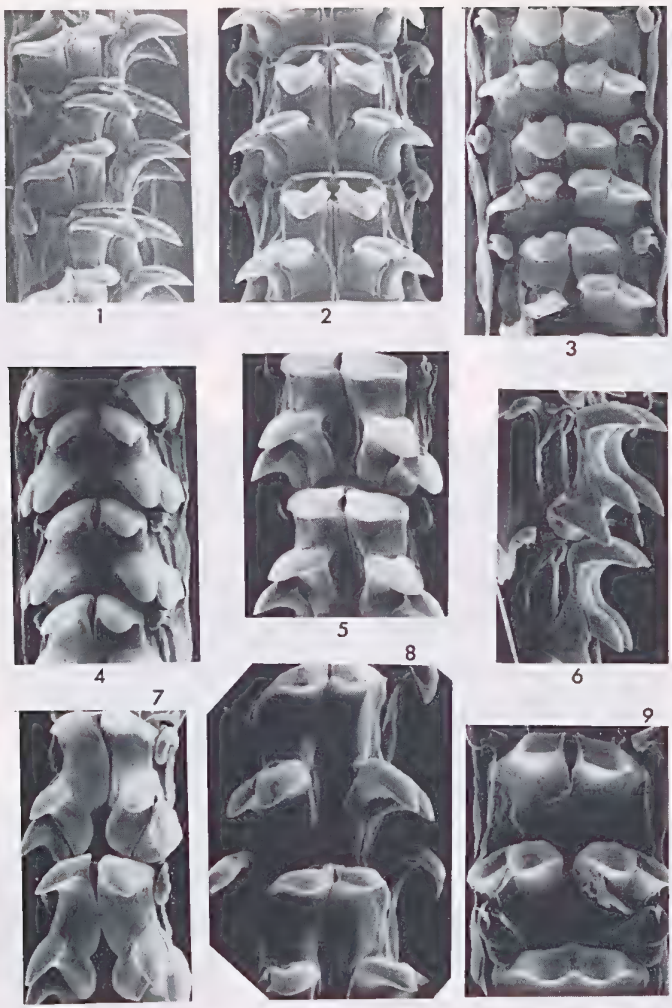

Plate 13.

1-4. *Patelloida mufria* (Hedley). 1, 2. Balmoral, Sydney, New South Wales. Small, laterally compressed, high spired form living subtidally on shells of *Thais orbita* (Gmelin) Stub No. 911, C.113557) x 310. 3. Mallacoota, Victoria. Large form living on exposed rocks. (Stub No. 653, C.112984) x 170. 4. Cape Banks, Botany Bay, New South Wales. Large form, living on exposed rocks (Stub No. 30, C.113558) x 240.

5-7. *Patelloida profunda calamus* (Crosse & Fischer). 5. Dunsborough, Western Australia (Stub No. 678, C.112986) x 160. 6, 7. American River, south Western Australia living subtidally on shells (Stub No. 632, C.112987) x 260.

8 *Patelloida profunda ivani* Christiaens. Dampier, north Western Australia (topotype) (Stub No. 633, C.112988) x 310.

9. *Patelloida profunda albonotata* (Smith). Natal, South Africa (Stub No. 676, C.112989) x 240.