REVISION OF THE AUSTRALIAN AND NEW ZEALAND TERTIARY AND RECENT TEMPERATE SPECIES OF THE FAMILY COSTELLARIIDAE (MOLLUSCA: GASTROPODA)

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Abstract. One hundred and thirteen taxa proposed either in the Mitracea or Costellariidae or subsequently referred to the latter family, have been elucidated. In this account 12 Recent and 9 Tertiary species from Australia and 5 Recent and 5 Tertiary species of Costellariidae from New Zealand are recognized as valid. *Austromitra minutenodosa* from the Great Australian Bight, South Australia, is described as new.

Species of Costellariidae are not particularly numerous in the temperate waters of the Austral-Neozelanic region and only 17 species belonging to 3 genus-groups live in that area. A fossil record of 14 species shows that there has been only an insigificant increase in the number of species since the late Tertiary. From the 113 names proposed for the group, 46 names belong to non-costellariid taxa, 36 are synonyms and 31 are considered to belong to recognized species. Australian Recent species outnumber New Zealand species *c.* 2.5:1 and Tertiary species *c.* 2:1 (Table 1).

Table 1. Number of Recent and Tertiary species of Costellariidae in Australia and New Zealand.

	Australia Recent	New Zealand Recent	Australia Tertiary	New Zealand Tertiary
(Costellaria) spp.	4	-	4	4
(Pusia) spp.	3	-	-	-
Austromitra spp.	5	5	5	1
Total	12	5	9	5

The first record of Costellariidae in the Austral-Neozelanic region was the appearance of *Austromitra* during the Upper Eocene in Australia and the later appearance of *Costellaria* species during Lower Miocene times in New Zealand and Mid-Miocene times in Australia. Although 4 *Costellaria* species are still living in Australian waters, in New Zealand the subgenus became extinct sometime during the Lower Pliocene. The three temperate water *Pusia* species from S.W. Australia must have arrived there in comparatively recent times and no *Pusia* species are known from New Zealand.

Austromitra appeared first during Upper Eocene times in Australia, during the Upper Miocene in New Zealand and during the Late Tertiary lived also in Patagonia, Sth. America and South Africa. Recent species have actually increased in numbers and continue to flourish in South Africa, Australia and New Zealand. The S.E. Atlantic species *innotabilis* E. A. Smith, 1890, has on re-examination been found not to belong to *Austromitra* but to *Vexillum (Costellaria).*

List of recognized species of Australian — New Zealand Recent temperate and Tertiary Costellariidae
(asterisk denotes fossil species)

Vexillum (Costellaria) lincolnense (Angas, 1878). Recent, S.E. Australia.
V. (C.) pellucidum (Tate, 1887). Recent, Southern Australia.
**V. (C.) leptaleum* (Tate, 1889). M. Miocene, S.E. Australia.
**V. (C.) euglypha* (Tate, 1889). M. Miocene, S.E. Australia.
**V. (C.) biornatum* (Tate, 1889). M. Miocene, S.E. Australia.
V. (C.) apicitinctum (Verco, 1896). Recent, Southern Australia.
V. (C.) acromiale (Hedley, 1915). Recent, East and Southern Australia.
**V. (C.) kalimnanense* Cernohorsky, 1970. Pliocene, S.E. Australia.
**V. (C.) neozelanicum* (Laws, 1939). L. Miocene, New Zealand.
**V. (C.) etremoides* (Finlay, 1924). L. Miocene, New Zealand.
**V. (C.) caudatum* (Marwick, 1931). L. Pliocene, New Zealand.
**V. (C.) elatior* (Finlay, 1924). Lower to M. Miocene, New Zealand.
Vexillum (Pusia) australe (Swainson, 1820). Recent, Southern Australia.
V. (P.) hansenae Cernohorsky, 1973. Recent, S.W. Australia.
V. (P.) marrowi Cernohorsky, 1973. Recent, S.W. Australia.
**Austromitra ambulacrum* (Marwick, 1927). U. Miocene, New Zealand.
A. rubiginosa (Hutton, 1873). Recent, New Zealand.
A. lawsi Finlay, 1930. Recent, New Zealand.
A. angulata (Suter, 1908). Recent, New Zealand.
A. planata (Hutton, 1885). Recent New Zealand.
A. zafra Powell, 1952. Recent, New Zealand.
A. analogica (Reeve, 1845). Recent, East and Southern Australia.
A. arnoldi (Verco, 1909). Recent, S.E. Australia.
A. volucra (Hedley, 1915). Recent, S.E. Australia.
**A. sordida* (Tate, 1889). M. Miocene to Pliocene, S.E. Australia.
**A. pumila* (Tate, 1889). U. Eocene, S.E. Australia.
**A. ralphi* (Cossmann, 1900). M. Miocene, S.E. Australia.
**A. angusticostata* Ludbrook, 1941. Pliocene, Southern Australia (only tentatively included as a valid species).
**A. lacertosa* (Cernohorsky, 1970). Miocene, S.E. Australia.
A. tasmanica (Tenison-Woods, 1876). Recent, S.E. Australia.
A. minutenodosa sp. n. Recent, Sth. Australia.

The following abbreviations have been adopted in this paper: AIM = Auckland Institute and Museum, Auckland; AMS = Australian Museum, Sydney; BMNH = British Museum (Natural History), London; CMC = Canterbury Museum, Christchurch; MHNP = Muséum National d'Histoire Naturelle, Paris; NMNZ = National Museum of New Zealand, Wellington; NMV = National Museum of Victoria, Melbourne; NZGS = New Zealand Geological Survey, Lower Hutt; SAM = South Australian Museum, Adelaide; TMAG = Tasmanian Museum and Art Gallery, Hobart; USNM = National Museum of Natural History, Smithsonian Institution, Washington, D.C.; VUW = Victoria University, Wellington; WAM = Western Australian Museum, Perth; ZMC = University Zoological Museum, Copenhagen.

The three dimensions given in the text represent in sequential order length x width x height of aperture expressed in "mm". The single measurement cited in the explanations to figures represents the length of the specimen.

Family COSTELLARIIDAE Macdonald, 1860

Genus **Vexillum** Roeding, 1798

Subgenus **Costellaria** Swainson, 1840

Costellaria Swainson, 1840, Treat. Malac. pp. 130, 320. Type species by M *Mitra rigida* Swainson, 1821 = *M. semifasciata* Lamarck, 1811. Recent, Indo-Pacific.

1840. *Callithea* Swainson, Treat. Malac. pp. 130, 320. Type species by SD (Herrmannsen, 1846) *Voluta sanguisuga* Linnaeus, 1758. Recent. (*Non Callithea* Feisthamel, 1835).

1887. *Uromitra* Bellardi, Mem. R. Accad. Sci. Torino 38: 277. Type species by SD (Harris, 1897) *U. antegressa* Bellardi, 1887. Mio-Pliocene of Europe.

1927. *Balcomitra* Finlay, Trans. Proc. N.Z. Inst. 57: 508. Type species by OD *Mitra paucicostata* Tate, 1889 (*non* Speyer, 1862) = *Vexillum (Costellaria) lacertosum* Cernohorsky, 1970. Miocene, S.E. Australia.

1929. *Arenimitra* Iredale, Mem. Queensl. Mus. 9 (3): 286. Type species by OD *A. arenosa* (Lamarck) = *Voluta exasperata* Gmelin, 1791. Recent.

1929. *Pulchritima* Iredale, Mem. Queensl. Mus. 9 (3): 287. Type species (art. 67 of ICZN) *Voluta sanguisuga* Linnaeus, 1758. Recent. (*Nom. subst. pro Callithea* Swainson, 1740).

1929. *Mitropifex* Iredale, Austral. Zool. 5 (4): 346. Type species by M *M. quasillus* Iredale, 1929 = *Mitra obeliscus* Reeve, 1844. Recent.

GEOGRAPHICAL DISTRIBUTION. Caribbean; Indo-Pacific; S.E. Australia.

STRATIGRAPHICAL RANGE. Eocene to Recent.

Four Recent endemic and 4 fossil species of the *Costellaria* group are known from southern Australia and only 4 fossil but no living species have been recorded from New Zealand. A full diagnosis of the genus and subgenus can be found in Cernohorsky (1970).

Australian species of *Vexillum (Costellaria)*

Vexillum (Costellaria) lincolnense (Angas, 1878) (Figs. 1-3)

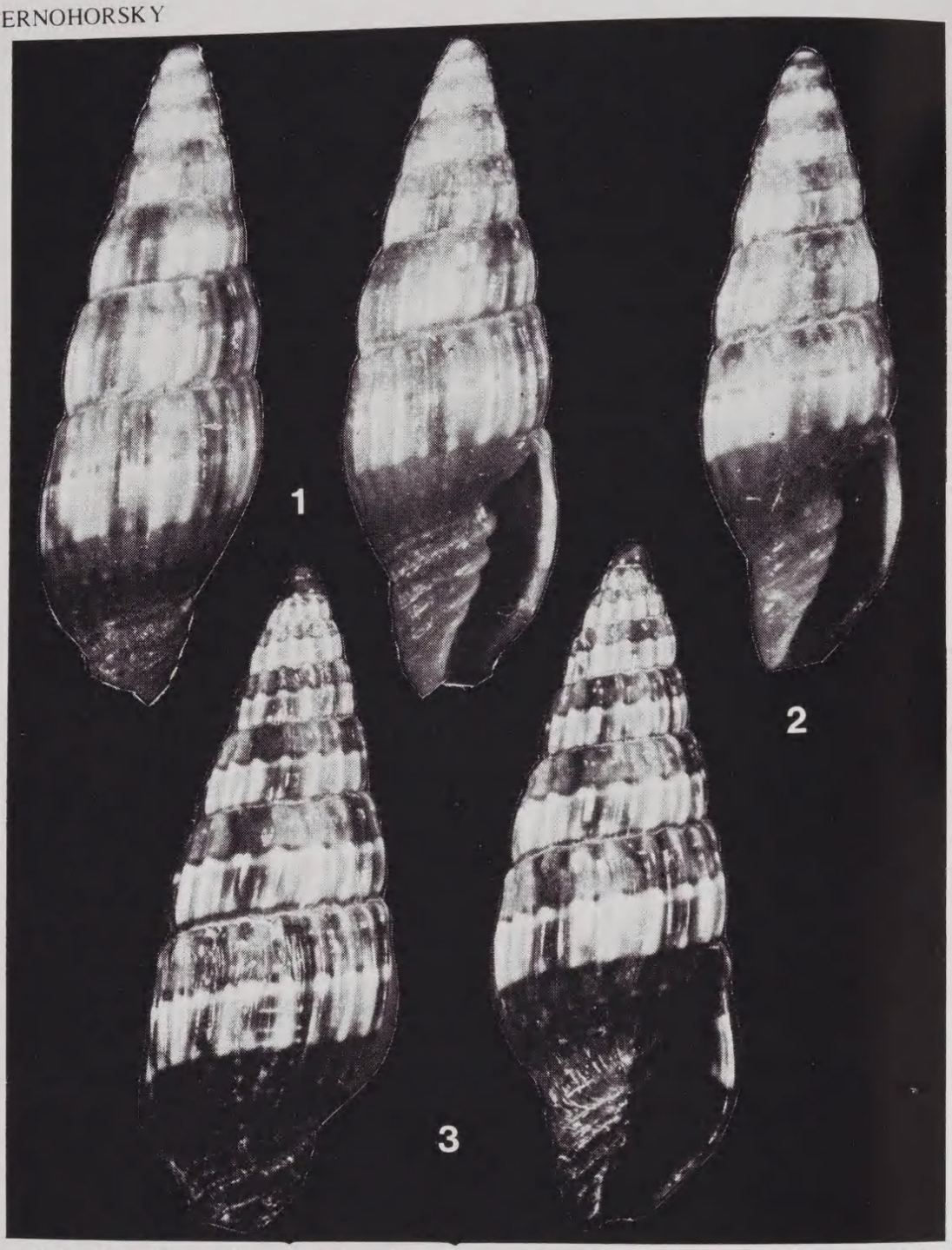
1878. *Mitra (Costellaria) lincolnensis* Angas, Proc. Zool. Soc. Lond. p. 313, pl. 18, figs. 10, 11.

1882. *Turricula (Costellaria) lincolnensis* Angas, Tryon, Man. Conch. 4: 177, pl. 52, fig. 513.

1908. *Turris lincolnensis* (Angas), Verco, Cat. mar. Moll. Sth. Aust. p. 13.

1932. *Austromitra lincolnensis* (Angas), Cotton, & Godfrey, Sth. Aust. Nat. 13 (2): 80, pl. 4, fig. 10; 1954 Macpherson, Aust. Geog. Soc. Rept. No. 1: 61; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 16; 1978 Hinton, Guide Austral. shells pl. 54, figs. 27, 27a; 1978 Ludbrook, Geol. Surv. West. Aust. Bull. 125: 158, pl. 17, figs. 15, 16.

Shell up to 17.0 mm in length, fusiformly-elongate, teleoconch of 5¾-7 weakly convex whorls, protoconch of 1½-1¾ smooth, glassy-brown embryonic whorls, sutures distinct. Sculptured with moderately regular, slender axial ribs which number from 14-19 on the penultimate and from 15-22 on the body whorl; axial ribs occasionally weakly nodulose at the body whorl suture. Spiral sculpture extremely faint or even absent. Aperture shorter than the spire, narrow, frequently lirate within, outer lip convex, columella with 4-5 prominent oblique folds, siphonal fasciole with 6-10 oblique cords. Greyish-white in colour, lower half of body whorl dark reddish-brown, sutural area with a



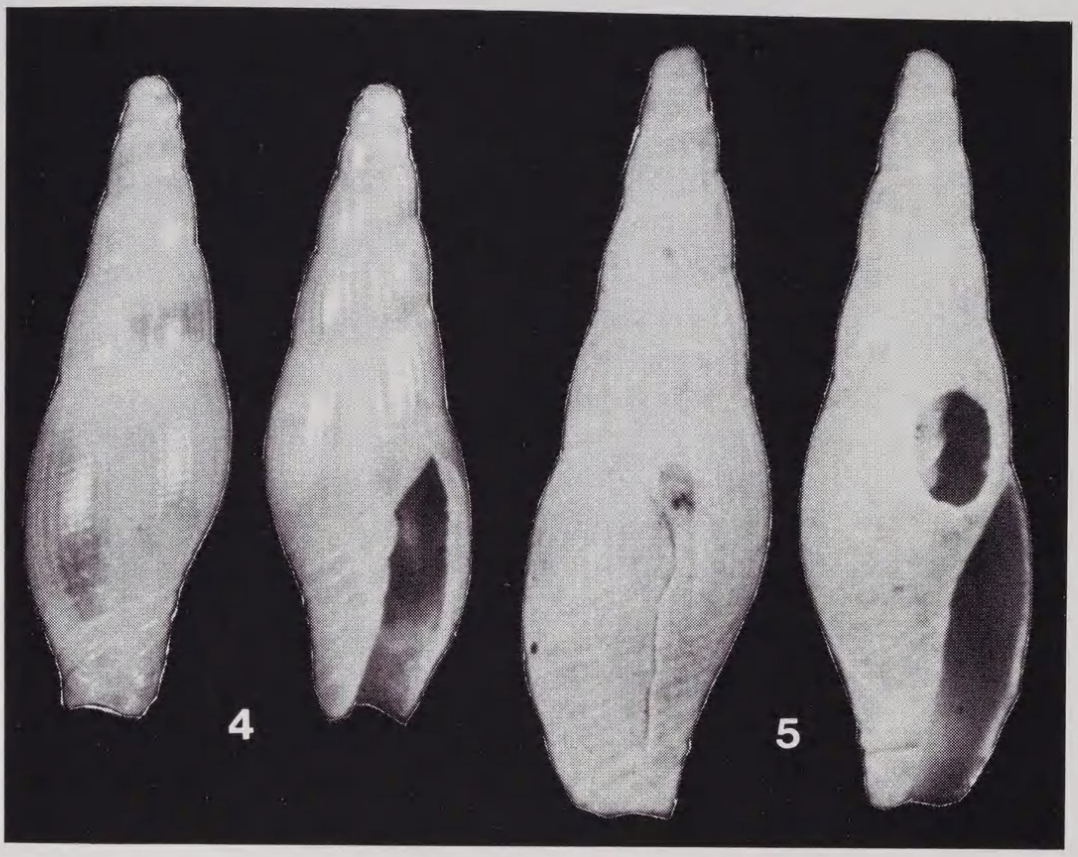
Figs. 1-3. *Vexillum (Costellaria) lincolnense* (Angas). 1. Lectotype BMNH No. 1878.4.10.2.; 14.9 mm. 2. Paralectotype, 12.9 mm. 3. Specimen from Coffin Bay, Sth. Australia; 12.8 mm.

broad, blotched reddish-brown spiral band and occasional axial streaks extending from suture to suture, interior of aperture brown and banded with white.

TYPE LOCALITY. Port Lincoln, South Australia.

DISTRIBUTION. From Adelaide, Sth. Australia to Augusta, West Australia. From the intertidal zone to a depth of 20 m, usually under rocks.

Type specimens. Two syntypes of *V. (C.) lincolnense* are in the BMNH No. 1878.4.10.2. The larger syntype, dimensions 14.9 x 5.0 x 6.4 mm, is here designated as the lectotype of *V. (C.) lincolnense* (Fig. 1).



Figs. 4-5. *Vexillum (Costellaria) pellucidum* (Tate). 4. Holotype SAM No. D-13514; 6.1 mm. 5. Paratype, 7.3 mm.

Material examined. Sth. Australia: Outer Harbour, Adelaide (AIM; AMS; USNM); Smoky Bay; Acraneens Creek near Ceduna; Pt. Brown, Sth. of Ceduna, 20 m; Coffin's Bay (all coll. Marrow); Port Lincoln (BMNH). West Australia: Esperance (AMS); Hopetoun, between Esperance and Albany (NMV; AMS); right side of lighthouse, Augusta (AMS).
Fossil record: Roe Plains, Roe Calcarenite, Eucla Basin, S.W. Australia, Early Pleistocene (Ludbrook, 1978).

This uncommon but easily recognized species appears to be intermediate in characters between *Vexillum (Costellaria)* and *Austromitra.* The elongate form, short aperture and disposition of axial ribs resembles *Costellaria,* but the lack of a distinct spiral sculpture favours a placement in *Austromitra.*

Vexillum (Costellaria) pellucidum (Tate, 1887) (Figs. 4, 5)

1887. *Mitra pellucida* Tate, Trans. Proc. R. Soc. Sth. Aust. 9: 63, pl. 4, fig. 13; 1906 Pritchard & Gatliff, Proc. R. Soc. Victoria N.S. 18 (2): 45; 1908 Verco, Cat. mar. Moll. Sth. Aust. p.13.

1932. *Mitroidea pellucida* Tate, Cotton & Godfrey, Sth. Aust. Nat. 13 (2): 82, pl. 4, fig. 7; 1951 Macpherson & Gabriel, Mem. Mus. Nat. Victoria No. 17: 134; 1962 Macpherson & Gabriel, Nat. Mus. Victoria Handb. No. 2: 209.

1957. *Mutyca pellucida* (Tate), Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 5.

Shell up to 8.0 mm in length, thin, shining and translucent, elongate-fusiform, teleoconch of 4¼-4½ almost flat or weakly convex whorls, protoconch of 1½ smooth embryonic whorls, sutures distinct and oblique. Sculptured with low, numerous and slender axial riblets which number from 19-30 on the penultimate and from 7-26 on the

body whorl; spiral sculpture consists of extremely fine macrostriae. Aperture shorter than the spire, narrow, outer lip thin, columella with 3-4 folds, siphonal fasciole with 6-7 oblique threads, siphonal notch distinct. Translucent white in colour.

TYPE LOCALITY. Fowler and Streaky Bays, Great Australian Bight, Sth. Australia.

DISTRIBUTION. From Portsea, Victoria to the Great Australian Bight, Sth. Australia.

Type specimens. The holotype and 1 paratype of *V. (C) pellucidum* are in the Tate collection, SAM No. D-13514, dimensions of holotype 6.1 x 2.0 x 2.6 mm (Fig. 4), paratype 7.3 x 2.3 x 3.0 mm (Fig. 5).

Material examined. Victoria: Portsea (coll. Marrow). Sth Australia: Fowler and Streaky Bays, Australian Bight (BMNH); Great Australian Bight, 33°05'S & 128°40'E (AMS).

The species is imperfectly known and only 6-8 specimens have been collected to date, all of them devoid of animal.

Vexillum (Costellaria) leptaleum (Tate, 1889) (Figs. 6-11)

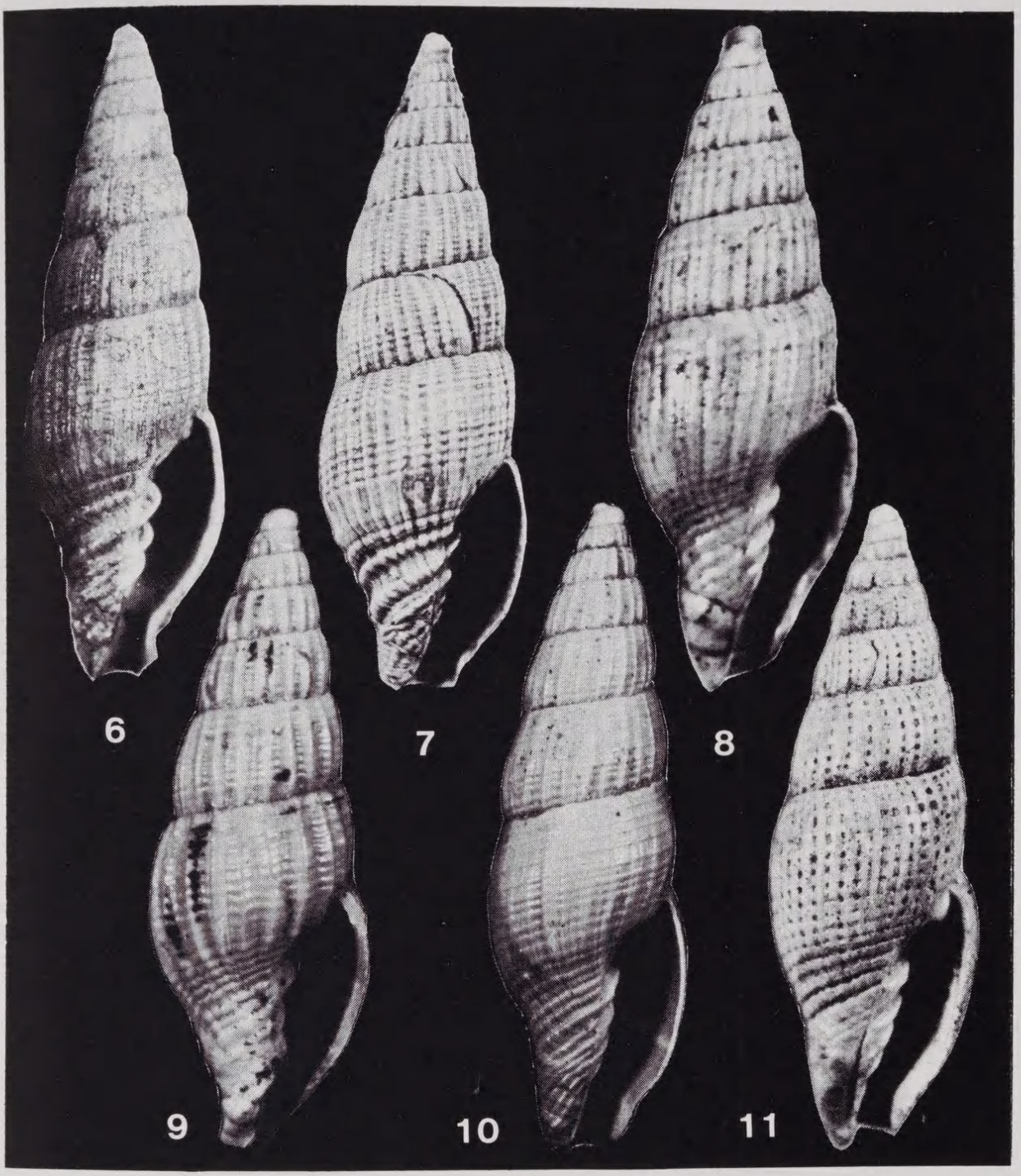
1889. *Mitra leptalea* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 140, pl. 5, fig. 3; 1893 Tate & Dennant, Trans. Proc. R. Soc. Sth. Aust. 17 (1): 220.
1889. *Mitra escharoides* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 139, pl. 5, figs. 8a, b.
1897 *Uromitra leptalea* Tate, Harris, Cat. Tert. Moll. Brit. Mus. Pt. 1: 125, pl. 5, figs. 3a, b (protoconch).
1970. *Mitropifex escharoides* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 168.
1970. *Balcomitra leptalea* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 177.

Shell up to 20.0 mm in length, fusiformly-elongate, teleoconch of 6-7 almost flat or weakly convex whorls, protoconch of 1½-2 smooth, embryonic whorls, sutures distinct. Sculptured with numerous, weak or distinct, slender axial ribs which are bisected by close-set, weak or distinct, unequal spiral threads, base of body whorl with 4-5 strong and occasionally nodulose oblique cords. Aperture shorter than the spire, smooth within in immature individuals but lirate in adults, outer lip convex and constricted basally, columella narrowly calloused and with 3-4 oblique, strong folds, parietal wall with a denticle in adult individuals; siphonal canal produced and straight, siphonal notch distinct.

TYPE LOCALITY. Lower beds at Muddy Creek, Victoria, Mid-Miocene of Australia.

Type specimens. The holotype and 13 paratypes of *V. (C.) leptaleum* are in the Tate collection, SAM No. T-629, dimensions of holotype 16.7 x 5.0 x 7.3 mm (Fig. 6). The holotype of *V. (C.) escharoides* is in the same Institution No. T-648, dimensions 16.8 x 5.6 x 7.0 mm (Fig. 11).

The species is very variable and the holotype of *V. (C.) escharoides*, which is a more mature individual than the types of *V. (C.) leptaleum*, falls clearly within the variational range of the latter species. In *V. (C.) escharoides* the spiral and axial threads are flatter and closer set and produce minute pits at the point of intersection. Since both taxa have been published simultaneously, I here select *V. (C.) leptaleum* as the name of the taxon and relegate *escharoides* Tate to its synonymy. The species appears to be the ancestral form of the Recent *V. (C.) apicitinctum* (Verco).



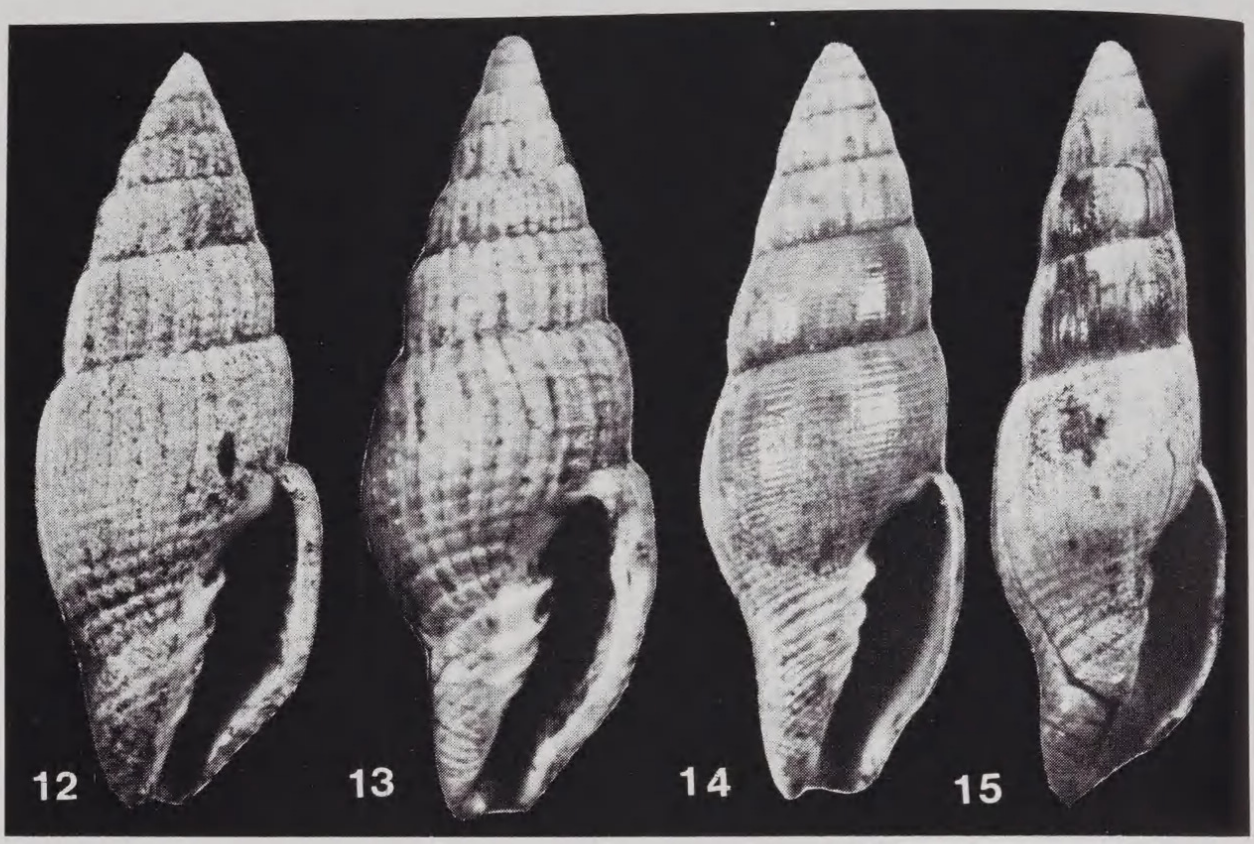
Figs. 6-11. *Vexillum (Costellaria) leptaleum* (Tate). 6. Holotype SAM No. T-629; 16.7 mm. 7. Paratype, 20.0 mm. 8. Paratype, 11.7 mm. 9, 10. Specimens from Mornington, Balcombe Bay, Victoria, Australia, M. Miocene; 12.4 mm and 13.3 mm respectively. 11. Holotype of *Mitra escharoides* Tate, SAM No. T-648; 16.8 mm.

Vexillum (Costellaria) euglypha (Tate, 1889) (Figs. 12-13)

1889. *Mitra euglypha* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 140, pl. 5, fig. 13.
1970. *Balcomitra euglypha* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 168.

The species is similar to *V. (C.) leptaleum* and differs in the following characters: the outline is broader, the protoconch has 2½ embryonic whorls, the sculptur is coarser, consisting of fewer and slightly thicker axial ribs and spiral threads, the outer lip is more angulate and the whorls have a slightly turreted appearance.

TYPE LOCALITY. Gippsland, Victoria, Miocene of Australia.



Figs. 12-15. 12, 13. *Vexillum (Costellaria) euglypha* (Tate). 12. Holotype SAM No. T-634; 15.0 mm. 13. Paratype, 12.6 mm. 14, 15. *V. (C.) biornatum* (Tate). 14. Holotype SAM No. T-646; 10.8 mm. 15. Paratype, 13.7 mm.

Type specimens. The holotype and paratype of *V. (C.) euglypha* are in the Tate collection, SAM No. T-634, dimensions of holotype 15.0 x 5.8 x 7.5 mm (Fig. 12).

This species may be the ancestral form of the Recent *V. (C.) acromiale* (Hedley).

Vexillum (Costellaria) biornatum (Tate, 1889) (Figs. 14, 15)

1889. *Mitra biornata* Tate, Trans. Proc. R. Soc. Sth. Aust. 11. 142, pl. 5, fig. 10.
1970. *Cancilla biornata* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 158.

The species is extremely similar to *V. (C.) leptaleum* in general shape, structure of whorls and apertural features. The early whorls are axially ribbed and only the last 1-2 whorls lack axial ribs which are replaced by fine spiral threads.

TYPE LOCALITY. Lower beds at Muddy Creek, Victoria, Mid-Miocene of Australia.

Type specimens. The holotype and paratype of *V. (C.) biornatum* are in the Tate collection, SAM No. T-646, dimensions of holotype 10.8 x 3.7 x 4.8 mm (Fig. 14).

In the Harris collection, Department of Palaeontology, BMNH, there is a lot of 5 specimens of *V. (C.) leptaleum* and one of the small specimens is the same form as *V. (C.) biornatum,* lacking the axial ribs on the last 2 whorls.

Figs. 16-18. *Vexillum (Costellaria) apicitinctum* (Verco). 16. Holotype SAM No. D-13510; 11.3 mm. 17. Broad, fine-ribbed form from Pt. Sinclair, Sth. Australia; 8.0 mm. 18. Broad, coarse-ribbed form from Port Lincoln, Sth. Australia; 10.5 mm.

The assignment of *biornatum* to the genus *Cancilla* Swainson, by Darragh (1970) is inappropriate since the species is axially ribbed and has a lirate aperture and clearly belongs to the family Costellariidae and not the Mitridae.

Vexillum (Costellaria) apicitinctum (Verco, 1896) (Figs. 16-18)

1896. *Turricula apicitincta* Verco, Trans. Proc. R. Soc. Sth. Aust. 20 (1): 225, pl. 8, figs. 4, 4a, b; 1908 Verco, Cat. mar. Moll. Sth. Aust. p. 13.

1932. *Austromitra apicitincta* Verco, Cotton & Godfrey, Sth. Aust. Nat. 13 (2): 79; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 14.

Shell up to 12.0 mm in length, fusiformly-elongate to elongate-ovate, teleoconch of 4½-6 weakly convex whorls, protoconch of 1½-2 smooth, glassy-brown embryonic whorls, sutures distinct. Sculptured with numerous, low, irregular and slender axial ribs which number from 19-35 on the penultimate and from 20-40 on the body whorl, axial ribs weakly constricted anteriorly to suture in some individuals; spiral sculpture consists of very fine spiral striae which number from 9-13 on the penultimate and from 12-26 on the body whorl. Aperture moderately narrow, outer lip convex, columella narrowly calloused in adult specimens and with 3-4 oblique folds, siphonal notch distinct, siphonal fasciole slightly calloused in mature adults and with 6-7 oblique cords. Greyish-white in colour, sutural area with a broad, brownish band which is frequently broken up into darker blotches, interspaces of axial ribs frequently pinkish-brown, body whorl occasionally with 2-3 very faint or distinct bands, base of shell sometimes dark brown, some individuals with a few small brown spots.

TYPE LOCALITY. Newland Head, South Australia, 20 fathoms (37 m) (locality of holotype; other locality cited was St. Vincent's Gulf, Sth. Australia, 17 fathoms (31m)).

DISTRIBUTION. From Port Stephens, N.S.W. along the South Australian coast to Cowaramup S.W. Australia. Subtidal, to 147 m, in sand, mud and gravel.

Type specimens. The holotype of *V. (C.) apicitinctum* is in SAM No. D-13510, dimensions 11.3 x 4.0 x 5.1 mm (Fig. 16). Paratypes in BMNH, 10.9 mm, 9.8 mm and 8.7 mm.

Material examined. South Australia: St. Vincent's Gulf, 31 m (SAM; BMNH); off Newland Head, 37 m (SAM); Port Lincoln; Pt. Sinclair; Smoky Bay (all coll. Marrow); off Port Lincoln, 88 m; S.W.W. of St. Francis I; St. Francis I, 20 m-30 m; 161 km E. of Salisbury, 34°13'S & 125°04'E, 123 m-125 m; Neptune I, 73 m (all AMS). New South Wales: Port Stephens (coll. Marrow). West Australia: between Eucla and Esperance, 79 m-147 m (AMS); Cowaramup (coll. Marrow).

There is a high degree of variation in shape and number of axial ribs in this species.

Vexillum (Costellaria) acromiale (Hedley, 1915) (Figs. 19-21)

1903. *Turris tasmanica* Ten. Woods, Hedley, Mem. Aust. Mus. 4 (6): 372 (*non Mitra tasmanica* Tenison-Woods, 1876).
1915. *Mitra acromialis* Hedley, Proc. Linn. Soc. N.S.W. 39: 730, pl. 84, fig. 85.
1951. *Austromitra acromialis* Hedley, Macpherson & Chapple, Mem. Nat. Mus. Victoria No. 17: 133; 1962 Macpherson & Gabriel, Nat. Mus. Victoria Handb. No. 2: 209; 1962 Iredale & McMichael, Austral. Mus. Mem. 11: 63.

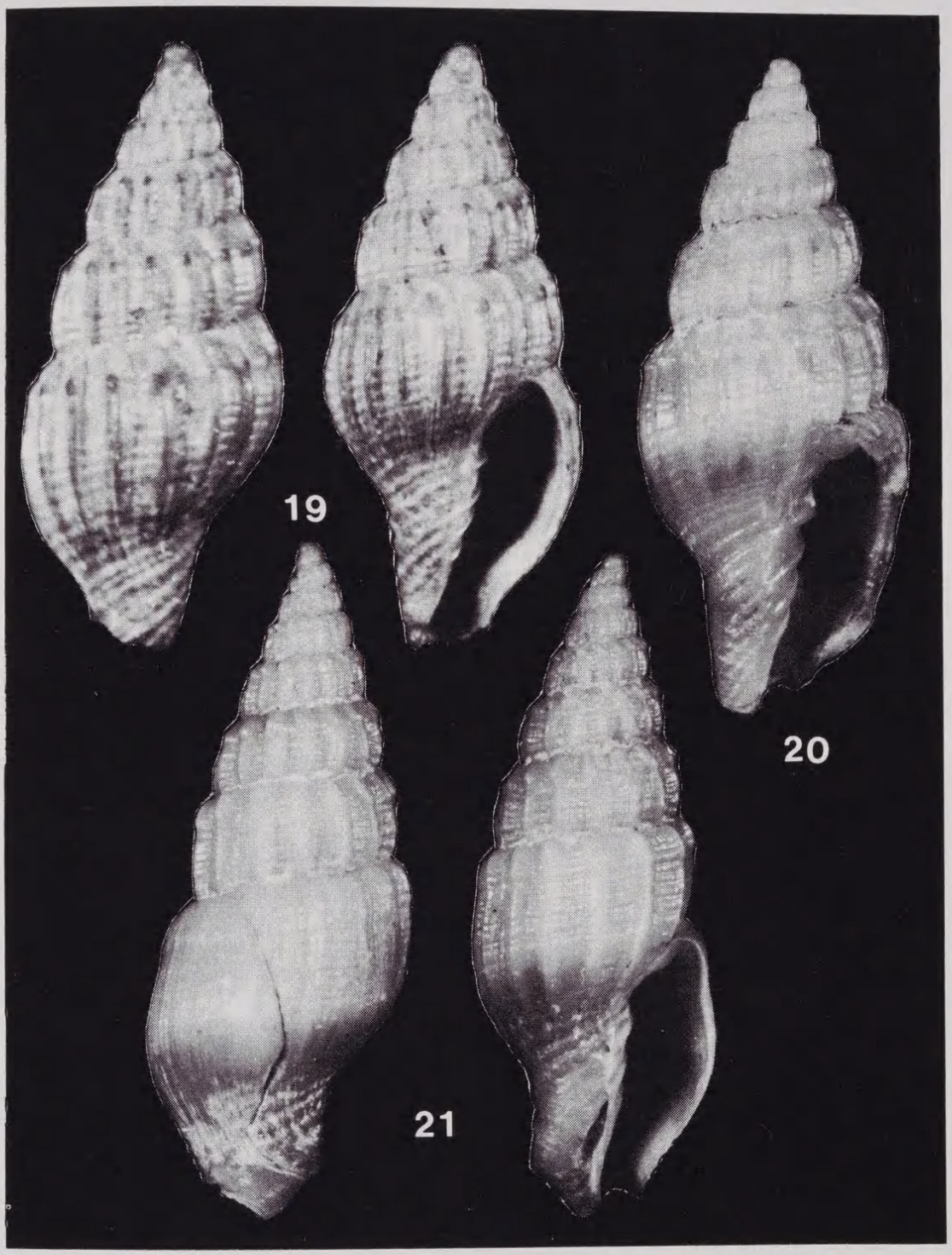
Shell up to 16.0 mm in length, adult specimens fusiformly-elongate, teleoconch of 5-7 whorls which are subangulate to almost angulate on the presutural ramp, protoconch of 1¼-1¾ smooth embryonic whorls. Sculptured with angulate axial ribs which number from 13-19 on the penultimate and from 11-19 on the body whorl, ribs becoming frequently obsolete on the dorsal side of the body whorl near the aperture; in juvenile and immature specimens the ribs on the presutural ramp are echinate but in adults they are constricted and nodose at this point. Spiral sculpture consists of fine spiral striae which number from 5-9 on the penultimate and from 9-14 on the body whorl. Aperture moderately narrow, outer lip convex in juveniles but angulate in adults, columella narrowly calloused and with 4 oblique folds, siphonal fasciole with 5-7 oblique cords. Base colour white, ornamented with 2 broad brown bands on the body whorl and a single band on spire whorls.

TYPE LOCALITY. Off Cabbage-Tree I, off Port Stephens, N.S.W., Australia, 63 m (locality of holotype).

DISTRIBUTION. From Cape Moreton, Sth. Queensland to Tasmania and along the South Australian coast to King George Sound, S.W. Australia. Subtidal, to 467 m.

Type specimens. The holotype and paratypes of *V. (C.) acromiale* are in AMS No. C-39854, dimensions of holotype 9.8 x 4.0 x 4.5 mm (juvenile — Fig. 19).

Material examined. Queensland: off Cape Moreton, 114-124 m (AMS). New South Wales: off Port Hacking, 82 m (coll. Garrard); Wooli; Cape Everard, 20 m; off Eden; Port Stephens, 80 m-100 m (all coll. Marrow); Broughton I, N. of Port Stephens, 64 m; off Port Kembla, 115 m-137 m; 26 km E. of Wollongong, 183 m; 37 km E. of Sydney, 456 m; 35 km E. of Narrabeen, 146 m; 8 km E. of Sydney Heads, 137 m; off Port Hacking, 82 m; E. of Broken Bay, 137 m; E. of Port Jackson, 118-302 m; E. of Twofold Bay, 73 m and 294 m-304 m; *c.* 32 km E. of Little Bay, Sth. Head, Sydney, 192 m-203 m; off Jibbon, Port Hacking, 80 m; off Sydney, 366 m; 1.5 km S.E. of Long Bay, Sydney, 28 m; Jervis Bay, 119 m; Crookhaven, 64 m; 3.5 km off Little Bay, Sydney, 59 m; Disaster



Figs. 19-21. *Vexillum (Costellaria) acromiale* (Hedley). 19. Holotype AMS No. C-39854; juvenile — 9.8 mm. 20 Specimen from Port Stephen, N.S.W., Australia; immature — 11.1 mm. 21. Specimen from off Eden, N.S.W., Australia, 80-100 m; adult — 15.6 mm.

Bay; 18 km N.W. of Crowdy Head, 91 m; off Ballina, 255 m; 24 km E. of Ballina, 28°49'S & 153°51'E, 185 m; E. of Bermagui, 36°27'S & 150°19'E, 321 m-381 m; off Sydney, 33°36'S & 151°19'E, 132 m; E of Brush I, Bateman's Bay, 35°28'S & 150°48'E, 448 m-467 m; E. of Green Cape, 37°21'S & 150°21'E, 330 m (all AMS). Victoria: S.E. of Lakes Entrance, 109 m and 155 m; off Cape Everard, 32 m-146 m; S. of Mt. Cann, 128 m-161 m; between Cape Howe and Lakes Entrance, 146 m-158 m; S.E. of Gabo I, 37°45'S & 150°12'E, 402 m-438 m (all AMS). Tasmania: E. of Babel I, Bass Strait; N.E. of Cape Pillar, 92 m-110 m (both AMS). West Australia: King George Sound, 22 m (AMS).

The holotype and paratypes of *V. (C.) acromiale* are immature individuals which lack the more fusiform shape, strong columellar folds, angulate outer lip and thickened siphonal fasciole of adult individuals. The species is moderately common in dredgings but live-taken specimens are rare.

Vexillum (Costellaria) kalimnanense Cernohorsky, 1970 (Figs. 22, 23)

1889. *Mitra terebraeformis* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 141, pl. 5, fig. 5 (*non* Conrad, 1848).

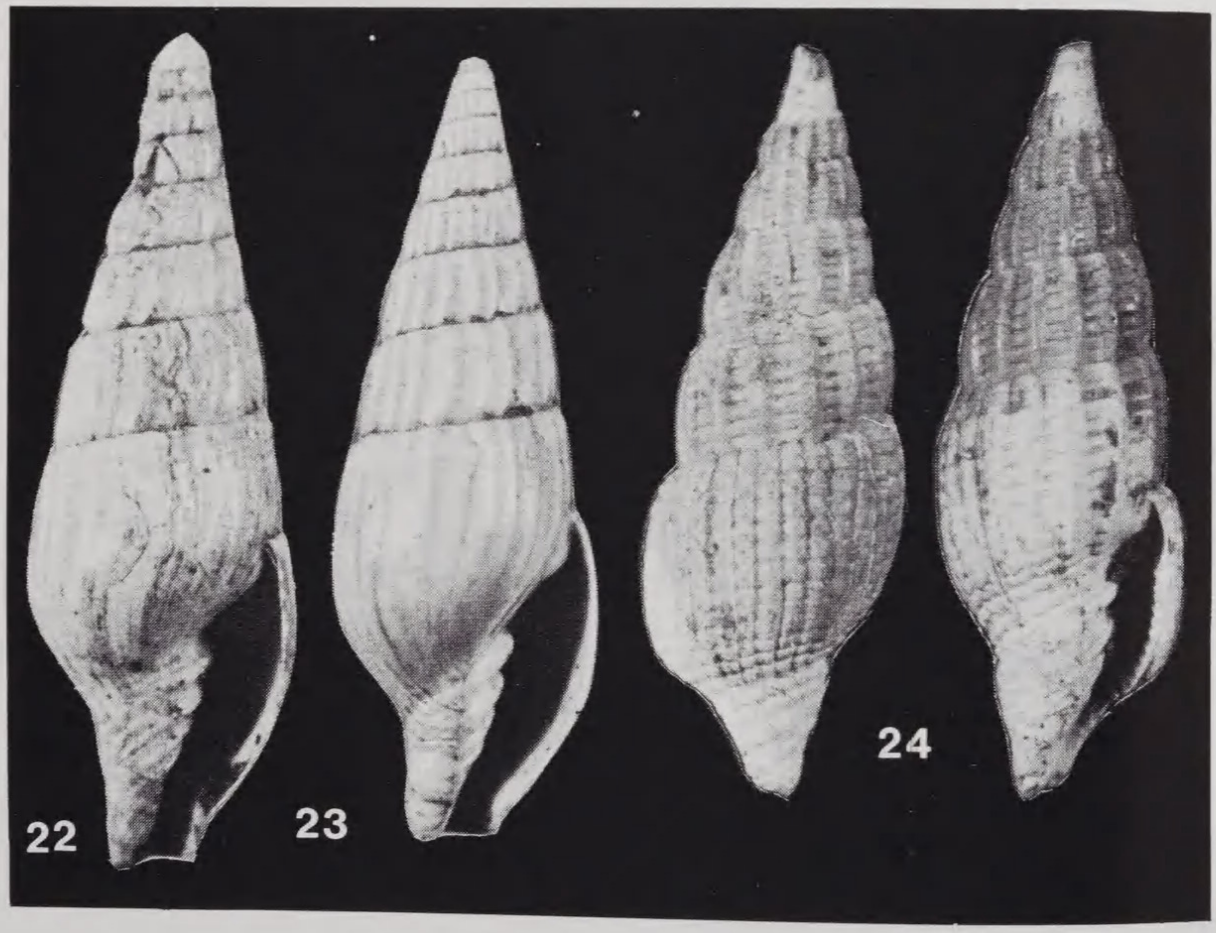
1897. *Uromitra terebriformis (sic)* Tate, Harris, Cat. Tert. Moll. Brit. Mus. Pt. 1: 128 (*non* Bellardi, 1887).

1970. *Balcomitra terebraeformis* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 201.

1970. *Vexillum (Costellaria) kalimnanense* Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 28, pl. 9, fig. 6 (*nom. subst. pro. Mitra terebraeformis* Tate, 1889).

Shell up to 20.0 mm in length, somewhat terebriform in shape, last whorl slightly inflated, smooth and shining, teleoconch of 7 almost flat-sided whorls, protoconch of 1½-1¾ smooth embryonic whorls. Sutures distinct and indented by a narrow, ill-defined subsutural band, whorls sculptured with slender, angulate and slightly curved axial ribs, interspaces smooth, base of body whorl constricted, siphonal fasciole with a few oblique cords. Aperture shorter than the spire, outer lip convex but constricted basally, columella with 4 oblique folds, siphonal canal straight.

TYPE LOCALITY. Upper beds at Muddy Creek, Victoria, Pliocene of Australia.



Figs. 22-24. 22, 23. *Vexillum (Costellaria) kalimnanense* Cernohorsky. 22. Holotype SAM No. T-626; 16.6 mm. 23. Paratype, 17.7 mm. 24. *V. (C.) neozelanicum* (Laws). Holotype NZGS No. TM-1297; 17.7 mm.

Type specimens. The holotype and 7 paratypes of *V. (C.) kalimnanense* (also of *Mitra terebraeformis* Tate) are in the Tate collection, SAM No. T-626, dimension of holotype 16.6 x 5.5 x 5.9 mm (Fig. 22).

Mitra terebraeformis Tate, 1889, being a primary homonym of *M. terebraeformis* Conrad, 1848, has been replaced with *V. (C.) kalimnanense*.

New Zealand species of *Vexillum (Costellaria)*

Vexillum (Costellaria) neozelanicum (Laws, 1939) (Fig. 24)

1939. *Uromitra neozelanica* Laws, Trans. Proc. R. Soc. N.Z. 68: 495, pl. 65, fig. 43; 1966 Fleming, N.Z. Dept. Sci. Res. Bull. 173: 65.

1970. *Vexillum (Costellaria) neozelanicum* (Laws), Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 54.

Shell *c.* 18.0 mm in length, fusiformly-elongate, teleoconch of 7 convex whorls, protoconch unknown. Sculptured with slender, angulate axial ribs which number from 14-25 on the penultimate and about 21 on the body whorl; spiral sculpture consists of finely impressed spiral grooves which produce narrow, low, flattish spiral cords which number from 7-8 on the penultimate and *c.* 15 on the body whorl. Aperture shorter than the spire, narrow, finely lirate within, columella with 4 oblique folds, siphonal canal produced, straight, and with 8-9 slightly more prominent oblique cords.

TYPE LOCALITY. Pakaurangi Point, Otaian, L. Miocene of New Zealand.

Type specimen. The holotype of *V. (C.) neozelanicum* is in NZGS No. TM-1297, dimensions 17.7 x 6.0 x 8.0 mm (Fig. 24).

Vexillum (Costellaria) etremoides (Finlay, 1924) (Figs. 25, 26)

1924. *Uromitra etremoides* Finlay, Trans. Proc. N.Z. Inst. 55: 469, pl. 50, figs. 6a, b; pl. 51, figs. 10a-c; 1966 Fleming, Bull. N.Z. Dept. Sci. Ind. Res. 173: 65.

1970. *Vexillum (Costellaria) etremoides* (Finlay), Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 54, pl. 9, fig. 10 (figd. holotype).

Shell up to 14.0 mm in length, fusiformly-elongate, teleoconch of 5-6½ convex whorls, protoconch of 3-3¼ conical, smooth, embryonic whorls, sutures distinct. Sculptured with prominently angulate, swollen and wide-spaced axial ribs which number from 6-8 on the penultimate and from 5-7 on the body whorl; spiral sculpture consists of narrow, low spiral threads which number from 6-9 on the penultimate and from 13-20 on the body whorl, cords on siphonal fasciole of the same strength as on body whorl. Aperture shorter than the spire, smooth within, columella with 3-4 folds, siphonal canal straight.

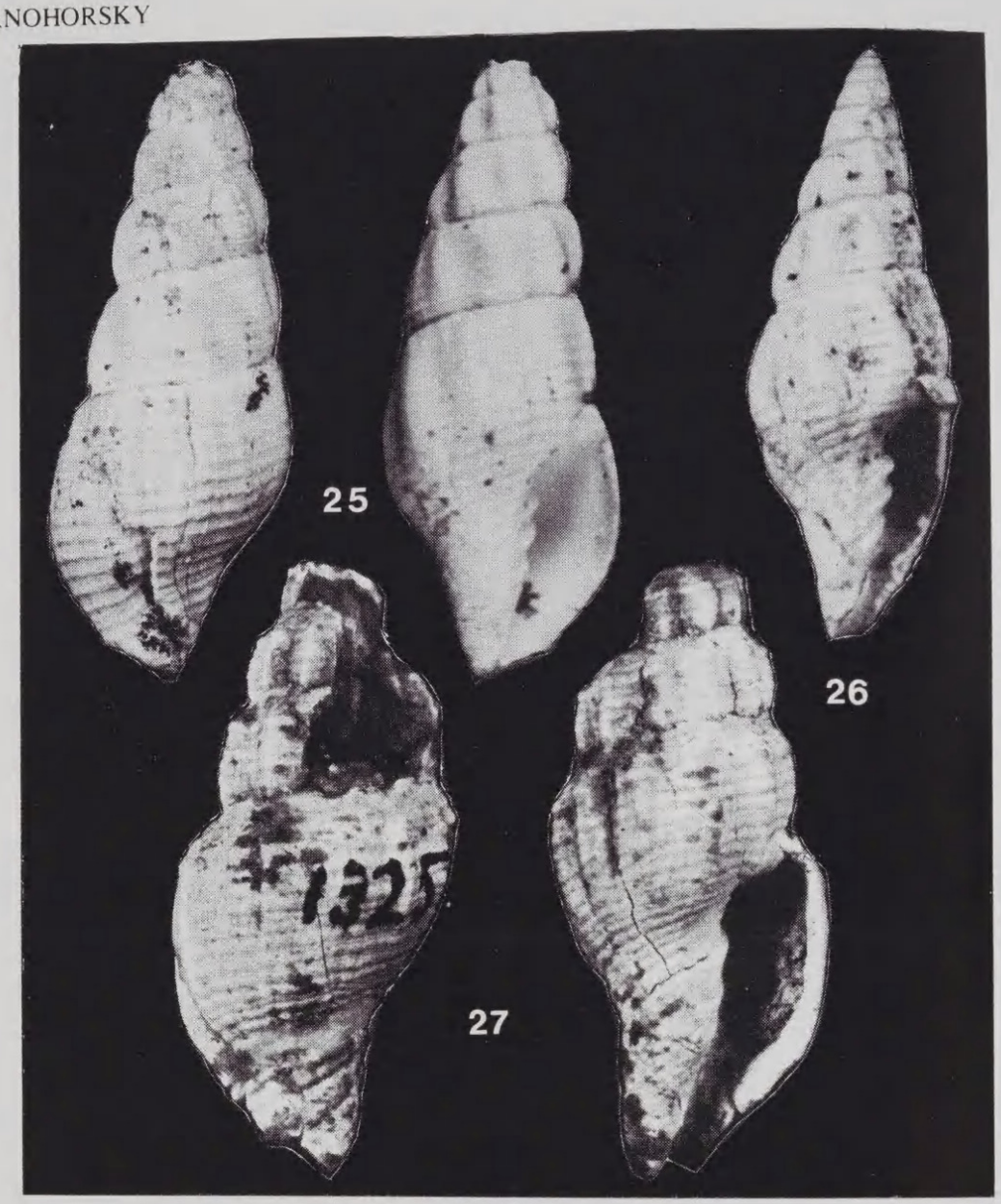
TYPE LOCALITY. Target Gully, Awamoan, L. Miocene of New Zealand.

Type specimens. The holotype and 9 paratypes of *V. (C.) etremoides* are in AIM No. TM-818, dimensions of holotype 11.1 + x 4.2 x 5.0 mm (Fig. 25).

Vexillum (Costellaria) caudatum (Marwick, 1931) (Fig. 27)

1931. *Austromitra caudata* Marwick, N.Z. Geol. Surv. Paleont. Bull. No. 13: 124, pl. 13, fig. 244; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64, pl. 113, fig. 1371; 1970 Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 57.

Shell incomplete, 12.2 mm in length, whorls incomplete, convex and subangulate on presutural ramp, 3¼ whorls present. Sculptured with angulate axial ribs which number *c.* 10 on the body whorl, ribs tending to be obsolete on the dorsal side of the body whorl;



Figs. 25-27. 25, 26. *Vexillum (Costellaria) etremoides* (Finlay). 25. Holotype AIM No. TM-818; 11.1 + mm. 26. Paratype, 7.0 mm. 27. *V. (C.) caudatum* (Marwick). Holotype NZGS No. GS-1325; 12.2 + mm.

spiral sculpture consists of well-defined, narrow spiral cords which number 7 on the penultimate and 21 on the body whorl, cords on siphonal fasciole more prominent. Outer lip angulate, columella not calloused and with 4 oblique folds, siphonal canal produced and slightly recurved.

TYPE LOCALITY. Waikohu district, Ormond series, Opoitian, L. Pliocene of New Zealand.

Type specimens. The holotype of *V. (C.) caudatum* is in NZGS No. GS-1325, dimensions 12.2 + x 5.5 x 7.0 mm (Fig. 27).

The produced siphonal canal and prominent spiral sculpture are features which are more compatible with the *Costellaria* group of species rather than *Austromitra,* and pending discovery of complete specimens, the species is tentatively assigned to *Vexillum (Costellaria).* The species bears a superficial resemblance to the Australian Recent species *V. (C.) acromiale* (Hedley). Fleming (1966) reported *V. (C.) caudatum* from the Upper Miocene to the Lower Pliocene.

Vexillum (Costellaria) elatior (Finlay, 1924) (Figs. 28-30)

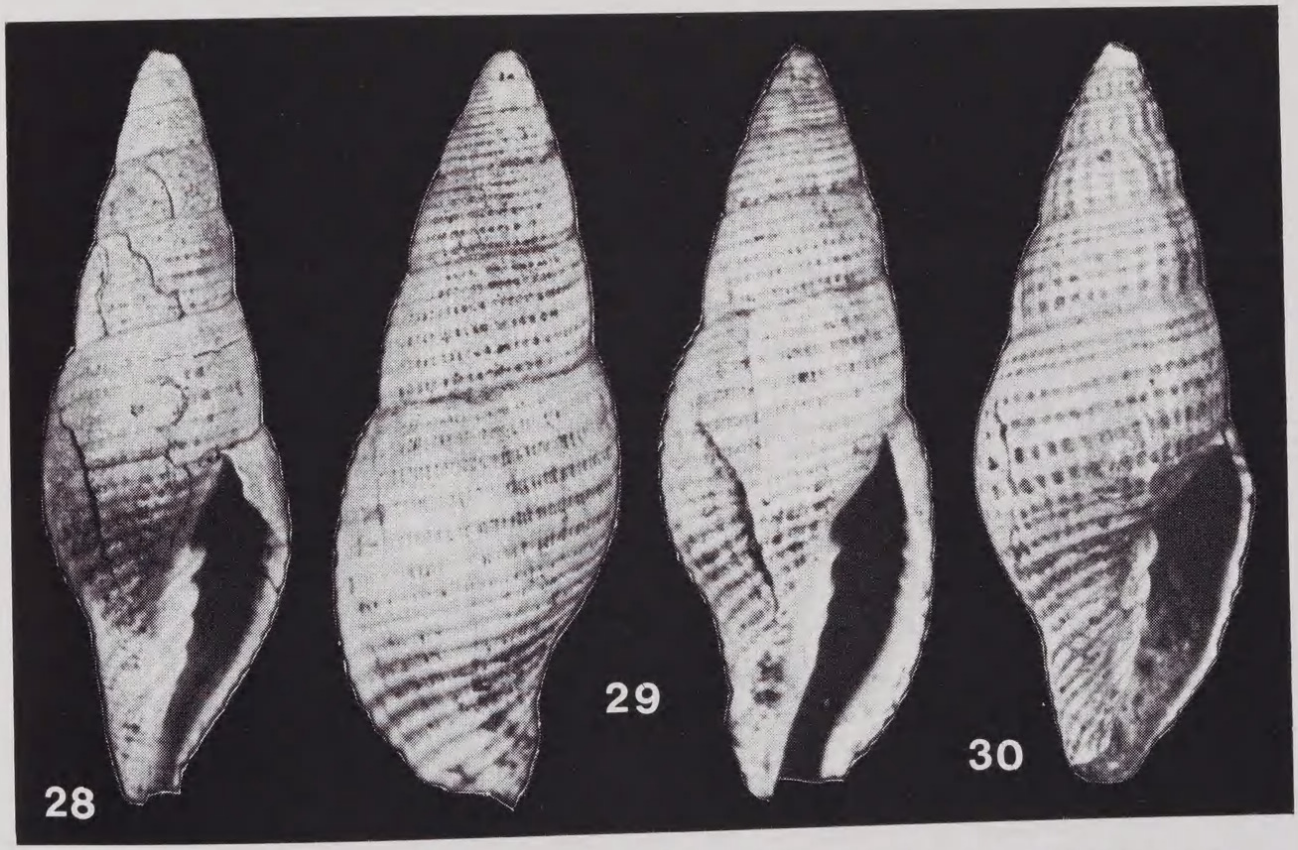
1924. *Mitra elatior* Finlay, Trans. Proc. N.Z. Inst. 55: 469, pl. 50, figs. 5a, b; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64.

1970 *Mitra (Nebularia) elatior* Finlay, Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 36, pl. 2, fig. 11.

Shell up to 19.0 mm in length, fusiformly-elongate, teleoconch of 5-6 slightly convex whorls, protoconch of 3¼-4 smooth, conical embryonic whorls. Sculpture consists of narrow, flat spiral cords which number from 5-7 on the penultimate and from 17-20 on the body whorl; interspaces either pitted or with numerous axial striae, surface of shell with some longitudinal growth-striae, rare individuals with axial ribs on spire whorls. Aperture equal in height or slightly longer than the spire, narrow, distinctly lirate within, outer lip regularly convex, columella with 4-5 (one specimen with 6) oblique folds, siphonal canal produced and straight.

TYPE LOCALITY. Clifden, Southland, Altonian, M. Miocene of New Zealand.

Type specimens. The holotype and numerous paratypes of *V. (C.) elatior* are in AIM No. TJ-479, dimensions of holotype 18.7 x 6.2 x 9.2 mm (Fig. 28).



Figs. 28-30. *Vexillum (Costellaria) elatior* (Finlay). 28. Holotype AIM No. TM-479; immature — 18.7 mm. 29. Paratype, 14.0 mm. 30 Axially ribbed specimen from Clifden, Miocene of New Zealand; 9.5 mm.

The presence of apertural lirae, which never occur in species of Mitridae, and the rare occurence of axial ribs on the spire whorls, necessitate a re-assignment of *elatior* from the Mitridae to the Costellariidae. Although almost all specimens examined lacked axial ribs, one Clifden individual had well-developed ribs on 3½ post-embryonic whorls, ribs later became weak on the last half of the penultimate whorl and absent on the body whorl (Fig. 30).

Subgenus **Pusia** Swainson, 1840

Pusia Swainson, 1840, Treat. Malac. p. 320. Type species by M *M. microzonis* (Lamarck) = *Mitra microzonias* Lamarck, 1811. Recent, Indo-Pacific.

1917. *Ebenomitra* Monterosato, Boll. Soc. Zool. Ital. 4: 26. Type species by SD (Coan, 1966) *Mitra ebenus* Lamarck, 1811. Recent.
1917. *Pusiola* Monterosato, Boll. Soc. Zool. Ital. 4: 26. Type species by M *Voluta tricolor* Gmelin, 1791. Recent (*non* Wallengren, 1863).
1921. *Pusiolina* Cossmann, Rev. Crit. Paleozool. 25 (2): 79. Type species (art. 67i of ICZN) *Voluta tricolor* Gmelin, 1791. (*Nom. subst. pro Pusiola* Monterosato, 1917).
1921. *Idiochila* Pilsbry, Proc. Acad. Nat. Sci. Philad. 72: 311. Type species by OD *Mitra turben* Reeve, 1844. Recent.
1968. *Ebenomitra* Nordsieck, Europ. Meeres-Gehauseschecken 1: 149. Type species by OD *Mitra ebenus* Lamarck, 1811. Recent (established as a new subgenus of *Mitra*).
1970. *Pusidina* Parenzan, Carta ident. conch. Medit. p. 189 (*nom. nudum*).

GEOGRAPHICAL DISTRIBUTION. Mediterranean; East Atlantic; Caribbean; Indo-Pacific; Southern Australia.

STRATIGRAPHICAL RANGE. Eocene to Recent.

A detailed definition of the genus-group has been given by Cernohorsky (1970). Three Recent endemic species of the *Pusia* group are confined to the southern part of Australia and no Recent species are known from New Zealand.

Australian species of *Vexillum (Pusia)*

Vexillum (Pusia) australe (Swainson, 1820) (Figs. 31-35, 40)

1820. *Mitra australis* Swainson, Zoolog. Illust. (1), 1: pl. 18, centre figs.; 1844 Reeve, Conch. Iconica 2: pl. 16, fig. 118; 1874 Sowerby, Thes. Conchyl. 4: 6, pl. 363, fig. 182; 1877 Tenison-Woods, Proc. R. Soc. Tasmania p. 8; 1899 Pritchard and Gatliff, Proc. R. Soc. Victoria, N.S. 11 (2): 185; 1908 Verco, Cat. mar. Moll. Sth. Aust. p. 13; 1921 May, Check-list Moll. Tasmania p. 79; 1923 May, Illust. Ind. Tasman. shells p. 79, pl. 37, fig. 11; 1923 May, Pap. Proc. R. Soc. Tasmania p. 54; 1932 Cotton and Godfrey, Sth. Aust. Nat. 13 (2): 77, pl. 4, fig. 2; 1936 Gabriel, Victorian Seashells p. 14, textfig.; 1940 Cotton and Godfrey, Sth. Aust. Nat. 20 (4): 12, textfig.; 1951 Macpherson amd Chapple, Mem. Nat. Mus. Victoria No. 17: 133, 1954 Macpherson, Austral. Geog. Soc. Repts. No. 1: 61.
1833. *Mitra melaleuca*Quoy and Gaimard, Voy. l'Astrolabe 2 (2): 657, pl. 45 bis, figs. 26, 27; 1838 Kiener, Spec. gen. icon. coq. viv. 3: 34, pl. 11, fig. 34.
1874. *Mitra kieneri* Sowerby, Thes. Conchyl. 4: 32, pl. 357, fig. 324 (*non* Philippi, 1850).
1896. *Mitra vincentiana* Verco, Trans. Proc. R. Soc. Sth. Aust. 20 (2): 223, pl. 8, fig. 3; 1899 Pritchard and Catliff, Proc. R. Soc. Victoria, N.S. 11 (2): 186; 1908 Verco, Cat. mar. Moll. Sth. Aust. p. 13 (*non M. vincentiana* Cossmann, 1881).
1920. *Vexillum australe* Swains., Cooke, Proc. Zool. Soc. Lond. for 1919: 419, text fig. 18 (radula).
1922. *Pusia australis* Swainson, Peile, Proc. Malac. Soc. Lond. 15: 94.
1957. *Vicimitra australis* (Swainson), Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 1.
1957. *Austromitra vincentiana* Verco, Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 18.
1962. *Eumitra australis* (Swainson), Macpherson and Gabriel, Nat. Mus. Vict. Hanb. No. 2: 210, fig. 251; 1971 Wilson and Gillett, Austral. Shells p. 118, pl. 76, fig. 6.
1970. *Vexillum (Pusia) australe* (Swainson), Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 22, fig. 147 (radula); 1978 Hinton, Guide Austral. shells, pl. 54, fig. 20.
1975. *Pusia australae (sic)* Swainson, Coleman, What shell is that, p. 74, fig. 218.
1978. *Mitra (Eumitra) australis* Swainson, Ludbrook, Geol. Surv. West. Aust. Bull. 125: 159, pl. 18, figs. 1, 2.

Shell up to 60.0 mm in length but frequently smaller, fusiformly-elongate to elongate-ovate, teleoconch of 9-10 weakly convex whorls, protoconch usually missing, sutures deeply impressed. Sculptured with moderately thick axial ribs on the early spire whorls, ribs becoming indistinct to obsolete on the last 3-5 whorls and sometimes only visible as very weak axial folds or longitudinal lirae. Spiral sculpture consists of spiral threads which number from 4-13 on the penultimate and from 6-22 on the body whorl; in some individuals the spiral threads are subdued and in others they are more prominent and most distinct anteriorly to the sutures. Aperture shorter than the spire, frequently lirate within, outer lip convex, columella not calloused and with 4-5 very strong oblique folds, siphonal fasciole with 7-10 oblique cords, siphonal notch distinct. Usually brown in colour, spire whorls with a single narrow whitish band or rarely blotches, body whorl with a white central band and occasionally small, dark brown spots, columella folds sometimes whitish; some individuals are uniformly dark brown. The periostracum is thin, brown and opaque.

TYPE LOCALITY. Van Diemans Land (*australe*); probably Port Roi Georges, New Holland (*melaleuca*); none (*kieneri*); Investigator's Straits, Sth. Australia, 13-15 fathoms (24-27 m) (*vincentiana*).

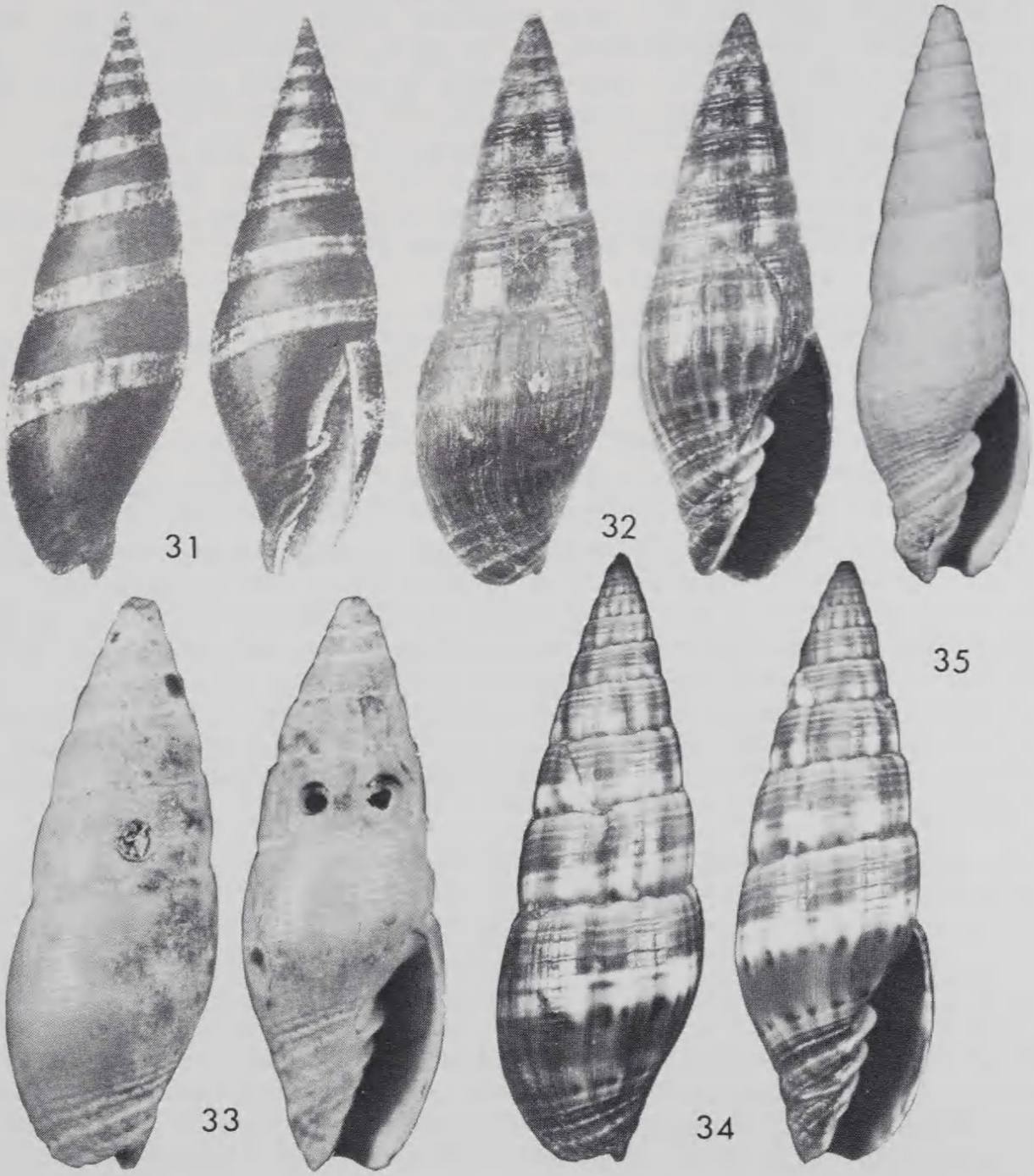
DISTRIBUTION. From Waratah Bay, Victoria to Tasmania and along the South Australian coast to Exmouth Gulf, West Australia. On reef-flats and under stones, from the intertidal zone to a depth of 33 m. Species dredged from 73 m were collected devoid of animal.

Type specimens. The original type of *Mitra australis* ex-coll. Humphrey can no longer be traced. The original 2 figures in vol. I, pl. 18, centre figures from Swainson (1820-1833) are here designated as the illustrated lectotype (Fig. 31). The type of *M. melaleuca* is in the MNHP and the holotype of *M. kieneri* Sowerby (*non* Philippi) in BMNH No. 1879.2.26.128., dimensions 32.4 x 10.8 x 14.9 mm (Fig. 32). The holotype and paratypes of *M. vincentiana* Verco (*non* Cossmann) are in SAM No. D-13508, dimension of holotype 19.0 x 8.8 x 10.8 mm. They are beach-worn, faded specimens and the holotype has 2 holes on the ventral side and 1 hole on the dorsal side of the penultimate whorl (Fig. 33).

Material examined. Victoria: Port Fairy (AIM); Western Port (coll. Clover); Airey's Inlet; Balnering; Somers; 2 km E. of Cape Liptrap, Waratah Bay, 30 m (all coll. Marrow); Mallacoota; Lorne; Flinders, Western Port Bay; Pt. Leo, Western Port Bay; Portsea; Port Fairy (all AMS). Tasmania: Kelso (AIM); Wynyard beach; Brickmaker's beach near Rocky Cape; near Somerset; E. of King I, Bass Str., 40°00'S and 144°14'E, 33 m; S. of Currie Harbour, King I, Bass Str. (all AMS). Sth. Australia: Kings Beach near Rosetta Heads (USNM); Outer Harbour, Adelaide (AIM; AMS); Wallaroo (coll. Clover); Port MacDonnell (coll. Marrow); Glenelg beach near Adelaide; St. Vincent's Gulf; Scales Bay; Holiday Land, Port Lincoln (all AMS); Investigator's Straits, 24 m-27 m (SAM). West Australia: Cheyne Beach, E. of Albany; Rottnest I; Cape Vlaming; Port Gregory; Cowaramup Bay (all WAM); Yallup; Margaret River (both coll. Clover); Albany (WAM); Exmouth Gulf (coll. Marrow); King George Sound; Hopetoun; Cape Riche, 113 km E. of Albany (all AMS).
Fossil record: Pit 0.64 km N. of Hampton repeater tower, Roe Plain, Roe Calcarenite, Eucla Basin, Early Pleistocene of S.W. Australia (WAM).

Ludbrook (1978) placed *australe* in the genus *Mitra* Lamarck, family Mitridae, but the axial ribs, lirate interior of aperture and type of radula (Fig. 40) clearly demonstrate

that the species belongs in the subgenus *Pusia*, family Costellariidae. Like most other *Pusia* species, *V. (P.) australe* is very variable in form, some individuals being broad and squat, others fusiformly elongate.



Figs. 31-35. *Vexillum (Pusia) australe* (Swainson). 31. Illustrated lectotype from Swainson, 1820, pl. 18, centre figures. 32. Holotype of *M. kieneri* Sowerby, BMNH No. 1879.2.26.128.; 32.4 mm. 33. Holotype of *M. vincentiana* Verco, SAM No. D-13508; 19.9 mm. 34. Specimen from Pt. Nepean, Queenscliff, Victoria, Australia; 33.0 mm. 35. Specimen from Roe Calcarenite, Madura dist., Eucla Basin, E. Pleistocene of S.W. Australia; 27.3 mm.

Vexillum (Pusia) hansenae Cernohorsky, 1973 (Figs. 36, 37)

1973. *Vexillum (Pusia) hansenae* Cernohorsky, Rec. Auckland Inst. Mus. 10: 138, figs. 13-16.

Shell up to 21.0 mm in length but usually smaller, variable in form, elongate-ovate to fusiformly-elongate. Teleoconch of 4-6 convex whorls, protoconch of 1-1½ smooth and slightly globose embryonic whorls; sculptured with broad, irregular, ill-developed flattish axial folds numbering 12-21 on the penultimate and 2-15 on the body whorl. Spiral sculpture not visible to the naked eye, base of body whorl with 6-14 oblique spiral cords, sutures narrowly incised. Aperture narrow, equal in height or slightly longer than the spire, lirate within, lirae occasionally obsolete, columella only thinly glazed and with 4 prominent oblique folds. Base colour bluish-white to steel-grey, spire whorls ornamented at sutures with a turret-like, dark olive-green narrow band which appears as small quadrate spots at the sutures; lower two-thirds of body whorl dark olive-green, interrupted in places by narrow, interrupted bluish-white bands of the protruding base colour. At periphery, the dark olive-green zone has a turret-like border; aperture greenish-brown and occasionally cream-banded, columellar folds white or grey, parietal wall dark olive-green.

TYPE LOCALITY. Sarge Bay, Augusta, S.W. Australia.

DISTRIBUTION. From Cape Riche to Thomson Bay, West Australia. Normally in sheltered pools on exposed coasts, under rocks.

Type specimens. The holotype of *V. (P.) hansenae* is in WAM No. 13-72, dimensions 14.6 x 5.5 x 7.2 mm (Fig. 36).

Material examined. West Australia: 3 km N.W. of Busselton (WAM); Margaret River; Bunbury; Moses Rocks (all coll. Marrow); Sarge Bay, Augusta (WAM; coll. Eker; coll. Hansen); Two People's Bay, 225 km E. of Albany (AMS; coll. Marrow; coll. Haddrill); Cape Riche, E. of Albany (AMS; coll. Marrow; coll. Eker); off Dunsborough; Tor Bay, W. of Albany; S. of Cowaramup; Thomson Bay, N.E. of Rottnest I; Beach at Kwinana refinery, Cockburn Sound; *c.* 3 km of Cape Naturaliste; Hopetoun; Albany (all AMS).

Vexillum (Pusia) marrowi Cernohorsky, 1973 (Fig. 38)

1966. *Proximitra pica* (Reeve), Hodgkin, Kendrick, Marsh & Slack-Smith, West Aust. Nat. Club Handb. No. 9. 47, pl. 18, fig. 4 (*non Mitra pica* Deshayes and Edwards, 1844; *nec* Reeve, 1845).

1973. *Vexillum (Pusia) marrowi* Cernohorsky, Rec. Auckland Inst. Mus. 10: 140, figs. 19-23; 1978 Hinton, Guide Austr. shells pl. 54, figs. 22, 22a.

Shell up to 21.0 mm in length but frequently smaller, generally ovate to elongate-ovate, solid, teleoconch of 4-6 short, convex whorls, protoconch of 1½-2½ smooth embryonic whorls; sutures sharply incised, whorls sculptured with slender and occasionally angulate axial ribs numbering 15-28 on the penultimate and 1-20 on the body whorl. Slender and often flattened and irregular spiral striae encircle whorls numbering 5-14 on the penultimate and 8-17 on body whorl apart from 7-13 oblique basal cords; interspaces of spiral cords minutely punctate giving the impression of being finely striate. Aperture longer than the spire, moderately wide and lirate within, outer lip constricted anteriorly; columella calloused and with 4 prominent folds, siphonal canal short and straight. Brown to purplish-brown in colour, ornamented with an irregular white presutural spiral band, occasional chevron-shaped markings and small or large white blotches; aperture brown near edge of outer lip and violet or purplish within, parietal wall brown, columellar folds bluish-white or violet.

TYPE LOCALITY. Yanchep reef, *c.* 48 km N. of Perth, West Australia.

DISTRIBUTION. From Murchison River mouth to Margaret River, S. of Cape Naturaliste, W. Australia. From the intertidal zone to 24 m, on rocks.

Figs. 36-38. 36, 37. *Vexillum (Pusia) hansenae* Cernohorsky. 36. Holotype WAM No. 13-72; 14.6 mm (slender form). 37. Paratype, 9.5 mm (broad form). 38. *V. (P.) marrowi* Cernohorsky. Holotype WAM No. 408; 12.9 mm.

Type specimens. The holotype of *V. (P.) marrowi* is in WAM No. 408, dimensions 12.9 x 6.2 x 7.8 mm (Fig. 38).

Material examined. West Australia: Port Gregory, East Wallaby I and Zeewyck Channel, Houtman Abrolhos Archipelago; Pt. Dennison reef, S.W. of Dongara; Yanchep reef; North Beach, Perth; Woodman's Pt., Coburn Sound; Lady AdelineBay, Rottnest I; Shoalwater Bay, via Rockingham; N.W. of Busselton jetty, 22 m-24 m; Bunker Bay (all WAM); Sth. Cottesloe Beach, Perth; Margaret River, S. of Cape Naturaliste (coll. Eker); Kilcarnup; Trigg I; Devils Brook; Horrock's Beach; Sorrento Beach, N. of Perth (all coll. Marrow); Pt. Peron, 48 km S. of Perth; *c.* 3 km S. of Cape Naturaliste; Geographe Bay;

Murchison River mouth; S.W. end of Garden I, S. of Perth; Wyadup, 6 km S. of Yallingup; off Dunsborough; Ellensbrook, Sth. Cowaramup; Geraldton (all AMS).

This common, intertidal species has been confused with *Mitra pica* Reeve, 1845 (*non* Deshayes and Edwards, 1844), which is *Waimatea obscura* (Hutton, 1873), an operculate species from Australia and New Zealand belonging to the family Volutomitridae.

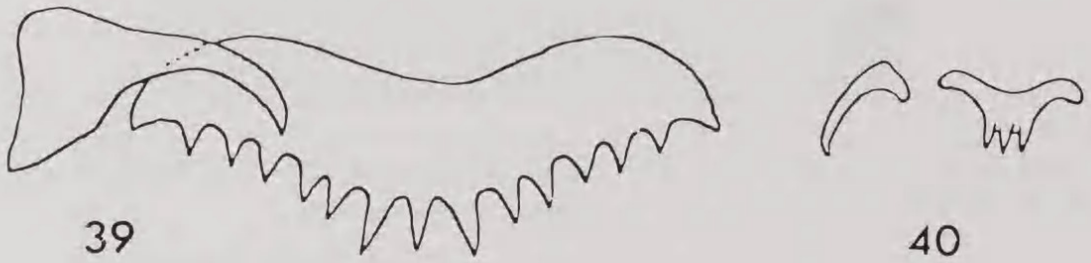
Genus **Austromitra** Finlay, 1927

Austromitra Finlay, 1927, Trans. Proc. N.Z. Inst. 57: 410. Type species by OD *Columbella rubiginosa* Hutton, 1873. Recent, New Zealand.

GEOGRAPHICAL DISTRIBUTION. Southern hemisphere: New Zealand; Australia; South Africa (Recent and fossil). Tertiary of Patagonia, Argentina (fossil).

STRATIGRAPHICAL RANGE. Eocene to Recent.

A diagnosis of the genus has been given by Cernohorsky (1970). Ponder (1972) who studied the anatomy of *Austromitra* advocated a separation from other costellariid genera on the basis of differences in the mid-esophagus, bursa copulatrix and primitive nature of the gland of Leiblein. The radula of *Austromitra* is of the vexilline type, consisting of a bow-shaped, multicuspid rachidian and a sickle-shaped lateral; these teeth are usually simple but some individuals have a few very minute denticles on the interior cutting edge (Fig. 39).



Figs. 39, 40. Half-row of radulae. 39. *Austromitra rubiginosa* (Hutton). N. of Tutukaka Beach, New Zealand. 40. *Vexillum (Pusia) australe* (Swainson) (after Cooke, 1920, fig. 18).

Egg-capsules of *Austromitra* according to Ponder (op. cit.) are found embedded in the tests of various species of compound and colonial tunicates. Capsules are transparent, horny and hemispherical with the flat side uppermost, and each capsule contains only 3-5 eggs with all embryos developing. It would appear that the majority of South and South-east Australian species of Costellariidae produce larvae with a direct development which is reflected in the slightly globose, paucispiral embryonic whorls of the protoconch (Fig. 41) as opposed to the conical, multispiral protoconch of species with a pelagic development. The same type of paucispiral protoconch of 1½-2 embyronic whorls of *Austromitra* is also present in several tropical species of the subgenus *Pusia* and has also been observed in a specimen of the large *Vexillum taeniatum* (Lamarck) dredged in deep water in Papua New Guinea.

Fig. 41. *Austromitra analogica* (Reeve). South Australia. S.E.M. photograph of senile individual (protoconch).

Although all adult specimens of tropical Costellariidae species have distinct lirae on the interior wall of the outer lip, only 2 senile specimens from 1263 individuals of New Zealand *Austromitra* examined had 4-5 lirae in the aperture. Australian species of *Austromitra* either have or have not developed apertural lirae.

New Zealand species of *Austromitra*

Austromitra ambulacrum (Marwick, 1927) (Fig. 42)

1927. *Vexillum ambulacrum* Marwick, Trans. Proc. N.Z. Inst. 56: 320, pl. 73, fig. 11.
1927. *Austromitra ambulacra* (Marwick), Finlay, Trans. Proc. N.Z. Inst. 57: 140.
1966. *Austromitra ambulacrum* (Marwick), Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173:64, pl. 113, fig. 1370.

Shell up to 9.0 mm in length, elongate-ovate, sutures with a very narrow, flat sutural ramp, teleoconch of 4½ weakly convex and only slightly subangulate whorls, protoconch of 1½ moderately large, smooth embryonic whorls. Sculptured with narrow, irregular axial ribs which number 18 on the penultimate and 13 on the body whorl, ribs becoming obsolete towards base of body whorl; very fine and almost obsolete spiral striae are present, striae slightly stronger at the sutural ramp, siphonal fasciole with slightly stronger, oblique cords. Aperture only slightly longer than the spire, part of outer lip missing, columella not calloused and with 4 oblique folds, siphonal canal only slightly produced and straight.

TYPE LOCALITY. Tirangi Stream, Taranaki, Tongaporutuan, U. Miocene of New Zealand.

Type specimens. The holotype of *A. ambulacrum* is in NZGS No. GS-1135, dimensions 8.9 x 4.0 x 4.7 mm (Fig. 42).

This species appears to be the Miocene forerunner of the Recent *A. rubiginosa* (Hutton).

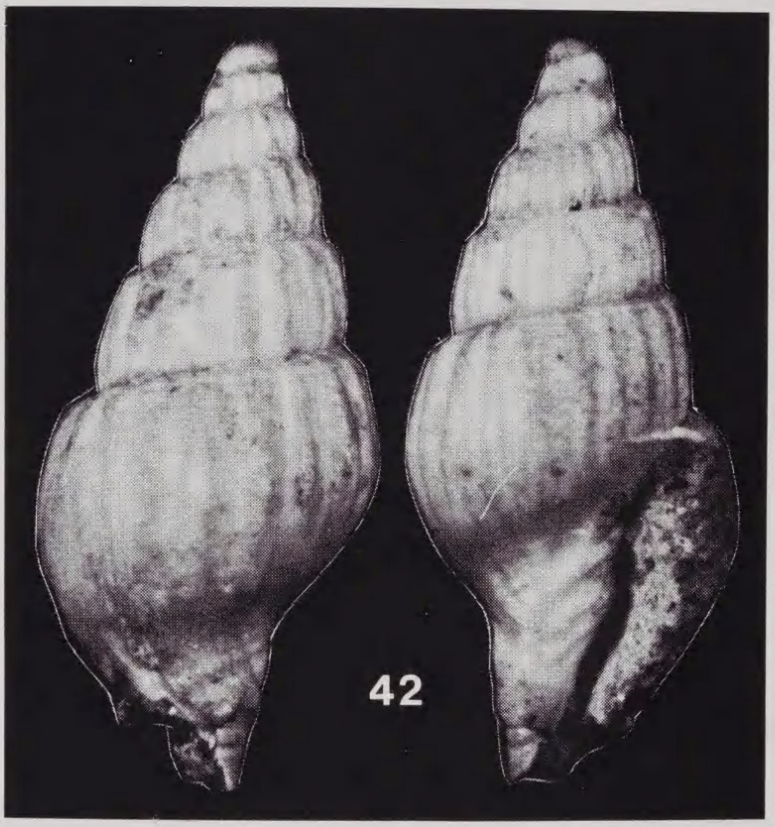


Fig. 42. *Austromitra ambulacrum* (Marwick). Holotype NZGS No. GS-1135; 8.9 mm.

Austromitra rubiginosa (Hutton, 1873) (Figs. 39, 43-57, 65)

1873. *Columbella (Atilia) rubiginosa* Hutton, Cat. Mar. Moll. New Zealand p.20.
1878. *Mitra rubiginosa* (Hutton), Hutton, J. Conchyl. 26: 22; 1880 Hutton, Man. N.Z. Moll. p. 60.
1884. *Turricula (Pusia) rubiginosa* (Hutton), Hutton, Trans. Proc. N.Z. Inst. 16: 226.
1893. *Turricula rubiginosa* (Hutton), Hutton, Macleay, Mem. vol. Linn. Soc. N.S.W. p. 46, pl. 6, fig. 19.
1904. *Vulpecula rubiginosa* (Hutton), Hutton, Ind. fauna Novaezeal. p. 74.
1908. *Vulpecula marginata* (Hutton), Suter, Trans. Proc. N.Z. Inst. 40: 349, pl. 27, fig. 8 (*non Turricula marginata* Hutton, 1885).
1913. *Vexillum pseudomarginatum* Suter, Man. N.Z. Moll. p. 364; 1915 Suter, Atlas, pl. 18, fig. 5 (*nom. subst. pro Vulpecula marginata* Suter, 1908).
1913. *Vexillum planatum* Hutton, Suter, Man. N.Z. Moll. p. 365; 1915 Suter, Atlas, pl. 18, fig. 6 (*non Turricula planata* Hutton, 1885).
1913. *Vexillum rubiginosum* Hutton, Suter, Man. N.Z. Moll. p. 366; 1915 Suter, Atlas, pl. 18, fig. 7; 1924 Bucknill, Seashells N.Z. p. 61, pl. 8, fig. 10.

1927. *Austromitra rubiginosa* (Hutton). Finlay, Trans. Proc. N.Z. Inst. 57: 410; 1928 Finlay, Trans. Proc. N.Z. Inst. 59: 256; 1952 Williams, Bull. Auckland Inst. Mus. Conch. Club No. 8: 4; 1961 Powell, Shells N.Z. p. 99, pl. 16, fig. 23; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64, 1968 Moreton and Miller, N.Z. Seashore p. 163, text fig. 57, fig. 12 (animal, egg-capsules and embryos); 1970 Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 57, pl. 10, figs. 5, 6, 8 (shell), textfig. 149 (radula), textfig. 179 (protoconch); 1972 Ponder, Malacologia 11 (2): 312, figs. 5A-D, 6A-E (anatomy, radula and egg-capsules); 1972 Mannering, Poirieria 6 (3): 60.

1927. *Austromitra rubiradix* Finlay, Trans. Proc. N.Z. Inst. 57: 411 (*nom. subst. pro Mitra planata auctt.*); 1972 Ponder, Malacologia 11 (2): 312, fig. 5E (radula).

1927. *Vexillum antipodum* Brookes, Trans. Proc. N.Z. Inst. 56: 588, pl. 102, fig. 1.

1934. *Austromitra erecta* Powell, Trans. Proc. R. Soc. N.Z. 64: 156, pl. 21, fig. 12; 1961 Warren, Bull. Auckland Inst. Mus. Conch. Sect. 16: 20.

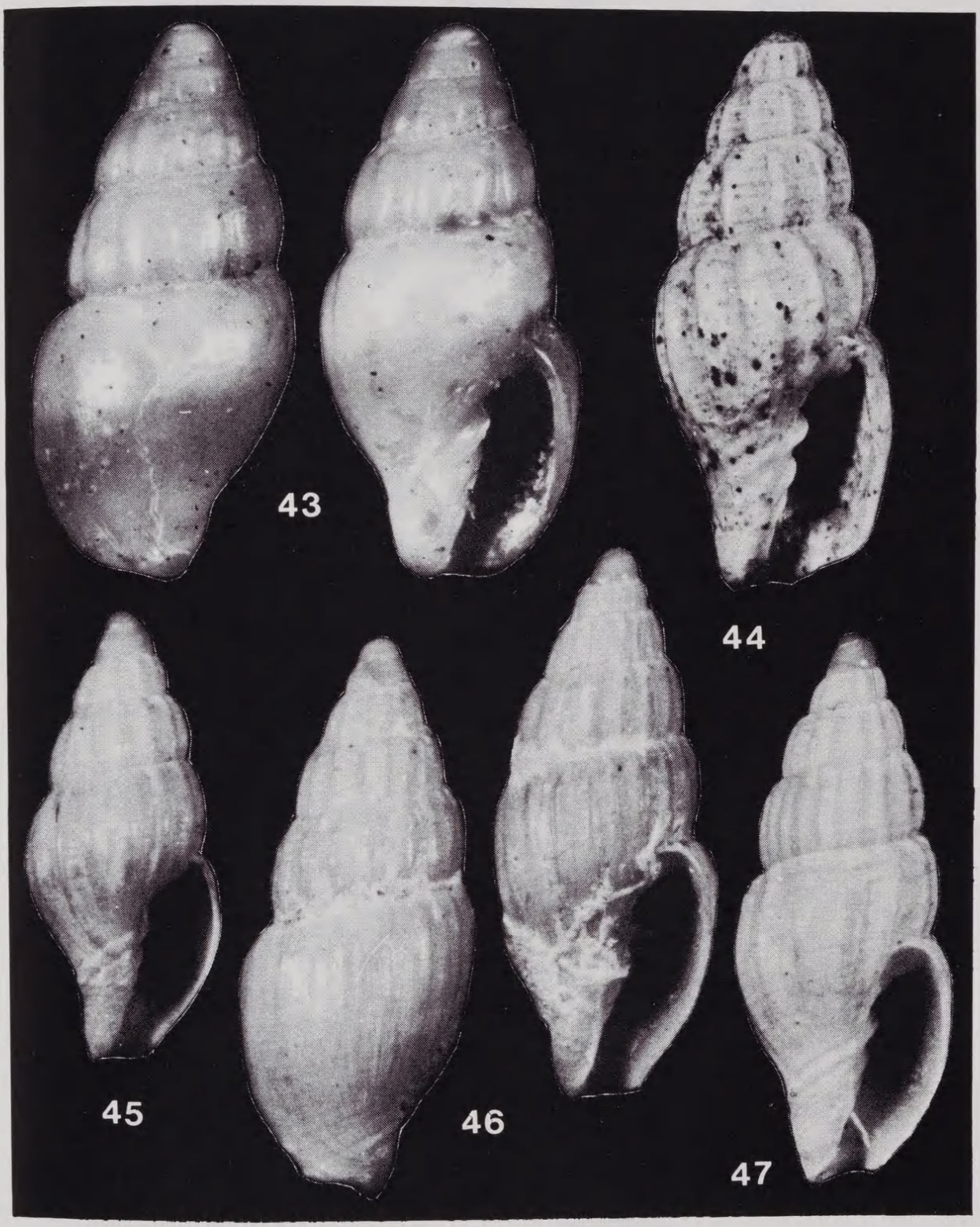
1952. *Austromitra pseudomarginata* (Suter). Williams, Bull. Auckland Inst. Mus. Conch. Club 8:4; 1958 Powell, Shells N.Z. ed. 3: 99; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64.

Shell up to 12.0 mm in length, variable in shape but usually elongate-ovate, teleoconch of 5-6 convex, weakly or distinctly subangulate whorls, protoconch of 1½-2 smooth, embryonic whorls. Sculptured with moderately elevated and frequently angulate axial ribs which number from 12-17 on the penultimate and from 0-16 on the body whorl, axial ribs being replaced in some individuals by longitudinal growth-striae on the dorsum of the body whorl; the axial ribs do not quite reach the posterior sutures and stop short at the presutural ramp where in some specimens they tend to become slightly nodose at this point; the smooth presutural area contains macroscopic axial striae and in some cases also a single spiral cord. Spiral sculpture variable, consisting of either very shallow or distinct spiral threads which in some individuals tend to override axial ribs; spiral striae number from 0-20 on the body whorl and in some specimens 2-3 spiral threads on the presutural ramp most prominent. Aperture about equal in height to the spire, almost always smooth within, outer lip convex and slightly constricted basally, columella not calloused and with 3-5 (usually 4) oblique folds, siphonal fasciole with 4-8 distinct oblique cords, siphonal canal straight. Variable in colour, usually dark reddish-brown to almost purplish-brown in some specimens, body whorl with a narrow white central band, siphonal canal orange in many specimens; some individuals white, fawn to pale yellowish-brown, body whorl with a broad, dark brown spiral band, spire whorls with a narrow brown band adjacent to sutures.

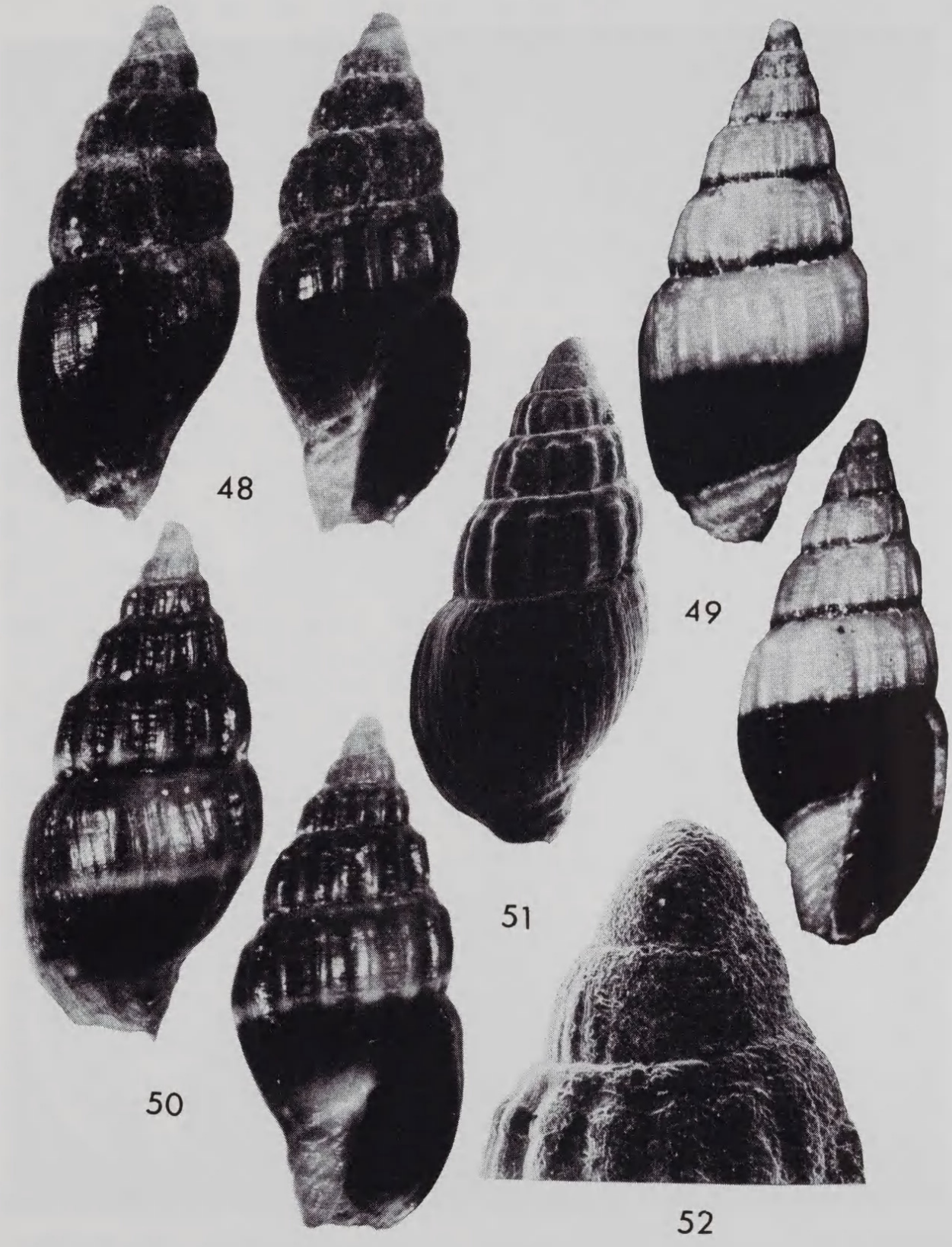
TYPE LOCALITY. Chatham Is (*rubiginosa*); 5 miles (8 km) Sth. of Cuvier I, 38 fathoms (70 m) (*pseudomarginata*); Whangaroa Harbour (*rubiradix*), Cooper's Beach, Doubtless Bay (*antipoda*); Taupo Bay, Whangaroa (*erecta*).

DISTRIBUTION. Throughout New Zealand. From the Three Kings Is to the Chatham Is and Stewart I (Fig. 57). From the intertidal zone to a depth of 88 m, under rocks and in shell-sand, juvenile specimens occasionally among algae. Although recorded from depth greater than 88 m, all specimens dredged were devoid of animal.

Type specimens. The lectotype of *A. rubiginosa* (here designated) is in NMNZ No. M-150, dimensions 7.6 x 3.6 x 3.8 mm (Fig. 43 — a very worn individual). The probable holotype and 4 paratypes of *A. pseudomarginata* are in NZGS No. TM-923, dimensions of probable holotype 4.0 x 1.8 mm (Fig. 45) (Suter's given size for the specimen he illustrated was 6.2 x 2.5 mm). The following holotypes are in the AIM: *A. rubiradix* No. TM-70, dimensions 8.2 x 3.5 x 4.0 mm (Fig. 48); *A. antipoda* No. TM-1291, dimensions 10.0 x 4.3 x 4.8 mm (Fig. 49) and *A. erecta* No. TP-10086, dimensions 9.6 x 4.6 x 5.5 mm, which is in Dr. A. W. B. Powell's private collection (Fig. 53).



Figs. 43-47. *Austromitra rubiginosa* (Hutton). 43. Lectotype NMNZ No. M-150; 7.6 mm (very worn). 44. Specimen from Petane, L. Pleistocene of New Zealand; 9.3 mm. 45. Probable juvenile holotype of *A. pseudomarginata* (Suter), NZGS No. TM-923; 4.0 mm. 46. Paratype NZGS, 5.4 mm. 47. Topotypé from off Cuvier I, 70 m; 5.7 mm.



Figs. 48-52. *Austromitra rubiginosa* (Hutton). 48. Holotype of *A. rubiradix* Finlay, AIM No. TM-70; 8.2 mm. 49. Holotype of *A. antipoda* (Brookes), AIM No. TM-1291; 10.0 mm. 50-52. Specimen from Mt. Maunganui, Tauranga. 50. 8.7 mm. 51, 52. S.E.M. photograph of dorsal side of shell and protoconch.

Figs. 53-56. *Austromitra rubiginosa* (Hutton). 53. Holotype of *A. erecta* Powell, AIM Powell coll. No. TP-10086; 9.6 mm. 54. Specimen from Leigh, Hauraki Gulf; 8.4 mm. 55, 56. Slender and smooth froms. 55. Nelson Harbour; 9.00 mm. 56. Goat I, Leigh, Hauraki Gulf; 9.3 mm.

Material examined. New Zealand: S.E. Bay, Great King I, Three Kings Is, 55 m (NMNZ; coll. Willan); between Three Kings Is and Nth. Cape, 34°21'S and 172°37'E, 88 m (NMNZ); Cape Maria van Diemen (AIM); Doubtless Bay (NMNZ; AMS; coll. Powell); Mangonui Heads (AIM,coll. Powell); Cable Bay, Doubtless Bay; Cooper's Beach, Doubtless Bay; Tauranga Bay, Whangaroa (all NMNZ); Taupo Bay, Whangaroa (coll.

Powell); Main Channel and Kaouou Bay, Whangaroa Harbour (NMNZ); Mahinepua near Whangaroa (coll. Willan); Outer Bay of Islands, 35°09'S and 174°12'E, 81 m (NMNZ); Albert Channel, Bay of Islands, 49 m; Ngataki Beach, Great Exhibition Bay (both coll. Willan); Reef Pt., Ahipara; Entrance to Deep Water Cove, 33-46 m; Koginga Pt., Parekura Bay (all NMNZ); Houhora Harbour (coll. Willan); near Knob Pt., Bay of Islands, 35°15'S and 174°11'E, 4 m; Tararoa Bay Pt., Bay of Islands (both NMNZ); between Marotiri I and Hen I, 55 m (coll. Powell); Hini Beach (NMNZ); Tutukaka Harbour (coll. Willan); Taurikura Bay, Whangarei Heads; Hen and Chicken Is, 46 m (both AIM); off Hen I, 35°58'S and 174°44'E, 4 m (NMNZ); Rocky Bay, Port Abercrombie, Gt. Barrier I; Port Fitzroy, Gt. Barrier I (both coll. Powell); Whangaparapara Harbour, Gt. Barrier I (coll. Willan); Goat I, Leigh (NMNZ; AMS); Ti Pt., Leigh (NMNZ); Matheson Bay, Leigh (coll. Willan); Colville Channel, 48-64 m (NMNZ; ZMC); off Cuvier I, 46-70 m (AIM; AMS; NMNZ); 6.4 km S. of Cuvier I, 73 m (coll. Powell); E. coast of Motutapu I (NMNZ); Red Bluff, Takapuna (coll. Powell); Takapuna reef, Auckland (AIM; NMNZ); Wenderholm Reserve, East coasts, Auckland; Kawau I, Hauraki Gulf; Orua Bay, Manukau Harbour, Auckland (all coll. Willan); off Motuihe I, Hauraki Gulf; Huia, Manukau Heads (both NMNZ); off Whale Rock, Mercury I, 24 m (coll. Willan); Kaiaua, Coromandel coast (coll. Marshall); 0.8 km off W. side of Mayor I, 33 m; N.N.E. of Mayor I, 84-150 m; Cape Runaway (all coll. Powell); off Mayor I, 256-311 m; N.W. of White I, 37°30'S and 177°03'E, 530 m; Matakoa Pt., Hicks Bay (all NMNZ); Waihau Bay, Cape Runaway (AIM; coll. Willan; coll. Marshall); Cemetery Pt., Waihau (NMNZ); Mt. Maunganui, Tauranga (AIM; coll. Powell); Te Kaha, East Cape (NMNZ; coll. Willan); Omaio, Cape Runaway area (coll. Marshall); Motonui Rock, Omaio Bay, Cape Runaway; Rurima Rocks; Otarawairere Bay, Ohope (all NMNZ); Tatapouri Beach, Gisborne (coll. Willan); Sponge Bay, Gisborne (coll. Marshall); between N. of Black I and Moturoa, 31 m (NMNZ); Mahia Peninsula (ZMC); Kai Iwi, near Wanganui (AIM); *c.* 16 km S.W. of Waitotara River mouth, 39°57'S and 174°34'E, 33-35 m; *c.* 29 km S. of Waitotara River mouth, 17-82 m; *c.* 18 km S.W. of Whangaehu River mouth, 40°09'S and 174°54'E, 55-57 m; *c.* 18 km S.W. of Wanganui, 40°11'S and 174°49'E, 58-64 m; *c.* 21 km W. of Rangitikei River mouth, 40°18'S and 174°59'E, 75-82 m; *c.* 19 km N.W. of Manawatu River mouth, 40°22'S and 174°59'E, 86 m; *c.* 18 km N. of Kapiti I, off Levin; *c.* 16 km E. of Stephens I, 40°38'S and 174°12'E, 128 m; Paturau, N.W. Nelson (all NMNZ); Cook Strait, 40°44'S and 174°34'E, 146 m (AIM. NMNZ); Channel between S. Rangitoto Is and D'Urville I, 40°46'S and 173°57'E, 59-64 m; off W. coast of D'Urville I, between Nile Head and Greenville Harbour, 40°47'S and 173°48'E, 62 m; W. of Castlepoint; Head of Titirangi Bay, Marlborough Sounds; Pauatahanui Arm, Paramata Harbour; Ship's Cove, Queen Charlotte Sound; Titahi Bay, Wellington (all NMNZ); W. side of Lyall Bay, Wellington (AMS); Nelson Harbour (AIM; coll. Powell); Tahunanui Beach, Nelson (coll. Powell); Island Bay, Wellington (NMNZ; coll. Powell); Plimmerton Beach, Wellington Harbour (coll. Willan); Lyall Bay, Wellington (AIM, NMNZ); 10 km off Karori Rock, Cook Strait, 41°24'S and 174°33'E, 468-501 m; Palliser Bay, 41°35'S and 175°04'E, 128-146 m (both NMNZ); Rocks Road, Nelson (AIM); Pegasus Bay, 43°14'S and 173°39'E, 512 m; Boulder Bay, Whale I; Purau, Lyttelton Harbour; Chatham Rise, 43°38'S and 177°19'E, 531 m; Hanson Bay, Chatham Is, 44°00'S and 176°21'E, 27 m (all NMNZ); Chatham Is (AIM; AMS); Rangatira I, Chatham Is (coll. Willan); Kaiangaroa and Ouwenga, Chatham Is; Head of Waitaki Canyon, off Oamaru, 45°10'S and 171°30'E, 256-293 m; Karitane Canyon, N.E. of Taiaroa Head, 585 m; Karitane Canyon, off E. Otago, 45°38'S and 171°01'E, 200 m; N.E. of Cape Saunders, E. Otago, 45°50'S and 170°56'E, 105 m (all NMNZ); Portobello, Dunedin (AIM); E. of Cape Saunders, Otago,

73-91 m (coll. Powell); Dunedin Harbour, 6 m (AIM); Foveaux Strait (AMS); Halfmoon Bay, Stewart I (NMNZ; AMS); Bravo I, Paterson Inlet, Stewart I; Easy Harbour, Stewart I, 7-20 m; off Poutama I, South Cape, Stewart I, 55 m (all NMNZ).
Fossil record: Petane, Nukumaruan, L. Pleistocene of New Zealand (AIM).

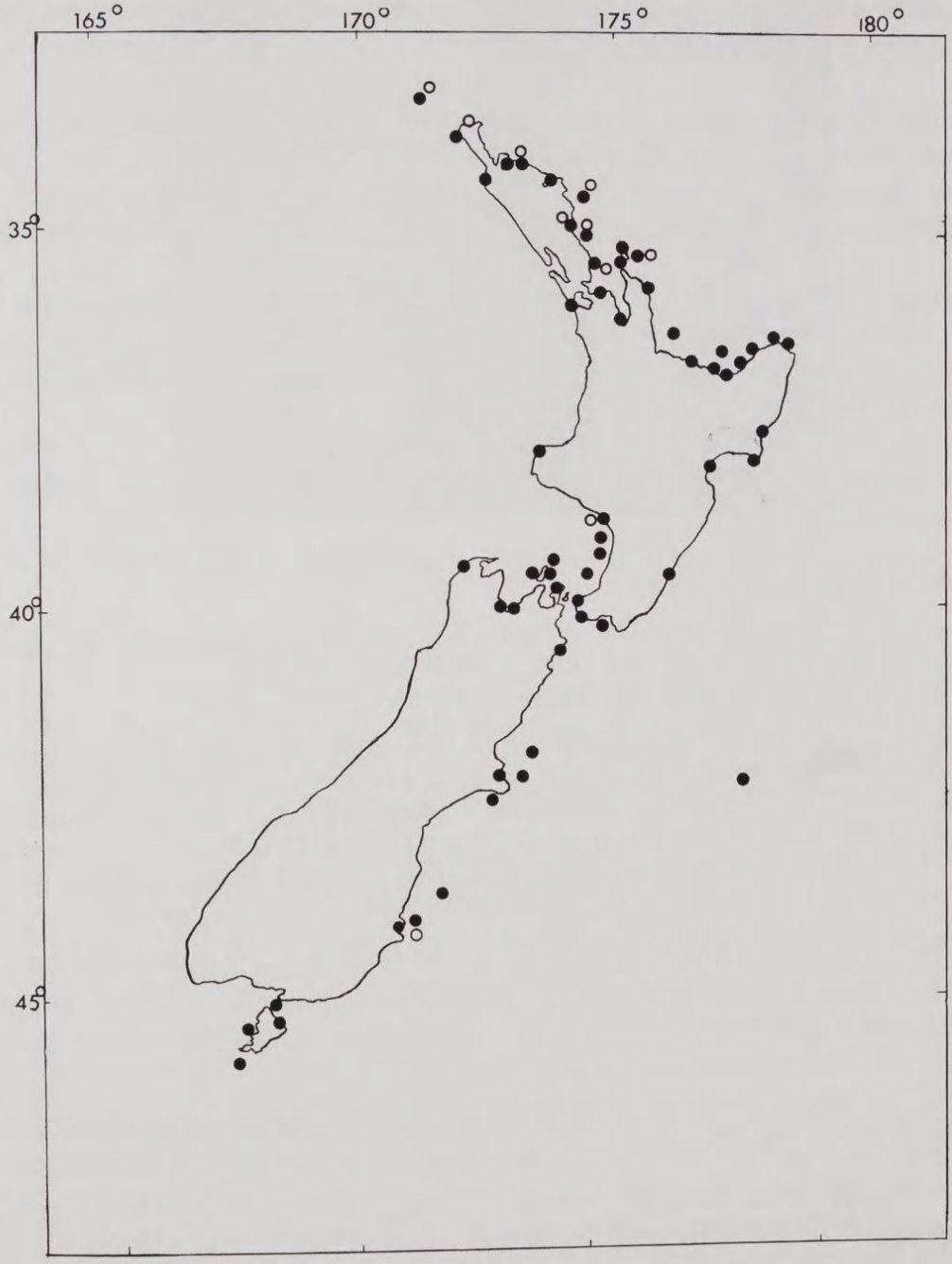


Fig. 57. Distributional map. *Austromitra rubiginosa* (Hutton) (full circles) and *A. angulata* (Suter) (open circles).

The following sculptural and colour variants have been described.

rubiradix Finlay: this is the common intertidal dark reddish-brown form with an orange siphonal canal and obsolete spiral sculpture.

erecta Powell: this is a coarsely sculptured, intertidal, dark reddish-brown form with an orange siphonal canal. The spiral sculpture consists of moderately deep spiral grooves which produce 3 flattish cords on the penultimate and 3-6 flattish cords on the body whorl. Among a series of 30 specimens, 1-2 specimens of *erecta* may be present.

antipoda Brookes: this is a colour form which is usually buff and ornamented with a broad, dark reddish-brown to purplish-brown band on the body whorl and a narrow band adjacent to the sutures on the spire whorls, siphonal canal frequently orange. Although more frequently encountered intertidally, this colour-form also occurs at Hen I in 55 m.

pseudomarginata Suter: this is another minute, 4.0-6.0 mm long subtidal, subadult form with whorls which are only weakly subangulate and the subsutural area has usually 1-3 more strongly pronounced spiral threads. All specimens examined were devoid of colour and animal.

Illustrated are some other unnamed forms encountered among the numerous specimens examined (Figs. 55, 56).

Austromitra lawsi Finlay, 1930 (Fig. 58)

1930. *Austromitra lawsi* Finlay, Trans. Proc. N.Z. Inst. 61: 235, pl. 43, fig. 17; 1956 Dell, Dominion Mus. Bull. No. 18: 174; 1958 Powell, Shells of N.Z. ed. 3: 99; 1970 Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 58.

Species similar to *A. rubiginosa*, 9.0-13.0 mm in length, fusiformly-elongate, whorls distinctly subangulate, axial ribs as in *A. rubiginosa*. Spiral sculpture consists of numerous, distinct spiral threads. Penultimate whorl with 12-14 axial ribs and 6-8 spiral striae, body whorl with 10-13 ribs and 12-17 spiral striae. Siphonal canal more produced than in *A. rubiginosa* but the one uppermost stronger cord on the siphonal fasciole and axial ribs which do not quite reach the posterior sutures are also evident in *A. lawsi*.

TYPE LOCALITY. 10 miles (16 km) E.N.E. of Otago Heads, 50 fathoms (92 m).

DISTRIBUTION. Only known from the type locality and immediate vicinity. Subtidal, from 92 m-549 m; all specimens examined were dredged devoid of the animal and the exact depth range of living specimens is unknown.

Type specimens. The holotype of *A. lawsi* is in AIM No. TM-68, dimensions 12.3 x 4.9 x 5.5 mm (Fig. 58). Paratypes are in Dr. A. W. B. Powell's private collection.

Material examined. New Zealand: E.N.E. of Otago Heads, 92 m (AIM; coll. Powell); Cape Saunders, 132 m (AIM); off E. Otago coast, 45°45'S and 171°05'E, 549 m and 45°47'S and 171°07'E, 458-549 m (both NMNZ).

The species is imperfectly known and only a very few specimens have been seen in collections. Most of these specimens were faded and collected devoid of animal. A similar strong spiral sculpture has also been observed in some subtidal examples of *A. rubiginosa* and the only difference between the two species appears to be the more turreted shape and produced siphonal canal in *A lawsi*. The species may, when more material becomes available, prove to be another southeastern subtidal form of *A. rubiginosa*.

Fig. 58. *Austromitra lawsi* Finlay. Holotype AIM No. TM-68; 12.3 mm.

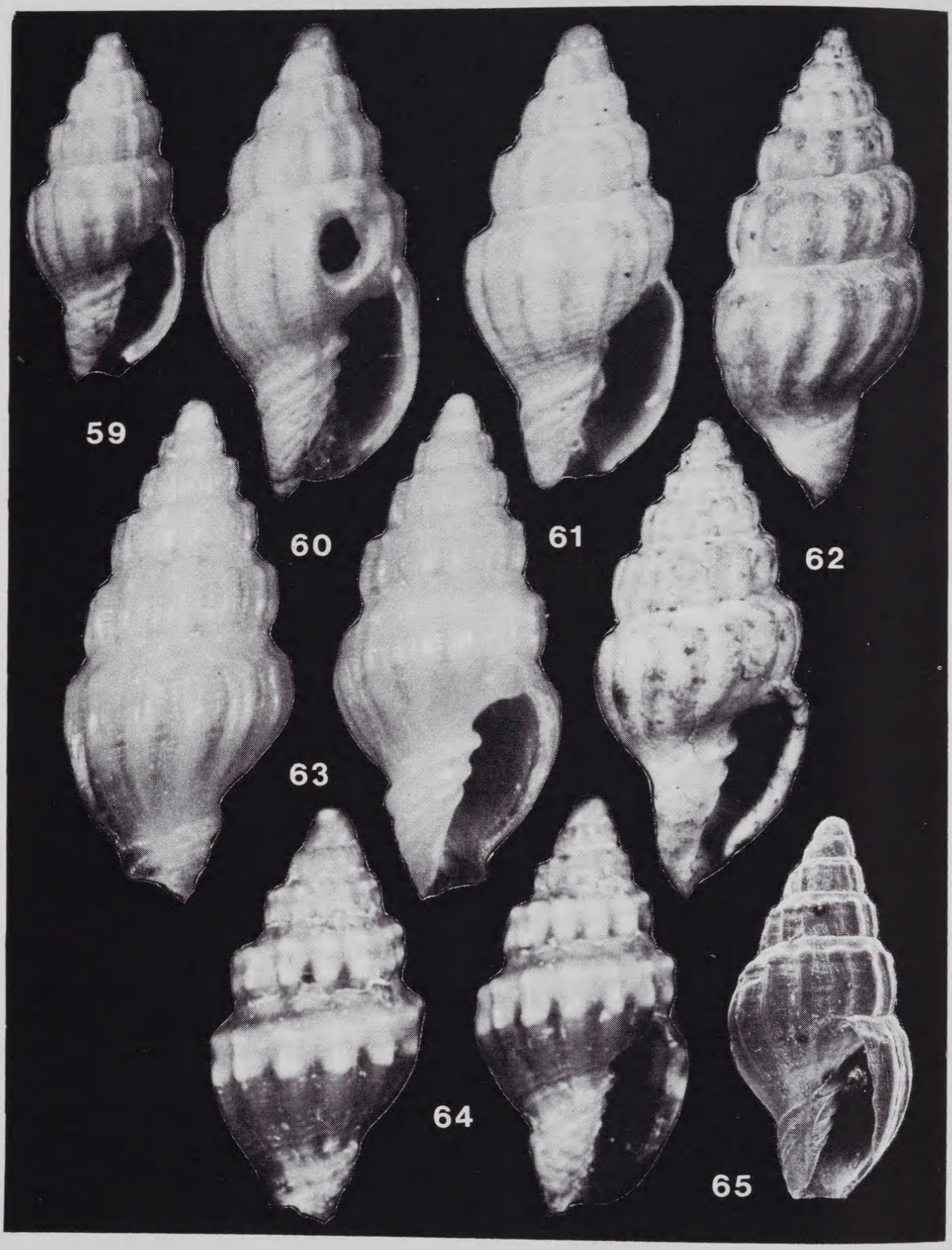
Austromitra angulata (Suter, 1908) (Figs. 57, 59-64)

1908. *Vulpecula marginata* subsp. *angulata* Suter, Trans. Proc. N.Z. Inst. 40: 350.
1913. *Vexillum pseudomarginatum* subsp. *angulatum* Suter, Suter, Man. N.Z. Moll. p. 364.
1943. *Austromitra quenelli* Fleming, Trans. Proc. R. Soc. N.Z. 73 (3): 199, pl. 29, fig. 12; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64; 1970 Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 57, pl. 10, fig. 11.
1958. *Austromitra angulata* (Suter), Powell, Shells of N.Z. ed. 3: 99; 1958 Hulmes, Bull. Auckland Inst. Mus. Conch. Sect. 14: 6; 1972 Seelye, Poirieria 6 (4): 77.

Shell up to 11.0 mm in length but frequently smaller, elongate-ovate, similar to *A. rubiginosa* but squatter, teleoconch of 4-5½ angulate or occasionally bi-angulate whorls, protoconch of 1½ smooth embryonic whorls, suture adpressed, presutural ramp concave and occasionally even ledged. Sculptured with prominently angulate axial ribs which sometimes become nodose upon reaching the angulate shoulder; like in *A. rubiginosa,* the axial ribs only reach the presutural ramp and do not extend to the posterior suture. Spiral sculpture very weak and consisting of very fine spiral striae, siphonal fasciole with 6-8 oblique cords, first posterior cord strong and being almost an extension of the first posterior columellar fold. Aperture about equal in height to the spire, narrow, smooth within, columella with 3-4 oblique folds. Uniformly fawn in colour, some individuals glassy-white to orange-brown in colour with the posterior part of axial ribs white and sometimes orange-brown spots on the summits of the white axial ribs; some individuals have a broad, reddish-brown band on the body whorl and darker spots in the interspaces.

TYPE LOCALITY. South of Cuvier I, 38 fathoms (70 m) (*angulata*); Takapau (N.E.) and Tahoraite (S.W.), sandstone facies of the Waitotaran, U. Pliocene of New Zealand (*quenelli*).

DISTRIBUTION. North and South Islands, New Zealand (Fig. 57). Subtidal, from 6-150 m, in bryozoan rubble, sand and shell-fragments.



Figs. 59-65. 59-64. *Austromitra angulata* (Suter). 59. Lectotype NZGS No. TM-920; 4.7 mm. 60. Paralectotype, 4.9 mm. 61. Spirally striate form from Cuvier I, 46 m; 4.9 mm. 62. Holotype of *A. quenelli* Fleming, NZGS No. GS-2314; 11.0 mm. 63. Bi-angulate form from off Three Kings Is, 92 m; 7.0 mm. 64. Specimen from off Motutapere I, Cavalli Is, 33 m; 4.3 mm. 65. *A. rubiginosa* (Hutton), juvenile specimen; 6.8 mm (S.E.M. photo).

Type specimens. The lectotype of *A. angulata* (here designated) and 2 paralectotypes are in NZGS No. TM-920, dimensions of lectotype 4.7 x 2.1 mm (Fig. 59). The holotype and paratype of *A. quenelli* are in NZGS No. GS-2314, dimensions of holotype 11.0 x 4.9 x 5.0 mm (Fig. 62).

Material examined. New Zealand: Three Kings Is, 92 m (coll. Powell); S.W. end of Tokananohia reef, N. of Motutapere I, Cavalli Is, 33 m (coll. Willan); Whangarei Heads, 6 m; 6.4 km S. of Cuvier I, 73 m (both coll. Powell); Cuvier I, 46 m (AIM); Poor Knights Is, 110 m; N.N.E. of Mayor I, 84 m-150 m (both coll. Powell); Hen and Chicken Is, 46 m (AIM); 29 km S. of Waitotara River mouth, 17 m-82 m (NMNZ); off Otago, 45°48'S and 170°59'E, 118 m (AMS).
Fossil record: Palliser Bay, Wellington, L. Pliocene of New Zealand (AIM); Takapau, Waitotaran, U. Pliocene of New Zealand.

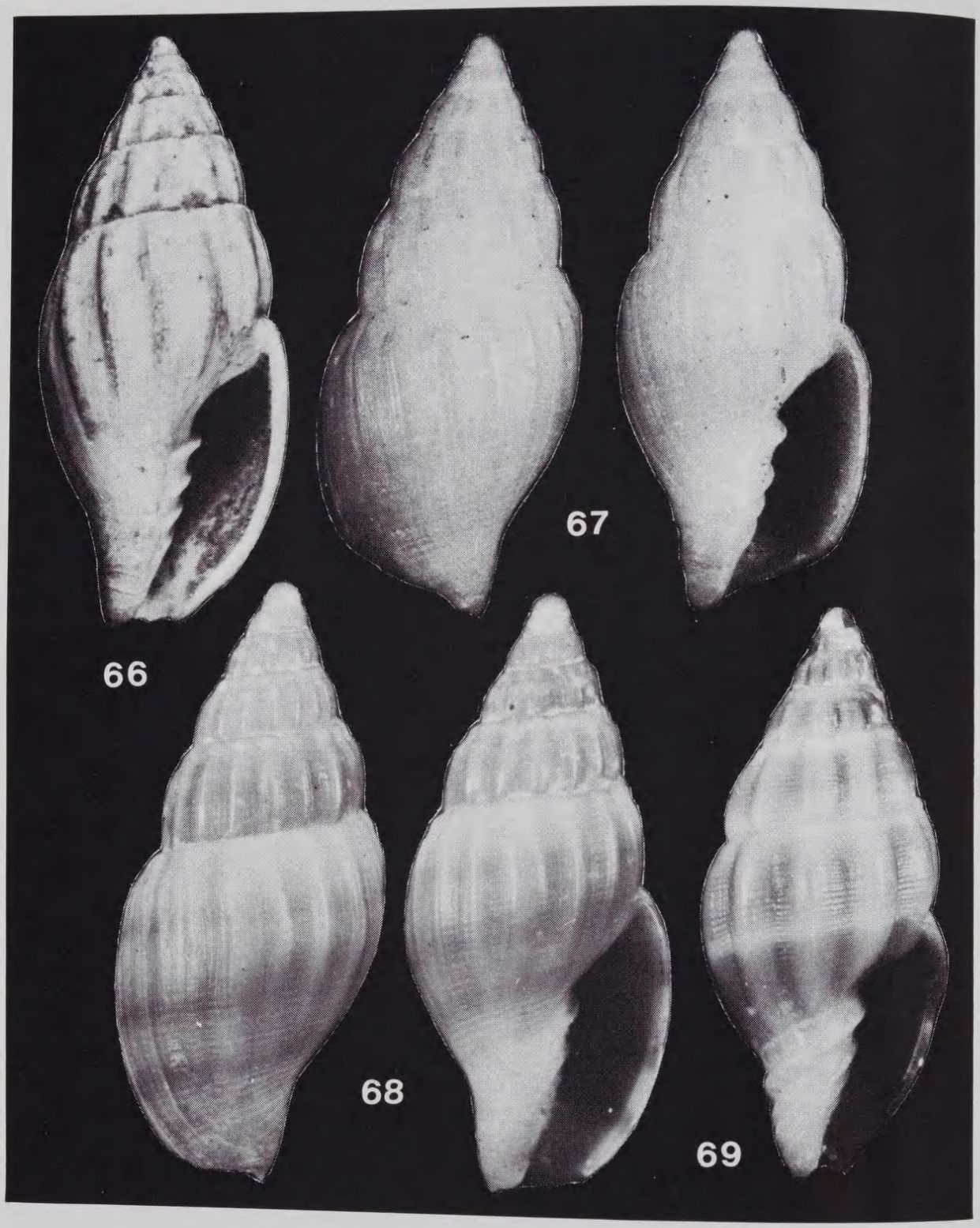
A. angulata is only tentatively listed as a valid species. It is impossible to determine without detailed population studies, if intermediate specimens are hybrids between *A. rubiginosa* and *A. angulata* or simply intergrading forms of a single species. Some juvenile individuals of *A. rubiginosa* (Fig. 65) cannot be dinguished from *A. angulata*.

Austromitra planata (Hutton, 1885) (Figs. 66-69)

1885. *Turricula planata* Hutton, Trans. Proc. N.Z. Inst. 17: 315, pl. 18, fig. 3.
1904. *Vulpecula planata* (Hutton), Hutton, Ind. fauna Novaezeal, p. 74.
1915. *Vexillum planatum* (Hutton), Suter, N.Z. Geol. Surv. Palaeont. Bull. No. 3: 22.
1927. *Austromitra planata* (Hutton), Finlay, Trans. Proc. N.Z. Inst. 57: 410; 1966 Fleming, N.Z. Dept. Sci. Ind. Res. Bull. 173: 64.
1930. *Austromitra planatella* Finlay, Trans. Proc. N.Z. Inst. 61: 235, pl. 43, fig. 18; 1952 Powell, Rec. Auckland Inst. Mus. 4 (3): 182, 1958 Powell, Shells of N.Z. ed. 3: 99.
1952. *Austromitra brunneacincta* Powell, Rec. Auckland Inst. Mus. 4 (3): 173, pl. 36, fig. 4; 1958 Powell, Shells of N.Z. ed. 3: 99, 41, fig. 4; 1964 Williams, Moll. Bay of Plenty, p. 41, textfig.
1970. *Austromitra rubiginosa* (Hutton), Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 84, pl. 10, figs. 7, 9, 10 (*non Columbella rubiginosa* Hutton, 1873).
1976. *Austromitra rubiginosa* forma *brunneacincta* Powell, Shells of N.Z. rev. ed.: 45, fig. 4.

Shell up to 15.0 mm in length, elongate-ovate and somewhat inflated, teleoconch of 4¾-5½ distinctly convex whorls, protoconch of 1½-1¾ smooth embryonic whorls. Sculptured with thin and slightly angulate axial ribs which extend from suture to suture and number from 10-20 on the penultimate and from 8-18 on the body whorl; axial ribs become less elevated, irregular and more crowded on the dorsal side towards the outer lip. Spiral sculpture consists of numerous, extremely fine spiral striae which number from 10-20 on the penultimate and from 25-45 on the body whorl. Aperture wider than in *A. rubiginosa*, outer lip occasionally angulate but usually convex, columella with 4-5 oblique, thin folds. In juvenile specimens the siphonal fasciole has 7-8 oblique cords but in adult individuals these become almost as fine as the remaining spiral striae. The majority of specimens examined were uniformly faded brown or fawn, but some specimens are brown and have 1-4 white narrow bands on the body whorl and a single white band adjacent to the sutures on spire whorls.

TYPE LOCALITY. Wanganui, Castlecliffian, L. Pleistocene of New Zealand (*planata*); off Cuvier I, 38 fathoms (70 m) (*planatella*); ½ mile (0.8 km) off west side of Mayor I, *ex-pisces* (*Cheilodactylus macropterus* Bloch & Schneider) taken in 18 fathoms (33 m) (*brunneacincta*).



Figs. 66-69. *Austromitra planata* (Hutton). 66. Holotype CMC No. M-3142; 14.5 mm. 67. Holotype of *A. planatella* Finlay, AIM No. TM-69; 10.6 mm. 68. Holotype of *A. brunneacincta* Powell, AIM No. TM-1192; 10.3 mm. 69. Juvenile specimen from off Northeast I, Three Kings I, 102 m; 10.8 mm.

DISTRIBUTION. East coast of the North Island, from the Three Kings Is to Mayor I. Subtidally, from 32 m-150 m, in sand and grit.

Type specimens. The holotype of *A. planata* is in CMC No. M-3142, dimensions 14.5 x 6.2 x 7.7 mm (Fig. 66). The holotype of *A. planatella* is in AIM No. TM-69, dimensions 10.6 x 4.5 x 5.2 mm (Fig. 67). The holotype of *A. brunneacincta* is also in AIM No. TM-1192, dimensions 10.3 x 4.5 x 6.1 mm (Fig. 68).

Material examined. New Zealand: off Northeast I, Three Kings Is, 34°09'S & 172°11'E, 102 m; off Three Kings Is, 34°11'S & 172°10'E, 92 m; off Nth. Cape, 92 m (all NMNZ); Spirits Bay, 59 m (coll. Powell); Whangaroa (AIM; coll. Powell); off Spirits Bay, 64 m (coll. Willan); Entrance to Deepwater Cove, 33-46 m; 4.8 km E. of Hen and Chicken I, 92 m; W. side of Tryphena reef, towards Cape Banner, 32 m; Colville Channel, trawled (all NMNZ); off Cuvier I, 70 m (AIM); N.N.E. of Mayor I, 84-150 m; off Mayor I, Bay of Plenty, 55 m (both coll. Powell); off Mayo I, *ex-pisces*, 33 m (AIM; NMNZ);
Fossil record: Wanganui, Caslteclíffian, L. Pleistocene of New Zealand (CMC).

Adult specimens of *A. planata* can be separated from *A. rubiginosa* on characters of inflated convex whorls, continuous axial ribs which reach from suture to suture and the extremely fine oblique spiral threads on the siphonal fasciole.

Austromitra zafra Powell, 1952 (Fig. 70)

1952. *Austromitra zafra* Powell, Rec. Auckland Inst. Mus. 4 (3): 183, pl. 36, fig. 3; 1958 Powell, Shells of N.Z. ed. 3:99, 41, fig. 3; 1964 Williams, Moll. Bay of Plenty, p.41, textfig.; 1976 Powell, Shells of N.Z. ed. 5: 103, 45, fig. 3.

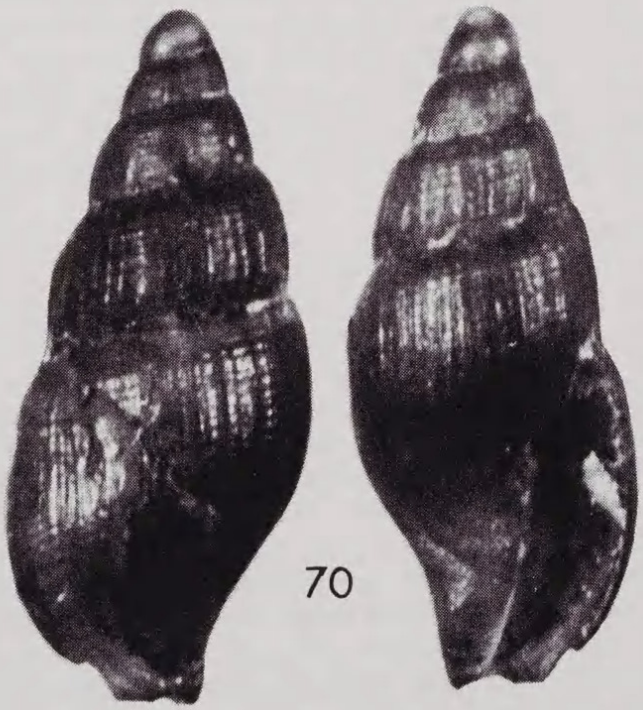


Fig. 70. *Austromitra zafra* Powell. Holotype AIM No. TM-1193; 5.2 mm.

Shell minute, 5.3 mm in length, fusiformly-ovate, teleoconch of 3½ slightly convex whorls, protoconch of 1½ smooth embyronic whorls. Sculptured with numerous, low, thin and irregular axial ribs which extend from suture to suture and number *c.* 27 on the penultimate and *c.* 40 on the body whorl; spiral sculpture consists of numerous, extremely fine spiral striae which number *c.* 9 on the penultimate whorl; oblique threads on the siphonal fasciole only imperceptibly thicker than main spiral striae. Aperture about equal in height to the spire, narrow, outer lip thin and brittle, columella with 4 oblique folds. Uniformly dark reddish-brown in colour, becoming slightly translucent toward the outer lip.

TYPE LOCALITY. 1.6 km off S.W. end of Mayor Island, from stomach of a tarakihi fish (*Cheilodactylus macropterus* Bloch & Schneider) taken in 92 m.

DISTRIBUTION. Known only from the type locality.

Type Specimens. The holotype of *A. zafra* is in AIM No. TM-1193, dimensions 5.2 x 2.2 mm (Fig. 70).

The holotype is the only specimen known to date. It is a juvenile individual in a slightly worn condition. *A. zafra* bears some resemblance to very small juveniles of *A. planata* (Hutton).

Australian species of *Austromitra*

Austromitra analogica (Reeve, 1845) (Figs. 41, 71-101)

1845. *Mitra analogica* Reeve, Conch. Icon. 2: pl. 35, sp. 293; 1882 Tryon, Man. Conch. 4: 126, pl. 37, fig. 103 only; 1923 May, Pap. Proc. R. Soc. Tasmania p. 54; 1923 May, Illust. Ind. Tasman. shells p. 79, pl. 37, fig. 16.
1855. *Volutomitra vincta* A. Adams, Proc. Zool. Soc. Lond. for 1854: 134.
1855. *Volutomitra cinnamomea* A. Adams, Proc. Zool. Soc. Lond. for 1854: 134.
1874. *Mitra vincta* Adams, Sowerby, Thes. Conchyl. 4: 25, pl. 23, figs. 520, 521; 1882 Tryon, Man. Conch. 4: 125, pl. 37, fig. 94 only.
1876. *Mitra scalariformis* Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1875: 140; 1970 Hedley, Rec. Austral Mus. 6 (4): 287; 1911 Hedley, Zool. Res. Fish. Exp. "Endeavour" p. 95; 1915 Hardy, Pap. Proc. R. Soc. Tasmania p. 69; 1921 May, Check-list Moll. Tasmania p. 80; 1923 May, Illust. Ind. Tasman. shells p. 79, pl. 37, fig. 20 (*non M. scalariformis* Borson, 1820).
1876. *Mitra teresiae* Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1875: 140; 1879 Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1878: 34; 1882 Tryon, Man. Conch. 4: 128; 1915 Hardy, Pap. Proc. R. Soc. Tasmania p. 72.
1876. *Mitra legrandi* Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1875: 140; 1879 Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1878: 34; 1900 Hedley, Rec. Aust. Mus. 3: 219, textfig.; 1913 Hedley, Proc. Linn. Soc. N.S.W. 38(2): 314; 1915 Hardy, Pap. Proc. R. Soc. Tasmania p. 67; 1918 Hedley, Proc. R. Soc. N.S.W. 51: M85; 1921 May, Check-list Moll. Tasmania p. 79; 1923 May, Illust. Ind. Tasman, shells p. 79, pl. 37, fig. 18.
1876. *Mitra scita* Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1875: 141; 1882 Tryon, Man. Conch. 4: 182; 1899 Pritchard and Gatliff, Proc. R. Soc. Victoria N.S. 11(2): 189; 1915 Hardy, Pap. Proc. R. Soc. Tasmania p. 69.
1878. *Mitra schomburgki* Angas, Proc. Zool. Soc. Lond. for 1878: 313, pl. 18, figs. 12, 13.
1878. *Mitra weldii* Tenison-Woods, Pap. Proc. Rm Soc. Tasmania p. 73.
1879. *Mitra tatei* Angas, Proc. Zool. Soc. Lond. for 1878: 861, pl. 54, fig. 8; 1922 Gatliff and Gabriel, Proc. R. Soc. Victoria N.S. 34: 135.
1882. *Turricula (Costellaria) schomburgki* Angas, Tryon, Man. Conch. 4: 173, pl. 51, fig. 470.
1882. *Turricula (Pusia) tatei* Angas, Tryon, Man. Conch. 4: 183, pl. 54, fig. 567.

1899. *Turricula scalariformis* T. Woods, Pritchard and Gatliff, Proc. R. Soc. Victoria N.S. 11(2): 189.
1901. *Turris schomburgki* Angas, Tate and May, Proc. Linn. Soc. N.S.W. Pt. 3: 361; 1908 Verco, Cat. Mar. Moll. Sth. Aust. p. 13.
1901. *Turris legrandi* T.W., Tate and May, Proc. Linn. Soc. N.S.W. Pt. 3: 361; 1908 Verco, Cat. Mar. Moll. Sth. Aust. p. 13.
1901. *Turris scalariformis* T.W., Tate and May, Proc. Linn. Soc. N.S.W. Pt. 3: 361; 1908 Verco, Cat. Mar. Moll. Sth. Aust. p. 13.
1906. *Mitra cinnamomea* A. Adams, E. A. Smith, Ann. Natal Mus. 1(1): 33.
1908. *Turris weldei (sic)* T.W., Verco, Cat. Mar. Moll. Sth. Aust. p. 13.
1908. *Turris vincta* A. Adams, Verco, *ibid.* p. 13.
1909. *Mitra bellapicta* Verco, Trans. R. Soc. Sth. Aust. 33: 337, pl. 25, fig. 1; 1921 May, Check-list Moll. Tasmania p. 79; 1923 May, Illust. Ind. Tasman. shells, p. 79, pl. 37, fig. 21.
1909. *Mitra retrocurvata* Verco, Trans. R. Soc. Sth. Aust. 33: 338, pl. 24, figs. 4, 5; 1911 Hedley, Zool. Res. Fish. Exp. "Endeavour" p. 95; 1921 May, Check-list Moll. Tasmania p. 79; 1923 May, Illust. Ind. Tasman. shells p. 79, pl. 37, fig. 17.
1916. *Vexillum pumilio* May, Proc. R. Soc. Tasmania p. 85, pl. 1, fig. 5; 1921 May, Check-list Moll. Tasmania p. 79; 1923 May, Illust. Ind. Tasman. shells p. 79, pl. 37, fig. 19.
1920. *Vexillum teresiae* T. Woods, Cooke, Proc. Zool. Soc. Lond. for 1919: 418 (description of radula).
1922. *Mitra analogica* var. *vincta* A. Adams, Gatliff and Gabriel, Proc. R. Soc. Victoria N.S. 34: 135.
1932. *Austromitra scalariformis* T.W., Cotton and Godfrey, Sth. Aust. Nat. 13(2): 78; 1941 Ludbrook, Trans. R. Soc. Sth. Aust. 65(1): 100; 1951 Macpherson and Chapple, Mem. Nat. Mus. Victoria No. 17: 133; 1952 Cotton, Bull. Dept. Mines 27: 9; 1956 Gabriel, Me. Nat. Mus. Victoria 22(4): 12; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 12; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209.
1932. *Austromitra legrandi* T.W., Cotton and Godfrey, Sth. Aust. Nat. 13(2): 78; 1951 Macpherson and Chapple, Mem. Nat. Mus. Victoria No. 17: 133; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Hanb. No. 2: 209; 1966 Macpherson, Mem. Nat. Mus. Vict. 27: 255.
1932. *Austromitra analogica* Reeve, Cotton and Godfrey, Sth. Aust. Nat. 13(2): 78; 1951 Macpherson and Chapple, Mem. Nat. Mus. Vict. No. 17: 133; 1962 Macpherson and Gabriel, Nat. Mus. Victoria Handb. No. 2: 209; 1978 Hinton, Guide Aust. shells pl. 54, figs. 23, 23a.
1932. *Austromitra schomburgki* Angas, Cotton and Godfrey, Sth. Aust. Nat. 13(2): 78, pl. 4, fig. 3; 1951 Macpherson and Chapple, Mem. Nat. Mus. Vict. No. 17: 133; 1952 Cotton, Bull. Dept. Mines 27: 9; 1954 Macpherson, Austral. Geog. Soc. Rept. No. 1: 61; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209; 1966 Macpherson, Mem. Nat. Mus. Vict. 27: 255.
1932. *Austromitra retrocurvata* (Verco), Cotton and Godfrey, Sth. Aust. Nat. 13(2): 80; 1951 Macpherson and Chapple, Mem. Nat. Mus. Vict. 17: 133; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 11; 1962 Macpherson and Gabriel, Mem. Nat. Mus. Vict. Handb. No. 2: 209.
1932. *Austromitra tatei* (Angas), Cotton and Godfrey, Sth. Aust. Nat. 13(2): 80; 1951 Macpherson and Chapple, Mem. Nat. Mus. Vict. No. 17: 133; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 17; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209; 1966 Macpherson, Mem. Nat. Mus. Vict. 27: 255.
1932. *Mitroidea jaffaensis* Cotton and Godfrey, Sth. Aust. Nat. 13(2): 82, pl. 4, fig. 8.
1951. *Austromitra pumilio* May, Macpherson and Chapple, Mem. Nat. Mus. Vict. No. 17: 133; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209.
1956. *Austromitra bellapicta* (Verco), Gabriel, Mem. Nat. Mus. Vict. 22(4): 12; 1962 Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 10.

1957. *Mutyca jaffaensis* (Cotton and Godfrey), Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 6.
1957. *Austromitra vincta* A. Adams, Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 13.
1962. *Austromitra analogica tincta (sic)* A. Adams, Macpherson and Gabriel, Nat. Mus. Vict. Handb. No. 2: 209.
1978. *Austromitra* sp. cf. *A. retrocurvata* (Verco), Ludbrook, Geol. Surv. West. Aust. Bull. 125: 159.

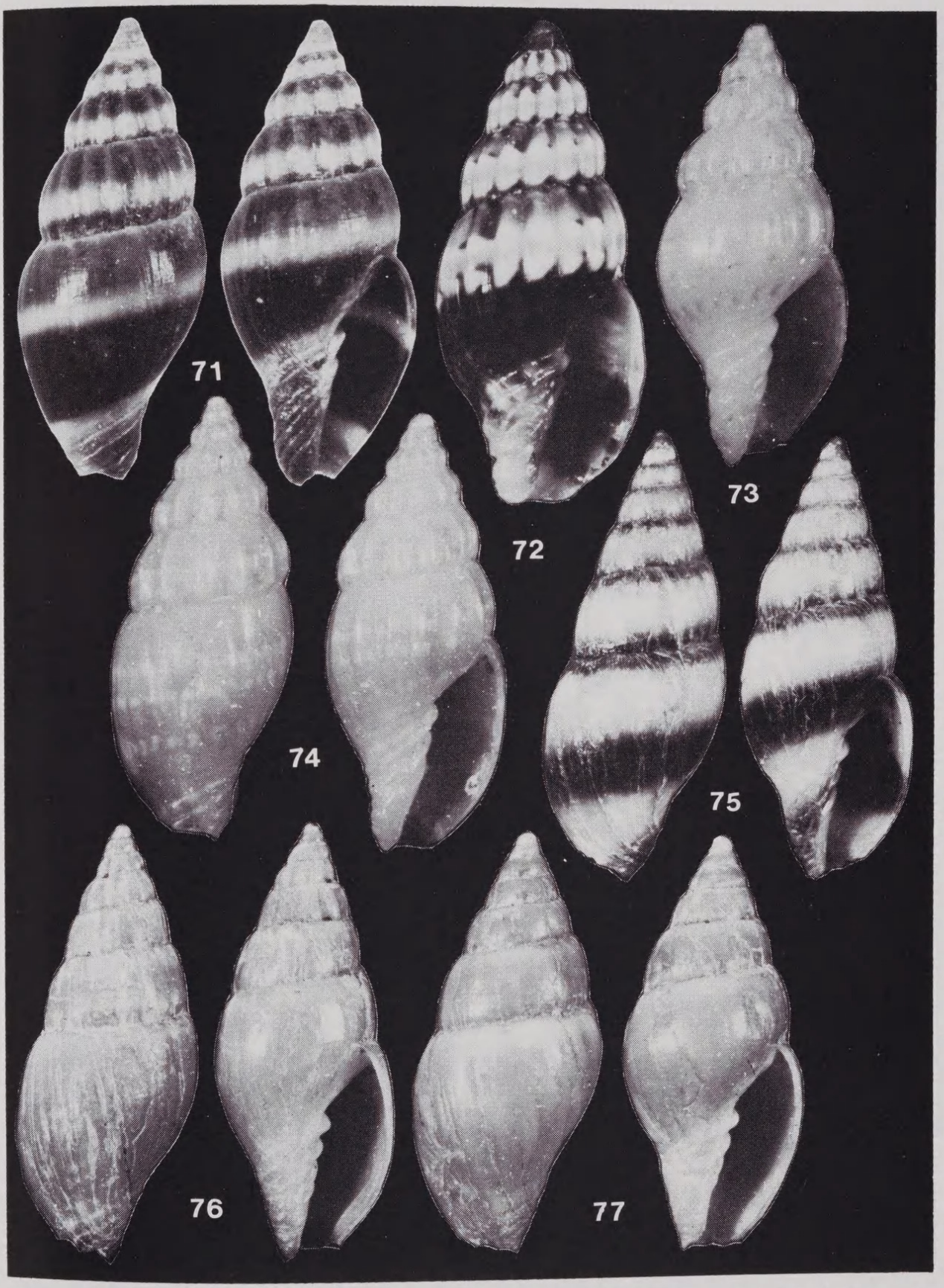
Shell up to 18.0 mm in length but frequently smaller,fusiformly-elongate to elongate-ovate, teleoconch of 4-6 convex whorls, protoconch of 1½-2 smooth glassy-brown embryonic whorls, sutures distinct. Sculpture extremely variable, consisting of thick or thin, usually angulate axial ribs which number from 0-20 on the penultimate and from 0-17 on the body whorl. Spiral sculpture is usually absent except for a few macrostriae. Aperture longer or shorter than the spire, frequently lirate within in mature specimens, outer lip convex, constricted or occasionally flaring, columella with 3-4 oblique folds, siphonal fasciole straight or sometimes slightly recurved and with 4-10 oblique cords. Variable in colour, some individuals uniformly tan or dark brown, others white and banded with dark brown or greenish-brown, some specimens with quadrate blotches at sutures.

The radula is of the vexilline type with bow-shaped rachidians which have 10-11 denticles (*fide* Cooke, 1920).

TYPE LOCALITY. None (*analogica*); Natal = error (*vincta* and *cinnamomea*); Long Bay, Tasmania (*scalariformis*); King I, Bass Strait, Tasmania (*teresiae, legrandi* and *scita*); South Australia (*schomburgki*); Long Bay and Blackman's Bay, Tasmania (*weldii*); Surveyor's Pt., Sth. Australia, 2 fathoms (4 m) (*tatei*); off Beachport, Sth. Australia, 40 fathoms (73 m) (*bellapicta*); off Beachport, Sth. Australia, 110-150 fathoms (201 m-275 m) (*retrocurvata*); off Thouin Bay, Tasmania, 40 fathoms (73 m) (*pumilio*); Cape Jaffa, Sth. Australia. 90 fathoms (165 m) (*jaffaensis*).

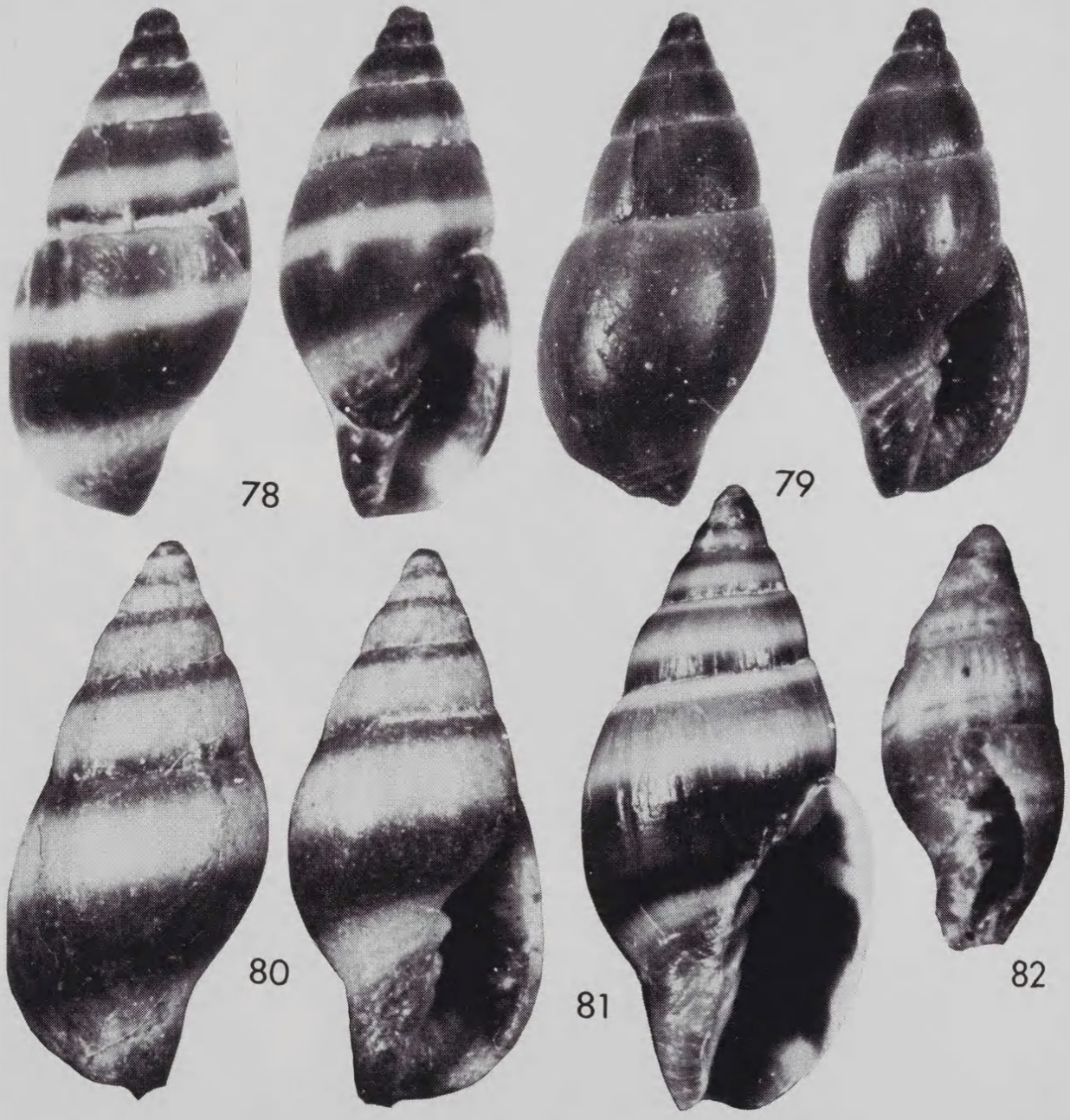
DISTRIBUTION. From southern Queensland along the southeast and south Australian coast to Cape Leeuwin, S.W. Australia (Fig. 101). Under rocks and in algae, from the intertidal zone to a depth of 570 m.

Type specimens. The following types are in the BMNH: three syntypes of *A. analogica* No. 1966667, dimensions of illustrated syntype 13.1 x 5.4 x 6.7 mm (Fig. 71); four syntypes of *A. vincta* No. 1958.8.30.2., dimensions of illustrated syntype 13.4 x 5.3 x 6.4 mm (Fig. 75); three syntypes of *A. cinnamomea* No. 1958.8.30.1., dimensions of illustrated syntypes 11.9 x 4.7 x 6.1 mm (Fig. 76) and 11.8 x 5.3 x 8.2 mm (Fig. 77); one syntype of *scita* Tenison-Woods (other syntypes in TMAG) No. 1900.8.14.80.; two syntypes of *A. schomburgki* No. 1878.4.10.3, dimensions of illustrated syntypes 9.6 x 3.9 x 4.8 mm (Fig. 83) and 9.9 x 4.4 x 5.5 mm (Fig. 84); two syntypes of tatei No. 1879.1.31.1, dimensions of illustrated syntype 7.0 x 3.4 x 3.3 mm (Fig. 90). The following types are in TMAG: two syntypes of *A. scalariformis* No. E-758 (old No. TM-5317), dimensions of illustrated syntype 9.2 x 3.9 x 4.6 mm (Fig. 85); five syntypes of *teresiae* No. E-764 (old No. TM-5315), dimensions of illustrated syntype 7.0 x 3.2 x 3.8 mm (Fig. 78); four syntypes of *legrandi* No. E-751 (old No. TM-5319) — the specimen marked as "holotype" (Fig. 92 — 6.0 x 2.4 mm) does not correspond to Tenison-Wood's description whereas the smaller 5.0 mm long paratype does (Fig. 82); three syntypes of *scita* No. E-767 (old No. TM-5318), dimensions of illustrated syntype 8.0 x 3.6 x 4.3 mm (Fig. 79); three syntypes of *weldii* No. E-765 (old No. TM-5314), dimensions of illustrated syntype 10.2 x 4.8 x 5.7 mm (Fig. 80); the holotype of *pumilio* May, No. E-753 (old No. C-539) dimensions 4.2 x 2.0 mm — the juvenile holotype has

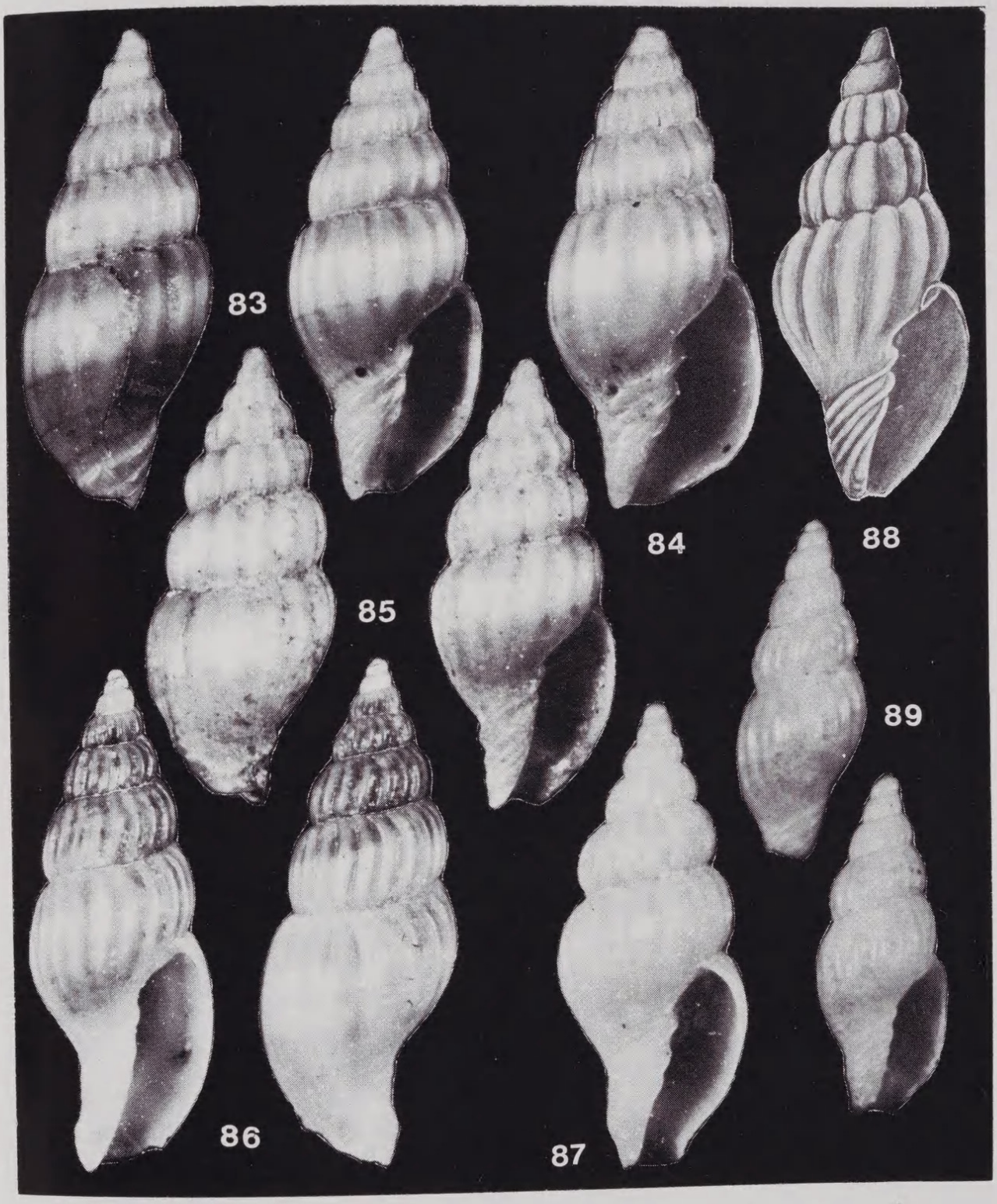


Figs. 71-77. *Austromitra analogica* (Reeve). 71. Syntype BMNH No. 1966667; 13.1 mm. 72. Specimen from Green I, Port Fairy, Victoria; 9.1 mm. 73, 74. Types of *A. bellapicta* (Verco). 73. Paratype, 9.3 mm. 74. Holotype SAM No. D-14097; 9.6 mm. 75. Syntype of *A. vincta* (A. Adams), BMNH No. 1958.8.30.2.; 13.4 mm. 76, 77. Syntypes of *A. cinnamomea* (A. Adams), BMNH No. 1958.8.30.1.; 11.9 mm and 11.8 mm respectively.

been badly affected by Museum disease (Fig. 88). The following types are in SAM: the holotype and several paratypes of *bellapicta* No. D-14097, dimensions of holotype 9.6 x 4.0 x 5.0 mm and illustrated paratype 9.3 x 4.0 x 5.5 mm (Figs. 73, 74); the holotype and several paratypes of *retrocurvata* No. D-13512, dimensions of holotype 16.8 x 6.7 x 8.5 mm (Fig. 86) and illustrated paratype 8.0 x 3.4 x 3.9 mm (Fig. 87) — the young paratypes have a straight siphonal canal; the holotype of *jaffaensis* No. D-10182, dimensions 4.8 x 1.7 mm (Fig. 89 — juvenile).

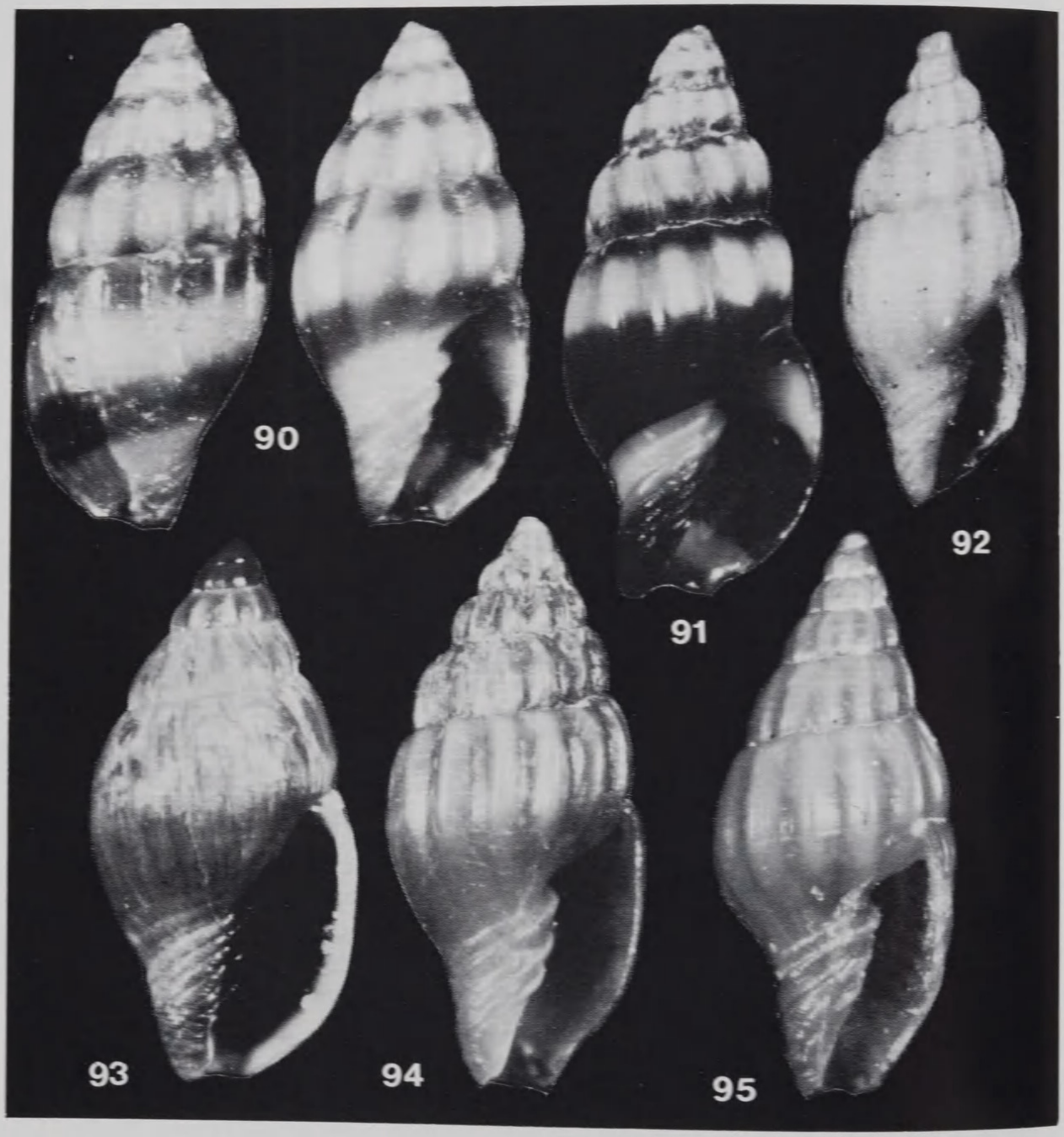


Figs. 78-82. *Austromitra analogica* (Reeve), smooth form. 78. Syntype of *A. teresiae* (T.W.), TMAG No. E-764; 7.0 mm. 79. Syntype of *A. scita* (T.W.), TMAG No. E-767; 8.0 mm. 80. Syntype of *A. weldii* (T.W.), TMAG No. E-765; 10.2 mm.



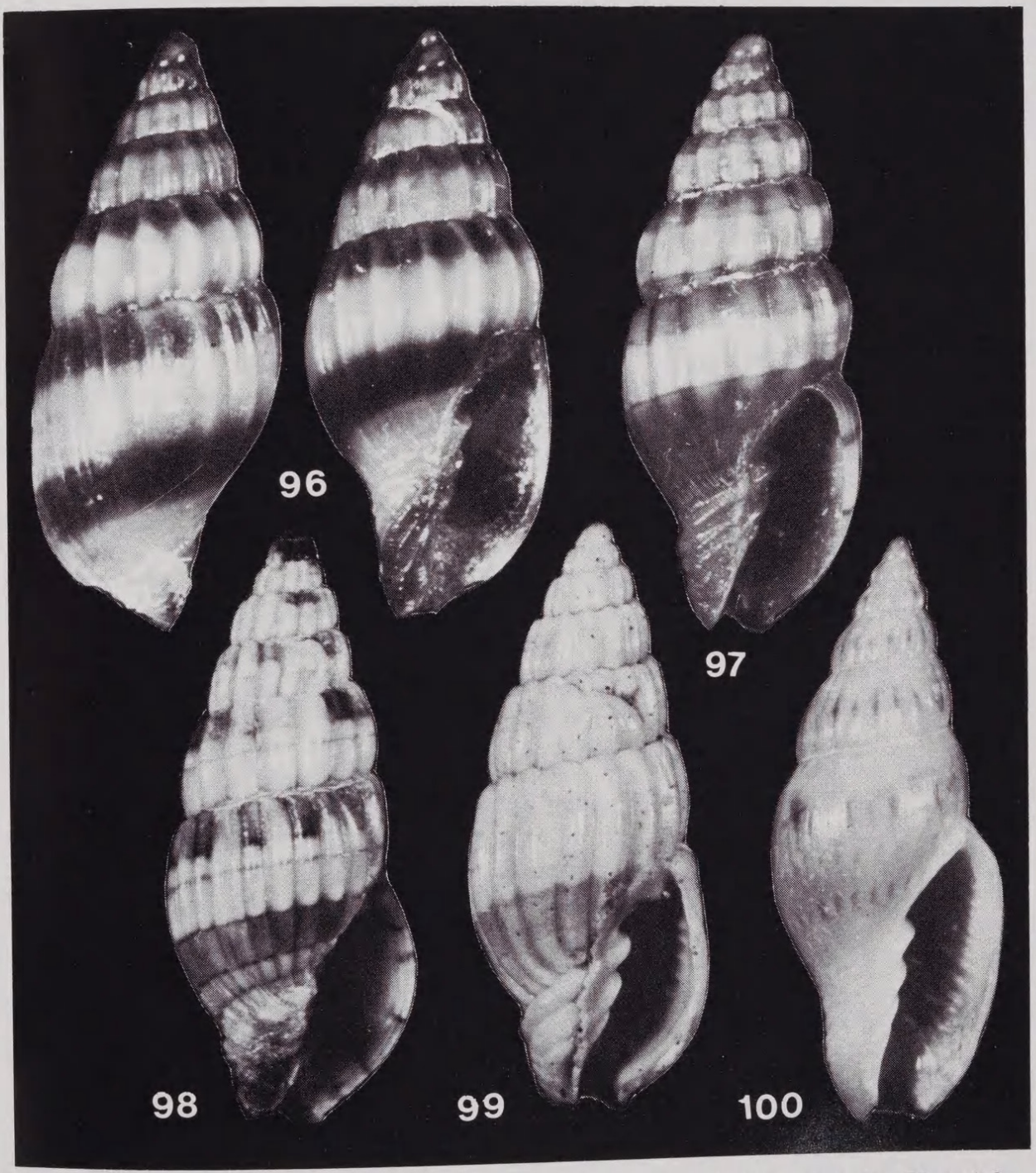
Figs. 83-89. *Austromitra analogica* (Reeve). 83, 84. Syntypes of *A. schomburgki* (Angas), BMNH No. 1878.4.10.3.; 9.6 mm and 9.9 mm respectively. 85. Syntype of *A. scalariformis* (T.W.), TMAG No. E-758; 9.2 mm. 86, 87. Holotype of *A. retrocurvata* (Verco), SAM No. D-13512; 16.8 mm (adult) and 8.0 mm (juvenile) respectively. 88. Type-figure of *A. pumilio* (May); 4.2 mm — juvenile. 89. Holotype of *A. jaffaensis* (Cotton & Godfrey), SAM No. D-10182; 4.8 mm — juvenile.

Material examined. Queensland: off S. end of Frazer I, 25°38'S & 153°51'E, 210-219 m; N.E. end of Cape Moreton, 114-124 m (both AMS). New South Wales; 35 km E. of Narrabeen, Sydney, 146 m; South Head, Sydney, 192-293 m; E. of Sydney, 75-150 m; *c*. 32 km E. of Little Bay; Geringong, S. of Wollongong; Sussex Inlet, Jervis Bay; 40 km E. of Twofold Bay, 37°27'S & 150°17'E, 294-304 m (all AMS). Victoria: Gabo I, 28 m (AMS); Cape Everard (coll. Marrow); Lakes Entrance; S.E. of Lakes Entrance, 155 m; 40 km S. of Wilson's Promontory, 39°19'S & 146°12'E, 76 m (all AMS); off Cape Liptrap, 30 m; Bear's Gully, Walkerville (both coll. Marrow); Phillip I; Western Port, 2-5 m; Port



Figs. 90-95. *Austromitra analogica* (Reeve). 90. Syntype of *A. tatei* (Angas), BMNH No. 1879.1.31.1.; 7.0 mm. 91. Specimen from Golfcourse reef, Flinders, Victoria; 11.0 mm. 92. Syntype of *A. legrandi* (T.W.), erroneously marked as "holotype", TMAG No. E-751; 6.0 mm. 93. Broad form from Cape Liptrap, Victoria; 7.0 mm. 94, 95. Axially ribbed form. 94. Western Port, Victoria; 8.7 mm. 95. Port Lincoln, Sth. Australia; 7.7 mm.

Leo, Western Port, 4 m; Warmest Channel, Western Port, 4 m; Balnarring, Western Port; Crayfish Rock, Western Port, 3-5 m (all AMS); Stony Pt.; Shoreham (both coll. Marrow); Flinders; Golf course near Flinders; Flinders Ocean platform (all AMS); Port Phillip (AMS; USNM); Balcombe Bay near Mornington (AMS); Portarlington, Port Phillip (USNM); Pt. Lonsdale; Moonlight Head (both coll. Marrow); Lorne; Portland (both AMS); Port Fairy (AMS; coll. Marrow); Tasmania: Bass Strait, 10-30 m; Deal I; Little Squally Cove; Thouin Bay, 73 m; Oyster Bay, 8 m; Eaglehawk Nook; Pirates Bay; Green Cape, Maria I, 15 m; 4 km N.E. Beaching Bay, 42°27'S & 148°12'E, 82 m; Kilburn Bay,



Figs. 96-100. *Austromitra analogica* (Reeve). 96-98. Port Lincoln, Sth. Australia, 73 m; 8.2 mm, 8.1 mm and 9.5 mm respectively. 99. W. of Pinjarra, W. Coolup, seismic shot-hole, E. Pleistocene of W. Australia; 8.0 mm — senile individual. 100. Cape Pillar, Tasmania; 16.7 mm.

7 m; off Cape Pillar, 182 m; 15 km N.E. of Tasman I, 43°12'S & 148°45'E, 570 m; Port Arthur; Primrose Pt.; E. side of Frederick Henry Bay; Derwent River; Timberbox, Hobart, 5 m; D'Entrecastaux Channel; Port Esperance; N.W. of Sandy Cape, 132 m; S. of West Pt., 41°09'S & 144°24'E, 88 m; N.W. of Hunters I; S.E. of King I, Bass Str., 40°20'S & 144°36'E, 55 m; E. of Grassy, King I, 58-77 m; Somerset; near Burnie; Ulverstone; off Devonport; Port Sorell; Brown River (all AMS). South Australia: Port MacDonnell; 18 km off Cape Marlin; Beachport; off Beachport, 201 m; Victor Harbour (all AMS); Wright I (coll. Marrow); 81 km S.E. of Kangaroo I, 77 m; Normanville (both AMS); Port Willunga (coll. Powell); Glenelg Beach near Adelaide; Outer Harbour Adelaide (both AMS); Gulf of St. Vincent (USNM); American River, Kangaroo I, 73-150 m; Knob's Bluff, N. coast of Kangaroo I (both AMS); Corny Pt. (coll. Marrow); Hardwicke Bay; Arno Beach, Spencer Gulf; Tumby Bay; off Port Lincoln, 88 m; S. of Cape Carbot, 170 m; Neptune I, 73 m; S. of Cape Catastrophe; 64 km S. of Cape Wiles, 183 m; 161 km E. of Salisbury, 34°13'S & 135°04'E, 123 m; off Streaky Bay, 65 m (all AMS); Port Brown; Sales Bay (both coll. Marrow); Smokey Bay, 40 m; West I, Nuyt's Archipelago, 53 m; 52 km S.S.W. of Francis I, 64 m; 81 km S.W. of Cape Adieu, 79 m; Pt. Sinclair; Gt. Australian Bight, 33°05'S & 128°40'E, 73 m (all AMS). West Australia: S.W. of Eucla, 79-140 m; Two Mile Beach, Hopetoun (both AMS); Hopetoun; Albany (both coll. Marrow); S. Point, S. of Two People's Bay near Albany; Windy Harbour; Cape Leeuwin, 77-144 m (all AMS).

Fossil record: Adelaidean stage, Pliocene Sth. Australia (Cotton, 1952); Paulik's bore, Jandikot, 33.5 m, E. Pleistocene of S.W. Australia; 150 miles (242 km) W. of Pinjarra, W. Coolup, from seismic shot-hole, E. Pleistocene of S.W. Australia (both WAM).

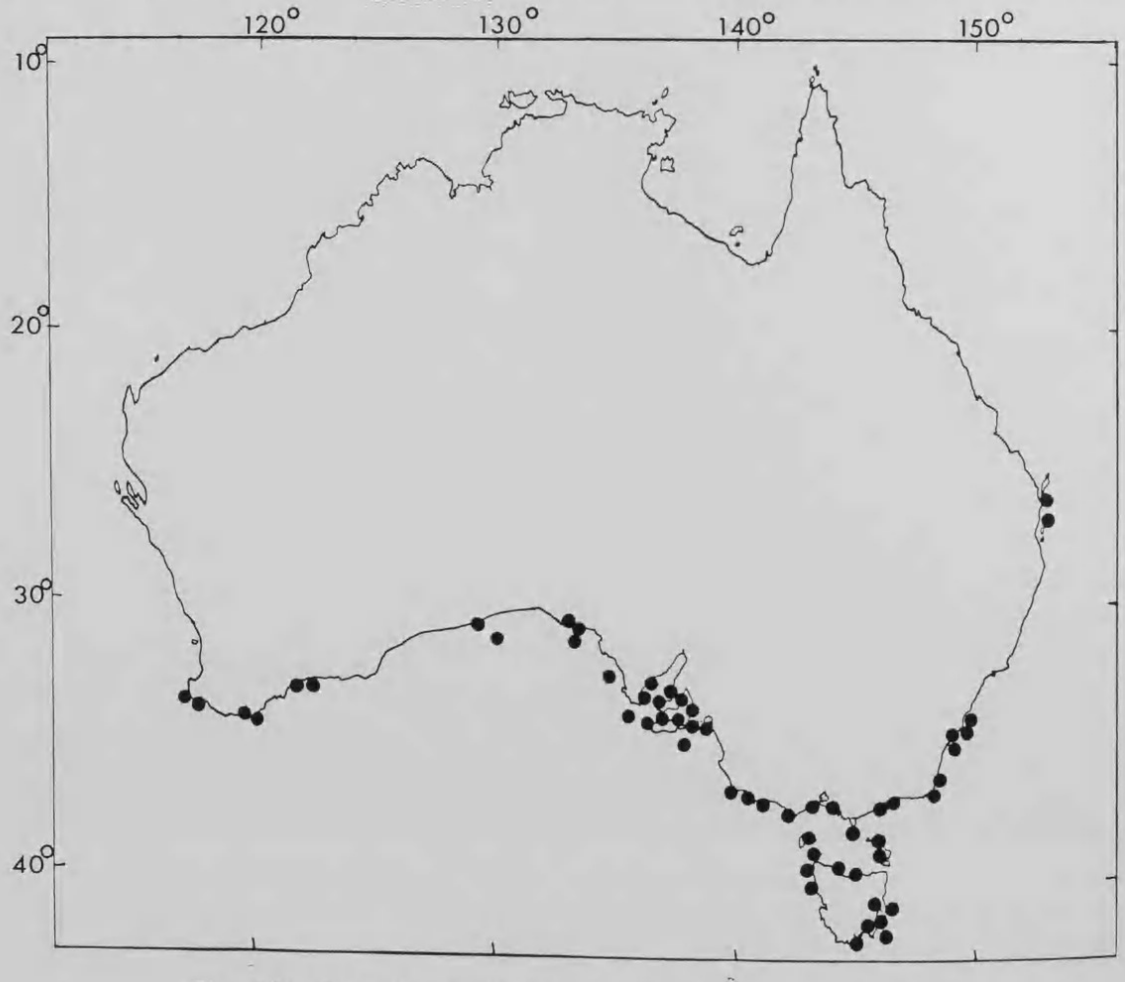


Fig. 101. Distributional map. *Austromitra analogica* (Reeve).

The species is extremely variable and consequently has received a total of 14 names, which may not be excessive when compared with the over 35 names proposed for the highly variably Mediterranean *Vexillum (Pusia) ebenus* (Lamarck). Early Australian authors had their doubts about the existence of so many "species" of *Austromitra* judging from the various synonymic treatments of the species. Tenison-Woods (1876) suggested that his *teresiae* could be a variety of *vincta* A. Adams. Pritchard and Gatliff (1899) synonymized *weldii* T.W. with *tatei* Angas and *scalariformis* T.W. with *legrandi* T.W. and *schomburgki* Angas. May (1903) considered *legrandi* to have been based on young shells of *schomburgki* Angas, and suggested that both taxa be combined with *scalariformis* T.W. Verco (1909) thought that his *bellapicta* could be a variety of *vincta* A. Adams. May (1921) synonymized *teresiae* T.W., *scita* T.W. and *weldii* T.W. with *vincta* A. Adams and two years later (May 1923) he combined *vincta* A. Adams with *analogica* Reeve and *bellapicta* Verco with *cinnamomea* A. Adams. Gatliff and Gabriel (1922) synonymized *vincta* A. Adams and *teresiae* T.W. with *analogica* Reeve, and *tatei* Angas with *weldii* T.W. Cotton and Godfrey (1932) combined *vincta* A. Adams, *teresiae* T.W., *scita* T.W. and *weldii* T.W. with *analogica* Reeve, and placed *bellapicta* Verco in synonymy of *cinnamomea* A. Adams, and later Cotton (1957) equalled *schomburgki* Angas with *scalariformis* T.W.

Seven names proposed last century apply to forms found within the intertidal zone, 5 names are applicable to forms found exclusively subtidally and 2 names have been applied to juvenile stages of subtidal forms. The various forms are discussed here in detail.

analogica Reeve: the typical form is axially ribbed but ribs become weak on the ventral side of the body whorl and obsolete on the dorsal side. The shell is blackish-brown, banded with white. The typical form occurs in the intertidal zone or very shallow depth (Figs. 71, 72).

bellapicta Verco: This form is essentially the same in form and sculpture, but is pellucid pinkish-brown with narrow dotted white bands and occasionally a row of brown dots. This form is found subtidally (Figs. 73, 74).

vincta A. Adams: this intertidal form has the same shape as *analogica* but differs in the axial ribs becoming obsolete on the last 2-4 whorls (Fig. 75).

cinnamomea A. Adams: in shape and sculpture this intertidal form resembles *vincta* and differs only in its uniform horny-brown colour (Figs. 76, 77).

teresiae Tenison-Woods: this intertidal form is closely similar to the *vincta* form and differs only in its smaller size and slightly squatter appearance. *M. weldii* Tenison-Woods is an identical form (Figs. 78, 80, 81).

scita Tenison-Woods: this is the same smooth intertidal form as *teresiae* Tenison-Woods but is uniformly dark brown in colour (Fig. 79).

legrandi Tenison-Woods: this is another small, intertidal dwarf form but the axial ribs are weakly produced and apart from being banded with brown has a narrow interrupted brown band within the white zone. The specimen erroneously marked as the "holotype" of *legrandi* is faded white in colour and represents the form *schomburgki* Angas (Figs. 82, 92).

tatei Angas: this is a small, broad and axially ribbed form with a brown sutural band and a peripheral band on the body whorl. It occurs in fairly shallow water of the subtidal region. Some specimens have brown axial ribs within the broad white zone (Fig. 90).

schomburgki Angas: this subtidal form is closely similar to the *analogica* form and differs in having the axial ribs more distinct on the body whorl. *Mitra scalariformis* Tenison-Woods, 1876, which is a primary homonym of *M. scalariformis* Borson, 1820, is the same form as *schomburgki* (Figs. 83-85).

retrocurvata Verco: this subtidal form is closely similar to the *schomburgki* form, but the holotype has a more produced and slightly recurved siphonal canal, a feature which is usually found in large, subtidal individuals. The immature paratypes do not differ from the *schomburgki* form (Figs. 86, 87).

pumilio May and *jaffaensis* Cotton and Godfrey: both taxa have been based on juvenile examples of the subtidal *schomburgki* form (Figs. 88, 89).

Austromitra arnoldi (Verco, 1909) (Figs. 102, 103)

1909. *Mitra arnoldi* Verco, Trans. Proc. R. Soc. Sth. Aust. 33: 336, pl. 24, fig. 6.

1932. *Austromitra arnoldi* (Verco), Cotton and Godfrey, Sth. Aust. Nat. 13(2): 80; 1957 Cotton, R. Soc. Sth. Aust. Malac. Sect. No. 12: fig. 9.

Shell up to 13.0 mm in length, elongate-ovate, teleoconch of 4-5 weakly shouldered whorls, protoconch of 1½-2 smooth, glassy-brown embryonic whorls, sutures distinct. Sculptured with angulate asial ribs which number from 10-13 on the penultimate and from 5-11 on the body whorl and which become obsolete towards the base, spiral sculpture absent except for obsolete macroscopic striae. Aperture moderately narrow, lirate within, outer lip convex, columella not calloused and with 4 oblique folds, siphonal fasciole with 5-6 oblique cords, siphonal notch distinct. Whitish in colour, sutures with large, rectangular dark brown to greenish-brown blotches between axial ribs, white areas with thin, interrupted brown axial hair-lines, base of body whorl with 1-2 brown bands which are irregularly broken up into small blotches; aperture brownish, occasionally banded with white.

Figs. 102, 103. *Austromitra arnoldi* (Verco). 102. Holotype SAM No. D-13511; 11.4 mm. 103. Topotype from St. Francis I, Sth. Australia; 9.2 mm.

TYPE LOCALITY. Petrel Bay, St. Francis Island, South Australia.

DISTRIBUTION. Apparently confined to South Australia. On muddy sand, under stones, intertidal.

Type specimens. The holotype and paratype of *A. arnoldi* is in SAM No. D-13511, dimensions of holotype 11.4 x 5.3 x 6.6 mm (Fig. 102).

Material examined. South Australia: St. Francis I; (AMS; SAM; coll. Powell); Streaky Bay; Ceduna (both AMS); Pt. Sinclair (AMS; coll. Marrow); Halls Bay; Pt. Brown; Smoky Bay (all. coll. Marrow).

The species appears to be rare and only a few lots were available for examination.

Austromitra volucra (Hedley, 1915) (Figs. 104-106)

1915. *Mitra volucra* Hedley, Proc. Linn. Soc. NS.W. 39: 730, pl. 84, fig. 84; 1951 Laseron, Rec. Aust. Mus. 22(4): 340, textfig. 6 (protoconch).

1962. *Austromitra volucra* Hedley, Iredale and McMichael, Aust. Mus. Mem. 11: 63.

Figs. 104-106. *Austromitra volucra* (Hedley). 104. Holotype AMS No. C-28463; 10.0 mm. 105. Specimen from Angourie, N.S.W.; 12.3 mm. 106. Specimen from Wooli Beach, N.S.W.; 13.3 mm.

Shell up to 16.0 mm in length, elongate-ovate and solid, teleoconch of 5-6 convex whorls, protoconch of 1¾-2 smooth, brown embryonic whorls, sutures narrowly and distinctly canaliculate. Early whorls with axial ribs which sometimes become obsolete on later whorls and are usually only visible as short riblets at the anterior end of the whorls descending into the canaliculate sutures; axial riblets number from 12-16 on the penultimate and from 0-5 on the body whorl, longitudinal growth-striae usually distinct; spiral sculpture absent but occasionally visible as weak macrostriae. Aperture about equal in height to the spire, lirate within, columella narrowly calloused in adult specimens and with 4 oblique folds, siphonal fasciole with 5-7 oblique cords. Brown to purplish-brown in colour, sometimes with a distinct purplish cast on upper spire whorls, ornamented with large white blotches which appear connected to each other by a narrow white line, base of shell white, interior of aperture purplish-brown, edge of outer lip orange-brown.

TYPE LOCALITY. Woolgoolga, New South Wales, Australia.

DISTRIBUTION. From southern Queensland to southern New South Wales. On coasts, under rocks, intertidal.

Type specimens. The holotype and 2 paratypes in AMS No. C-28463, dimensions of holotype 10.0 x 4.8 x 5.4 mm (Fig. 104).

Figs. 107-110. *Austromitra sordida* (Tate). 107. Holotype SAM No. T-640; 6.6 mm. 108-110. Paratypes, 8.6 mm, 6.7 mm and 7.4 mm respectively.

Material examined. Queensland: Mooloolaba Beach (AMS); New South Wales: Yamba (AMNH); Minnie Waters, N. of Wooli; Woody Head near Yamba; Woolgoolga; Clarence River; Shelly Beach, Angourie; Nambucca River (all AMS); Angourie; Wooli Beach (both coll. Marrow).

Austromitra sordida (Tate, 1889) (Figs. 107-110)

1889. *Mitra sordida* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 143, pl. 6, fig. 6.

1970. *Austromitra sordida* (Tate), Darragh, Mem. Nat. Mus. Victoria 31: 195.

Shell up to 9.0 mm in length, elongate-ovate and solid, whorls number 5 inclusive of protoconch which is not distinguishable in the type specimens, whorls prominently convex. Sculptured with thick, curved axial ribs which may become obsolete on the dorsal side of the body whorl, spiral sculpture either obsolete or worn away in type specimens, siphonal fasciole with a few oblique cords. Aperture about equal in height to the spire, lirate within, outer lip convex, columella with 4 thick, oblique folds, siphonal canal straight or slightly recurved.

TYPE LOCALITY. Lower and Upper beds at Muddy Creek, Mid-Miocene to Pliocene of Victoria, Australia.

Type specimens. The holotype and 11 very worn paratypes of *A. sordida* are in the Tate collection SAM No. T-640, dimensions of holotype 6.6 x 3.0 x 3.5 mm (Fig. 107).

The species is very similar to *A. analogica* (Reeve) and, as in that species, the axial ribs are either well-developed or obsolete on the body whorl. *A. sordida* appears to have thicker axial ribs than *A. analogica* but this may be due entirely to excessive wear in specimens of the type series.

Austromitra pumila (Tate, 1889) (Figs. 111, 112)

1889. *Peristernia pumila* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 117, pl. 8, fig. 4; 1970 Darragh, Mem. Nat. Mus. Victoria 31: 190.

Shell up to 5.0 mm in length, elongate-ovate, teleoconch of 3¼-3¾ whorls which are angulate at the presutural ramp, protoconch of 1½ smooth embryonic whorls, sutures weakly adpressed. Sculptured with prominent, thick and angulate axial ribs which number about 9-10 per whorl, ribs at shoulder thickly rounded without becoming tuberculate. Spiral sculpture consists of a few spiral striae which may be quite distinct in some individuals but almost obsolete in others. Aperture about equal in height to the spire, outer lip constricted basally, columella not calloused and with 3 close-set, oblique, parallel thin folds.

TYPE LOCALITY. Clayey green sands, Adelaide bore, Upper Eocene of South Australia.

Type specimens. The holotype and 9 paratypes of *A. pumila* are in the Tate collection, SAM No. T-560, dimensions of holotype, length 4.3 mm (Fig. 111).

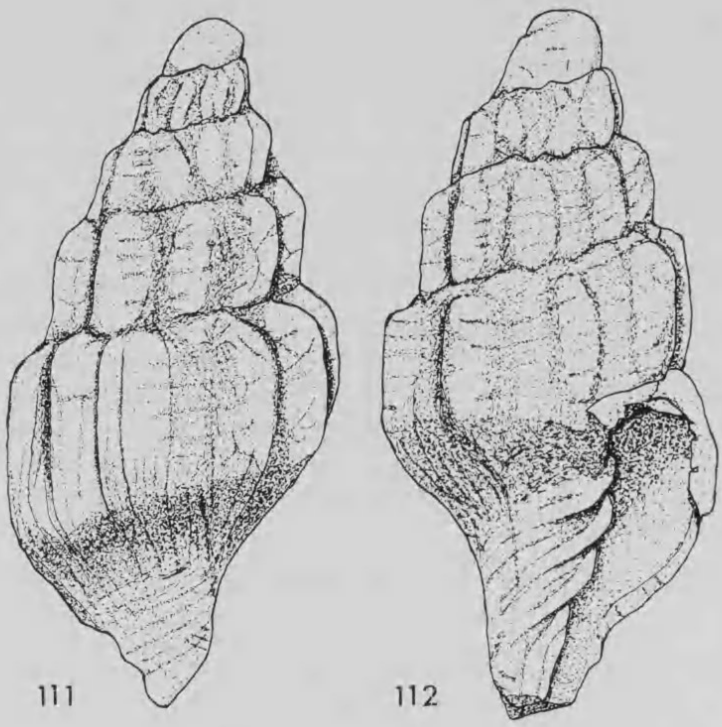
This species is the oldest *Austromitra* on record and bears some resemblance to the New Zealand *A. rubiginosa* (Hutton).

Austromitra ralphi (Cossmann, 1900) (Figs. 113-116)

1889. *Mitra semilaevis* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 143, pl. 5, fig. 9; 1893 Tate and Dennant, Trans. Proc. R. Soc. Sth. Aust. 17(1): 220 (*non* Edwards, 1856).

1897. *Uromitra semilaevis* Tate, Harris, Cat. Tert. Moll. Brit. Mus. Pt. 1: 127.

1899. *Mitra tatei* Cossmann, Essai paléoc. comp. 3: 165 (*nom. subst. pro M. semilaevis* Tate, 1889) (*non M. tatei* Angas, 1879).



Figs. 111, 112. *Austromitra pumila* (Tate). 111. Holotype SAM No. T-560; 4.3 mm. 112. Paratype, 4.2 mm.

1899. *Turricula tatei* Cossmann, Rev. paléoc. comp. 3(4): 144.

1899. *Costellaria tatei* Cossmann, Rev. paléoc. comp. 3(4): 193.

1900. *Mitra ralphi* Cossmann, Rev. Crit. Paléozool. 4(4): 186 (*nom. subst. pro M. semilaevis* Tate, 1889); 1927 Finlay, Trans. Proc. N.Z. Inst. 57: 508.

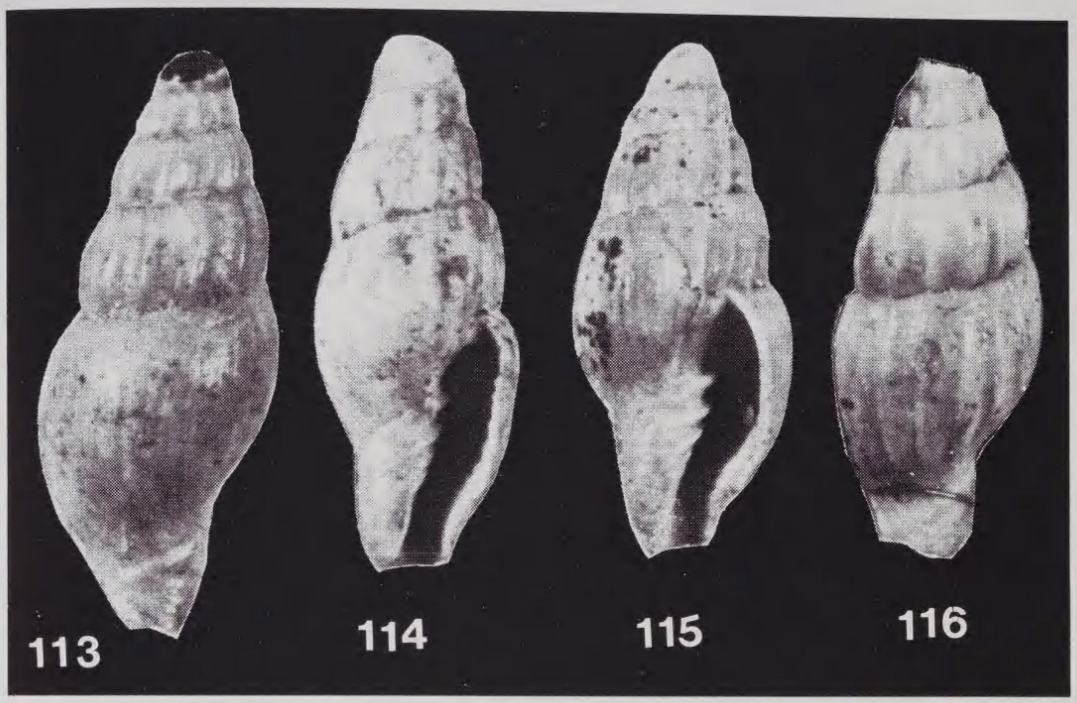
1928. *Uromitra ralphi* Cossmann, Chapman, Rec. Geol. Surv. Victoria 5(1): 42, 43, 59, 61.

Shell minute, up to 6.0 mm in length, fusiformly-elongate, teleoconch of 3-3½ convex whorls, protoconch of 1½ smooth embryonic whorls, sutures distinct. Sculptured with curved, sub-angulate axial ribs on the spire whorls, axial ribs becoming obsolete on the body whorl in some specimens but in others axial ribs continue on the body whorl to the outer lip. Spiral sculpture consists of weak and at times obsolete spiral threads which are usually most distinct anteriorly to the sutures. Aperture equal in height or slightly longer than the spire, lirate within, outer lip convex and constricted basally, columella with 4 oblique folds, siphonal canal straight and with oblique cords, one cord usually more prominent than others.

TYPE LOCALITY. Lower beds at Muddy Creek, M. Miocene of Victoria, Australia. (Other locality mentioned is blue clays at Schnapper Point).

Type specimens. The holotype and 13 paratypes of *A. ralphi* (also type of *Mitra semilaevis* Tate and *M. tatei* Cossmann) are in the Tate collection, SAM No. T-645, dimensions of holotype 5.5 x 2.0 x 3.0 mm (Fig. 113).

Mitra semilaevis Tate, 1889, is a primary homonym of *M. parva* var. *semilaevis* Edwards, 1856, and *M. semilaevis* Koenen, 1885, and *M. tatei* Cossmann, 1899, is a primary homonym of *M. tatei* Angas, 1879.



Figs. 113-116. *Austromitra ralphi* (Cossmann). 113. Holotype SAM No. T-645; 5.5 mm. 114-116. Paratypes, 5.0 mm, 4.8 mm and 4.7 mm respectively.

Harris (1897) remarked that *A. ralphi* can be readily distinguished from other species on the basis of the smooth body whorl. The prominence or obsolescence of axial sculpture on the body whorl in species of Costellariidae is a variable feature and some paratypes of *A. ralphi* have quite distinct axial ribs all the way to the outer lip.

Austromitra angusticostata Ludbrook, 1941 (Figs. 117-120)

1941. *Austromitra angusticostata* Ludbrook, Trans. R. Soc. Sth. Aust. 65(1): 96, pl. 5, fig. 13; 1952 Cotton, Bull. Dept. Mines 27: 9.

1941. *Austromitra schomburgki* (Angas), Ludbrook, Trans. R. Soc. Sth. Aust. 65(1): 100.

1954. *Austromitra mawsoni* Ludbrook, Trans. R. Soc. Sth. Aust. 77: 61 (*nomen nudum*).

1954. *Austromitra pauciplicata* Ludbrook, *ibid.* 77: 61 (*nomen nudum*).

1954. *Austromitra multiplicata* Ludbrook, *ibid.* 77: 61 (*nomen nudum*).

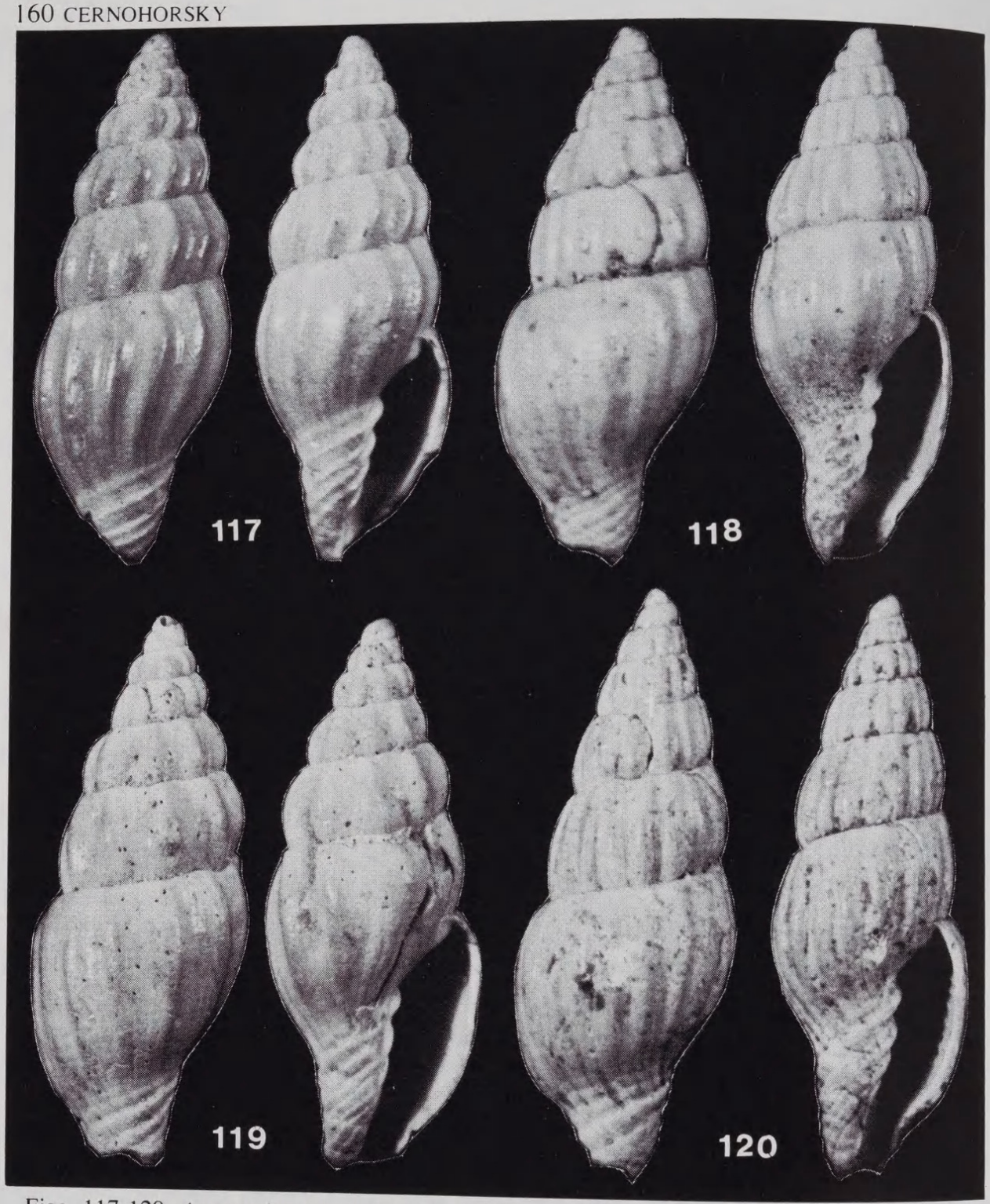
1958. *Austromitra mawsoni* Ludbrook, Trans. R. Soc. Sth. Aust. 81: 69, pl. 3, fig. 6.

1958. *Austromitra pauciplicata* Ludbrook, *ibid.* 81: 70, pl. 3, fig. 7; 1978 Ludbrook, Geol. Surv. West. Aust. Bull. 125: 159, pl. 17, figs. 17, 18.

1958. *Austromitra multplicata* Ludbrook, Trans. R. Soc. Sth. Aust. 81: 71, pl. 3, fig. 8.

Shell up to 9.0 mm in length, fusiformly-elongate, teleoconch of 4¾-5¼ convex whorls, protoconch of 1½ smooth embyronic whorls, sutures distinct. Sculptured with angulate axial ribs which number from 9-17 on the penultimate and from 10-15 on the body whorl; spiral sculpture absent except for some macroscopic spiral striae. Aperture narrow, sometimes lirate within, columella with 4 oblique folds, siphonal fasciole with 6-9 oblique cords.

TYPE LOCALITY. Abbatoir's Bore, Pliocene of Sth. Australia (*angusticostata* and *pauciplicata*); Weymouth's Bore, Pliocene of Sth. Australia (*mawsoni* and *multiplicata*).



Figs. 117-120. *Austromitra angusticostata* Ludbrook. 117. Holotype SAM No. T-1655; 8.0 mm. 118. Holotype of *A. mawsoni* Ludbrook, SAM No. F-15406; 8.2 mm. 119. Holotype of *A. pauciplicata* Ludbrook, SAM No. F-15407; 8.4 mm. 120. Holotype of *A. multiplicata* Ludbrook, SAM No. F-15408; 8.8 mm — adult specimen.

DISTRIBUTION. Abbatoir's Bore; Weymouth's Bore; Hindmarsh Bore, Dry Creek Sands, Adelaide District, Pliocene of Sth. Australia; Roe Calcarenite, Eucla Basin, E. Pleistocene of S.W. Australia.

Type specimens. The following holotypes are in the Department of Palaeontology, SAM: *A. angusticostata* No. T-1655, dimensions 8.0 x 3.0 x 3.7 mm (Fig. 117); *A. mawsoni* No. F-15406, dimensions 8.2 x 3.3 x 3.6 mm (Fig. 118); *A. pauciplicata* No. F-15407, dimensions 8.4 x 3.6 x 3.7 mm (Fig. 119), and *A. multiplicata* No. F-15408, dimensions 8.8 x 3.2 x 4.2 mm (Fig. 120).

The diagnostic characters given by Ludbrook (1958) to separate the "species" *mawsoni, pauciplicata* and *multiplicata* from *A. angusticostata* Ludbrook, or even *A. analogica* (Reeve), do not appear to be significant when tabulated in detail and compared with the actual recorded range of variability of diagnostic features of *A. analogica* (Table 2).

Table 2. Comparison of diagnostic characters in *Austromitra*.

Species	Size in mm	teleoconch whorls	Protoconch whorls	ribs on body whorl	ribs on penult whorl	Cords on fasciole
angusticostata	8.0	5¼	1½	12	12	6
mawsoni	8.2	4¾	1½	12	13	8
pauciplicata	8.4	5	1½	10	9	9
multiplicata	8.8	5	1½	15	17	9
analogica	5.0-18.0	4-6	1½-2	0-17	0-20	4-10

All these Pliocene forms of *A. analogica* are sympatric in either the Abbatoir's Bore, Weymouth's Bore or Hindmarsh Bore, and are further sympatric with specimens reported by Cotton (1952) under the name "*schomburgki*" and "*scalariformis*" from the Adelaidean stage, Pliocene of Sth. Australia. These Pliocene forms described by Ludbrook lack any constant diagnostic feature by which they can be separated from the numerous forms of the Recent *A. analogica*.

Austromitra lacertosa (Cernohorsky, 1970) (Figs. 121-123)

1889. *Mitra paucicostata* Tate, Trans. Proc. R. Soc. Sth. Aust. 11: 141, pl. 5, fig. 2; 1893 Tate and Dennant, Trans. Proc. R. Soc. Sth. Aust. 17(1): 220 (*non* Speyer, 1862).

1897. *Uromitra paucicostata* (Tate), Harris, Cat. Tert. Moll. Brit. Mus. Pt. 1: 126.

1899. *Costellaria paucicostata* (Tate), Cossmann, Essai paleoc. comp. 3: 165, pl. 8, fig. 3.

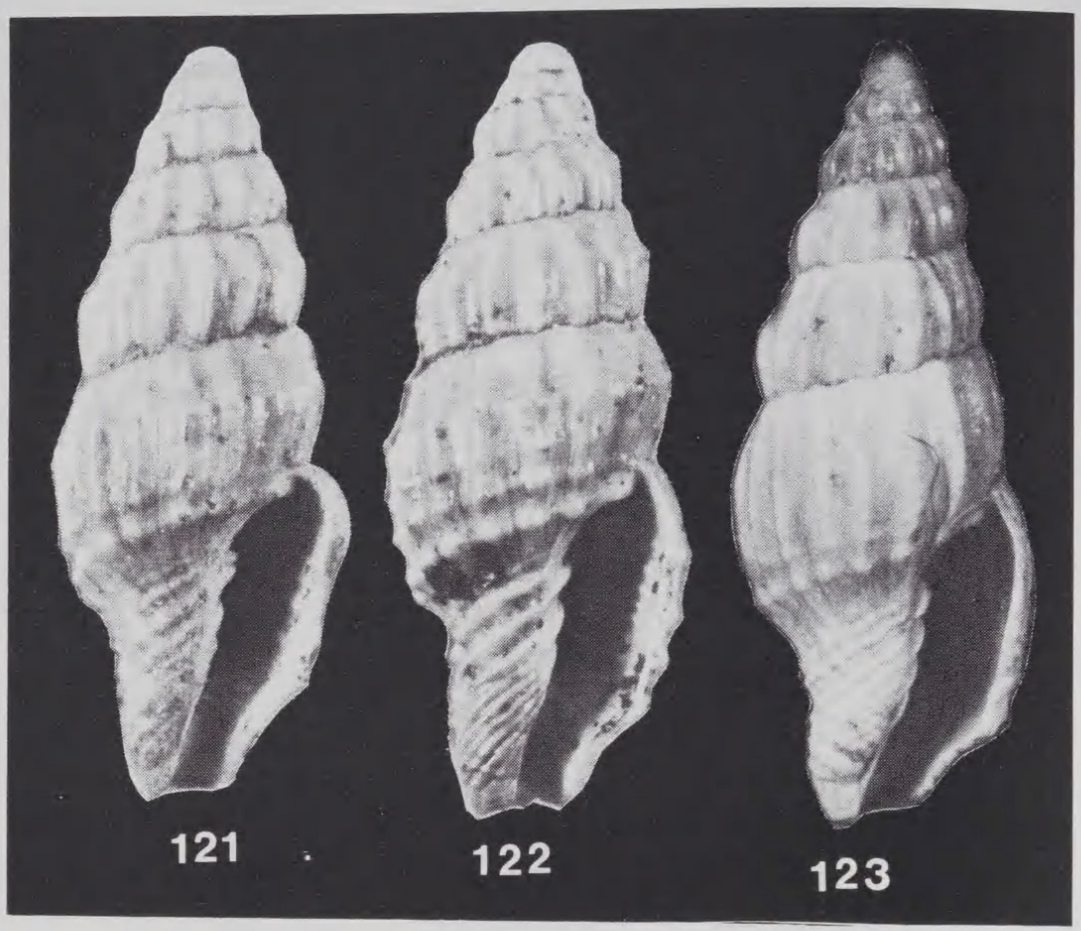
1927. *Balcomitra paucicostata* (Tate), Finlay, Trans. Proc. N.Z. Inst. 57: 508; 1970 Darragh, Mem. Nat. Mus. Victoria 31: 186.

1970. *Vexillum (Costellaria) lacertosum* Cernohorsky, Bull. Auckland Inst. Mus. No. 8: 28 (*nom. subst. pro Mitra paucicostata* Tate, 1889).

Shell up to 12.0 mm in length but frequently smaller, fusiformly-elongate and angulate on the presutural ramp of spire whorls, body whorl bi-angulate, teleoconch of 5 whorls, protoconch of 1½ smooth embryonic whorls. Sculptured with elevated and angulate axial ribs which are slightly nodose at sutures, spire whorls concave anteriorly to sutures and then descending almost vertically to the next suture. Body whorl with 2-4 strong but ill-defined cords which become nodose at the point of intersection with axial ribs, peripheral cord most prominent, siphonal fasciole with 6-8 strong, crowded oblique cords, interspaces of axial ribs obsoletely spirally striate. Aperture shorter than the spire, lirate within and constricted basally, columella not calloused and with 3-4 oblique folds, siphonal canal produced, siphonal notch distinct.

TYPE LOCALITY. Lower beds at Muddy Creek, M. Miocene of Victoria, Australia. Some paratypes from blue clays at Schnapper Point.

Type specimens. The holotype and 12 paratypes of *A. lacertosa* (and *Mitra paucicostata* Tate) are in the Tate collection, SAM No. T-625, dimension of holotype 8.9 x 3.6 x 3.9 mm (Fig. 121).



Mitra paucicostata Tate, 1889, is a primary homonym of *M. paucicostata* Speyer, 1862. Paratypes "G" and "N" of *A. lacertosa* appear to be the *schomburgki* form of *A. analogica* (Reeve).

Austromitra tasmanica (Tenison-Woods, 1876) (Figs. 124-128)

1876. *Mitra tasmanica* Tenison-Woods, Pap. Proc. R. Soc. Tasmania for 1875: 139; 1903 May, Proc. R. Soc. Tasmania for 1902: 109, fig. 1 only (figd. holotype); 1907 Hedley, Rec. Aust. Mus. 6(4): 287; 1911 Hedley, Zoool. Res. Fish. Exp. "Endeavour", p. 95; 1915 Hardy, Pap. Proc. R. Soc. Tasmania p. 70; 1921 May, Check-list Moll. Tasmania p. 80; 1923 May, Illust. Ind. Tasman, shells p. 79, pl. 37, fig. 15; 1923 May, Pap. Proc. R. Soc. Tasmania p. 54.

1901. *Turris tasmanicus* (Tenison-Woods), Tate and May, Proc. Linn. Soc. N.S.W. pt. 3: 361.

1903. *Turris tasmanica* (Ten. Woods), Hedley, Mem. Aust. Mus. 4(6): 372.

1906. *Turricula tasmanica* (T. Woods), Pritchard and Gatliff, Proc. R. Soc. Victoria, N.S. 18(2): 45; 1906 Gatliff, Proc. R. Soc. Victoria, N.S. 19(1): 3, pl. 2, figs. 6, 7.

1932. *Austromitra tasmanica* (Tenison-Woods), Cotton and Godfrey, Sth. Aust. Nat. 13(2): 78; 1962 Macpherson and Gabriel, Nat. Mus. Victoria Handb. No. 2: 209, textfig. 249; 1978 Hinton, Guide Aust. shells pl. 54, fig. 25.

1951. *Mitra cericosta* Laseron, Rec. Aust. Mus. 22(4): 342, textfig. 9.

1962. *Austromitra bucklandi* Gabriel, Mem. Nat. Mus. Victoria No. 25: 192, textfig. 6; 1962 Macpherson and Gabriel, Nat. Mus. Victoria Handb. No. 2: 209; 1969 Garrard, J. Malac. Soc. Aust. No. 12: 11; 1971 Wilson and Gillett, Aust. shells p. 118, pl. 76, fig. 7.

1962. *Austromitra bucklandi bassiana* Gabriel, Mem. Nat. Mus. Victoria No. 25: 192, textfig. 7; 1962 Macpherson and Gabriel, Nat. Mus. Victoria Handb. No. 2: 209.

1962. *Austromitra cericosta* Laseron, Iredale and McMichael, Aust. Mus. Mem. No. 11: 63.

1978. *Austromitra tasmanica* forma *bucklandi* Gabriel, Hinton, Guide Aust. shells pl. 54, figs. 24, 24a.

1978. *Austromitra tasmanica* forma *cericostata (sic)* Laseron, Hinton, Guide Aust. shells pl. 54, fig. 30.

Shell up to 18.0 mm in length, elongate-ovate, some individuals broader than others, teleoconch of 5-6½ almost flat-sided or weakly convex whorls which are roundly angulate at sutures, protoconch of 1½-2 smooth embryonic whorls, sutures distinct and narrowly ledged. Sculptured with angulate and occasionally slender axial ribs which are either distinct or absent on the body whorl and number from 15-29 on the penultimate and from 3-25 on the body whorl; spiral sculpture consists of numerous, fine spiral striae which number up to 22 on the penultimate and up to 40 on the body whorl. Aperture narrow, smooth within, outer lip convex, columella narrowly calloused in adult individuals and with 4 strong, oblique folds, siphonal fasciole with 6-8 cords, siphonal notch distinct. White in colour, spire whorls with dark brown blotches between ribs posteriorly to sutures, interspaces of axial ribs occasionally darker, body whorl with a nebulous band at sutures, a central row of brown blotches and lower third of body whorl brown in colour, aperture brown and occasionally banded with white.

TYPE LOCALITY. Tasmania, Australia (*tasmanica*); off Crookhaven, N.S.W., Australia, 30-35 fathoms (55-64 m) (*ceriocsta*); Twofold Bay, N.S.W., Australia, 10 fathoms (18 m) (*bucklandi*); 18 miles (29 km) E. of Lakes Entrance, Victoria, 15 fathoms (27 m) (*bassiana*).

DISTRIBUTION. From New South Wales to Victoria and Tasmania. Subtidal to a depth of *c.* 183 m. Specimens dredged from 439 m were faded individuals devoid of animal.

Type specimens. The holotype of *A. tasmanica* is in TMAG No. E-761 (old No. TM-5316), dimensions 12.5 x 5.2 x 6.2 mm (Fig. 124); the holotype of *A. cericosta* is in AMS No. C-65641, dimensions 14.7 x 5.1 x 6.8 mm (Fig. 125); the holotype of *A. bucklandi* is in NMV No. F-20727, dimensions 15.4 x 6.5 x 7.8 mm (Fig. 126), and the holotype of *A. bucklandi bassiana* is also in NMV No. F-20729, dimensions 13.8 x 5.0 x 6.6 mm (Fig. 127).

Material examined. New South Wales: 2.3 km E. of Malabar, 66 m; E. of Port Jackson, 54-91 m and 146 m; off Shoalhaven Bight, 150°17'E & 33°58'S, 66 m; off Port Hacking, 183 m; off Crookhaven, 55-64 m; off Jervis Bay, 36 m; 16 km N. of Eden, 36 m; Brush I, S. of Ulladulla (all AMS); off Eden, 36°00'S & 150°20'E, 66-119 m; S. of Eden, 38°10'S & 141°55'E, 347-439 m (both ZMC); Eden; 16 km N. of Twofold Bay, 24 m; off Twofold Bay, 18 m; Disaster Bay (all AMS); Victoria: E. of Lakes Entrance, 24 m; off Lakes Entrance, 36 m; Western Port (all AMS); Western Port Bay (coll. Marrow); Tasmania: off N.E. Tasmania, 128 m (coll. Powell); Little Swanport, 33 m; Cape Pillar, 183 m; Derwent River; N.W. of Hunter I, 63 m; off Tinderbox, 11 m (all AMS).

This is a composite species and only the holotype represents *A. tasmanica*. The paratype of var. A (11.0 x 5.1 x 6.0 mm) is a large *tatei* form of *A. analogica* (Reeve), and paratype of var. B (11.6 x 4.7 x 5.8 mm) is the *schomburgki* form of *A. analogica*.

Figs. 124-128. *Austromitra tasmanica* (Tenison-Woods). 124. Holotype TMAG No. E-761; 12.5 mm (broad form). 125. Holotype of *A. cericosta* (Laseron), AMS No. C-65641; 14.7 mm (slender form). 126. Holotype of *A. bucklandi* Gabriel, NMV No. F-20727; 15.4 mm (broad form). 127. Holotype of *A. bucklandi bassiana* Gabriel, NMV No. F-20729; 13.8, (slender form). 128. Broad, obsoletely sculptured specimen from Western Port Bay, Victoria; 13.2 mm.

According to Cooke (1920) the radula is of the *Vexillum* type with a bow-shaped rachidian containing 10-11 cusps.

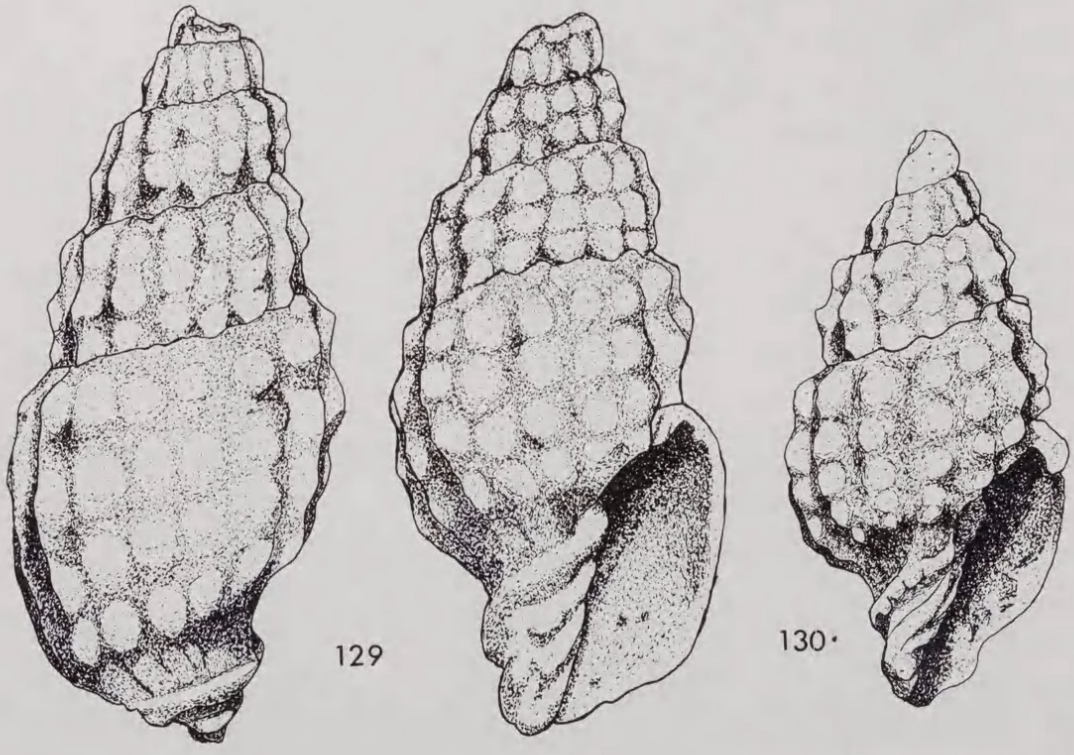
Austromitra minutenodosa sp. n. (Figs. 129, 130)

Shell minute, up to 4.5 mm in length, elongate-ovate, teleoconch of 4½ whorls which are sub-angulate at sutures, protoconch (missing in adult specimens) of 1¼ smooth embryonic whorls in juvenile individuals. Whorls sculptured with moderately large, round nodules which are connected to each other by axial ribs which are prominent on early whorls but become less thick and concave between nodules on body whorl; penultimate whorl with 3 spiral rows of nodules, anterior row of nodules pressed against and partly covered by suture, body whorl with 4 rows of nodules. Axial ribs number from 13-14 on the penultimate and the body whorl and extremely fine, macroscopic longitudinal striae are visible in some individuals, spiral sculpture absent. Aperture about equal in height to the spire, smooth within, columella not calloused and with 3 strong, oblique folds, first two posterior folds become thick and rope-like and extend onto the siphonal fasciole towards the dorsal side. All specimens white to creamy-white in colour.

TYPE LOCALITY. Great Australian Bight, 33°05'S and 128°40'E, in 75 m.

Holotype. In AMS No. C-114474; length 4.2 mm, width 1.9 mm (*leg*. H.M.A.S. "Gascoyne", 5 July 1962) (Fig. 129).

Paratypes. One paratype in AIM, remaining 6 paratypes in AMS.



Figs. 129, 130. *Austromitra minutenodosa* sp. n. Great Australian Bight, Sth. Australia, 75 m. 129. Holotype AMS No. C-114474; 4.2 mm. 130. Immature paratype, 3.5 mm.

There is no similar Australian or New Zealand species with which *A. minutenodosa* could be compared. The only superficially similar species, belonging to a different genus, is *Vexillum (Costellaria) nodospiculum* Cernohorsky, 1970, from deep water in the Philippines, but that species is considerably more fusiform with a conical protoconch of 3½ embryonic whorls, 2 sutural rows of spikey nodules on the penultimate whorl, differently formed axial ribs and spiral sculpture. Although the new species is described on the basis of specimens collected devoid of animals, it is so distinct from any known *Austromitra* to warrant description on the basis of the present material.

Excluded species of Costellariidae

Species previously recorded in the closely allied families Mitridae and Volutomitridae have been recorded and re-assigned to their respective families by Cernohorsky (1972). Species now excluded from the Costellariidae are listed below and will be discussed in detail in a subsequent paper.

Thala marginata Tenison-Woods, 1877, now a synonym of *Rugobela columbelloides* (Tenison-Woods, 1877), family Turridae.

Vexillum apicicostatum Suter, 1917, now a synonym of *Waimatea inconspicua* (Hutton, 1885), family Volutomitridae.

Vulpecula (Pusia) biconica Murdoch and Suter, 1906, now a synonym of *Microvoluta marginata* (Hutton, 1885), family Volutomitridae.

Vexillum fenestratum Suter, 1917, now a member of *Egestas* Finlay, 1927, family ? Fasciolariidae.

Vexillum fractum Marwick, 1926, now in the family Volutomitridae.

Vulpecula (Pusia) hedleyi Murdoch, 1905, now a member of *Peculator* Iredale, 1924, family Volutomitridae.

Vexillum ligatum Suter, 1917, now a synonym of *Waimatea enysi* (Hutton, 1873), family Volutomitridae.

Turricula lincta Hutton, 1885, now a synonym of *Microvoluta marginata* (Hutton, 1885), family Volutomitridae.

Vexillum lornense Marwick, 1926, now a member of *Waimatea* Finlay, 1927, family Volutomitridae.

Turricula marginata Hutton, 1885, now a member of *Microvoluta* Angas, 1877, family Volutomitridae.

Vexillitra marwicki Vella, 1954, now a member of *Microvoluta* Angas, 1877, family Volutomitridae.

Vexillum parki Allan, 1926, now a member of *Waimatea* Finlay, 1927, family Volutomitridae.

Vexillum plicatellum Marshall and Murdoch, 1923, now a member of *Conomitra* Conrad, 1865, family Volutomitridae.

Austromitra plicifera Marwick, 1928, now a member of *Proximitra (Parvimitra)*, family Volutomitridae.

Vexillum (Latiromitra) problematicum Ponder, 1968, now a member of *Volutomitra (Latiromitra)*, family Volutomitridae.

Vexillum (Costellaria) rutidolomum Suter, 1917, now a member of *Proximitra* Finlay, 1927, family Volutomitridae.

Vexillum suteri Finlay, 1924, now a synonym of *Waimatea enysi* (Hutton, 1873), family Volutomitridae.

Austromitra tricordata Beu, 1970 (Fig. 131)

1970. *Austromitra tricordata* Beu, Trans. R. Soc. N.Z. Earth Sci. 7(12): 225, pl. 4, fig. f. (Bell's Creek, tributary of Mangaopari Stream, Wairarapa, New Zealand; Tongaporutuan, U. Miocene).

The holotype of *A. tricordata* Beu, is in VUM No. VM-427, length 6.1 mm, width 2.3 mm (Fig. 131 — immature). The species does not appear to belong to *Austromitra*. The sculpture, uncorded siphonal fasciole, unnotched siphonal canal and the three very minute, short folds placed high on the columella are features incompatible with *Austromitra*. These characters, however, compare favourably with species of *Egestas* Finlay, 1927, particularly the Lower Miocene *Egestas fenestrata* (Suter, 1917). This species is about the same size as *E. tricordata* but is more slender and some immature specimens also show a bi-cordate penultimate and tri-cordate body whorl and the same minute columellar folds. The Lower Miocene *E. fenestrata* is most probably the ancestral form of the Upper Miocene *E. tricordata*.

The radular anatomy of *Egestas waitei* (Suter, 1909), the type-species of *Egestas*, remains unknown and the assignment of *Egestas* to the family Fasciolariidae is only tentative.

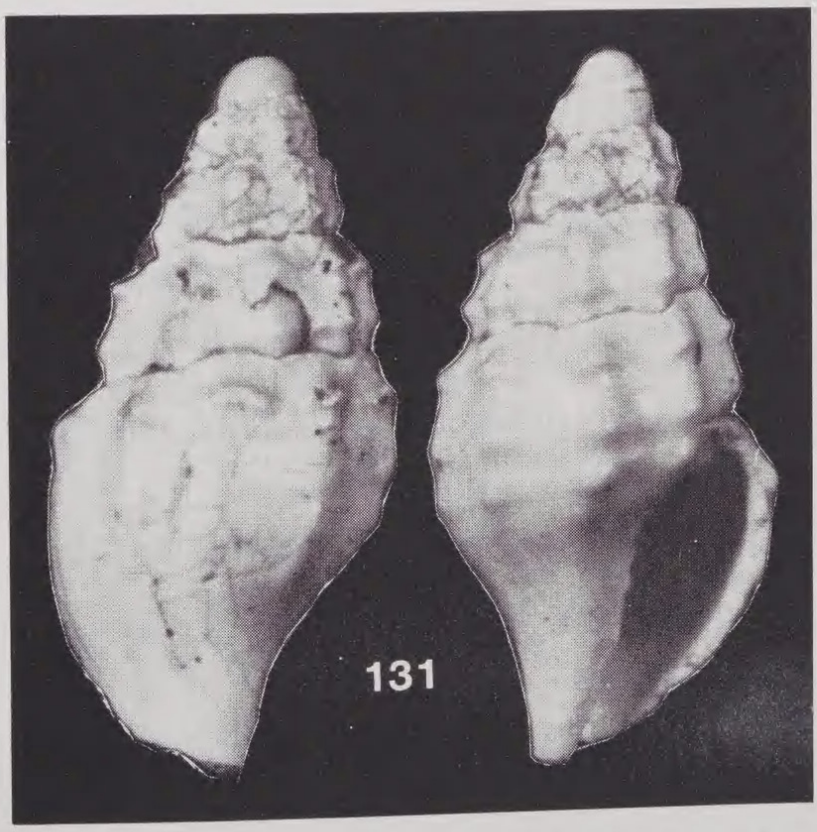


Fig. 131. *Egestas tricordata* (Beu). Holotype VUM No. VM-427; 6.1 mm.

Vexillum waitei Suter, 1909, now a member of *Egestas* Finlay, 1927, family ? Fasciolariidae.

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