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PORT PHILLIP SURVEY 1957–1963.

ECHINODERMATA

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SUMMARY.

The present paper deals mainly with the echinoderms collected by the Port Phillip Survey but also includes a study of some of the specimens collected in the vicinity of Port Phillip by J. B. Wilson toward the end of the last century and deposited in the British Museum. In addition there are details of further interesting material from localities outside the bay, notably from Cape Schank, which was sent to me together with the Survey specimens. The report starts with a fauna list in which the species taken by the Survey or by Wilson in Port Phillip appear in the left-hand column, while the other species that have been (or are now) recorded from that part of the Flindersian region east of the Great Australian Bight from depths of less than 40 fathoms (about 70 metres) appear on the right. This illustrates the limited number of species that occur within the bay. There follows the list of records of the Survey material, then details of certain of the species (including a few from outside Port Phillip) with keys to all the species given in both sides of the fauna list, each class being treated separately. Four new species, a starfish and three brittle-stars, are described, while remarks on an undetermined Antedonid and a Cucumarian of the genus *Stereoderma*, not previously represented in the waters of southern Australia, are included.

INTRODUCTION.

The echinoderm fauna of the eastern half of the Flindersian region from the Great Australian Bight to Wilson's Promontory, Victoria, is fairly well known from the works of H. L. Clark supplemented by Cotton and Godfrey's paper of 1942. However, few records exist of a number of the species and the localities of most of the specimens in the South Australian Museum reported on by H. L. Clark in 1928 (including the types of a number of species not otherwise known) are uncertain.

The fauna list given in this paper may need to be supplemented by the addition of further species at present only known from the other half of the Flindersian region, that is from south-west and western Australia. The possibility of this is emphasized by the discovery of *Nectria macrobrachia* among the additional material that had been collected at Cape Schank, Victoria sent to me by Miss Macpherson. This species was previously recorded only from Houtman's Abrolhos, off Geraldton, Western Australia.

The depth limit of 40 fathoms (73 metres) used in compiling the fauna list was chosen to allow a wide margin beyond the maximum depth of 10 or 11 fathoms in which collecting has been carried out in Port Phillip, and the depths at which skin-diving and small boat dredging are practicable.

The species in the left-hand column of the fauna list marked with an asterisk were not collected by the recent Survey but only by F. Bracebridge Wilson in the 1880s. Much of his material was the subject of a report by

Bell (1888), but since some of the specific names used by Bell were incorrect or have been referred to other genera I think it is worth while to include here an amended list. Wilson collected mainly just inside the Heads in the equivalent of areas 49, 50, 51, 58, 59 and 60; unfortunately few details of the precise localities remain with the specimens.

Positions of Areas and stations are shown on Charts 1 and 2 (back of volume).

Chart 1 is a bathymetric chart plotted from Admiralty Chart 1171 Port Phillip with the numbered area grid superimposed.

Chart 2 shows position of the stations numbered 1—317 with the same grid superimposed to aid in location of the stations and for correlation with depth, &c.

Localities in the text are shown as Area number followed immediately by the station number in brackets. Table A (back of volume) records station number, date, method of collecting (dive or dredge) and depth in fathoms.

The greater part of this report was completed in December, 1962, but further interesting material collected in 1963, prompted some additions and a few alterations.

The Survey material together with some additional specimens from localities outside Port Phillip were sent to me by Miss J. Hope Macpherson, to whom I am indebted for the opportunity of carrying out this work.

Holotypes of new species described in this paper are deposited in the National Museum of Victoria.

FAUNA LIST OF ECHINODERMATA FROM DEPTHS OF LESS THAN 40 FATHOMS. (73 METRES.)

PORT PHILLIP (SURVEY & WILSON*)	OTHER EAST FLINDERSIAN SPECIES.
Crinoids:—	
Comanthus (*Cenolia*) *trichoptera* (J. Müller)	*C.* (*Cenolia*) *tasmaniae* A. H. Clark
**Ptilometra macronema* (J. M.)	*Comatulella brachiolata* (Lamarck)
Aporometra wilsoni (Bell)	
Euantedon paucicirra H. L. Clark	
Antedon incommoda Bell	
Antedon loveni Bell	
Antedonid sp.	
Asteroids:—	
	Luidia australiae Döderlein
	Astropecten pectinatus Sladen
	[2]*Astropecten schaveri* Död.
	Astropecten vappa Müller & Troschel
[3]*Tosia australis* Gray	*Astropecten preissi* M. & Tr.

1. A. H. Clark (1931) mentions a specimen of *C. brachiolata* from Port Phillip in the British Museum collection; this cannot now be found.

2. *Astropecten schaveri* will probably prove to be a synonym of *A. pectinatus*.

3. Livingstone's record of *Tosia tuberculata* (a synonym of *T. nobilis*) from this area I believe was based on a misidentification of *Tosia australis* forma *astrologorum*; see A.M.C., 1953.

Asteroids—*continued.*

Tosia magnifica (M. & Tr.)
(synonyms *aurata* and *grandis*)
Pentagonaster duebeni Gray
(synonyms *crassimanus* and *stibarus*)
Nectria multispina H. L. C.

Nectria ocellata Perrier
Nectria macrobrachia H. L. C.

**Austrofromia polypora* (H.L.C.)
Petricia vernicina (Lmk.)
Patiriella gunni (Gray)
Patiriella calcar (Lmk.)
Paranepanthia grandis (H.L.C.)
Nepanthia hadracantha sp. nov.
Plectaster decanus (M. & Tr.)

Anthaster valvulatus (M. & Tr.)

Patiriella exigua (Lmk.)
Asterina atyphoida H. L. C.

Coscinasterias calamaria (Gray)
Allostichaster polyplax (M. & Tr.)

Echinaster arcystatus H.L.C.
Echinaster glomeratus H.L.C.
Australiaster dubius (H.L.C.)
Allostichaster regularis H.L.C.
Uniophora granifera (Lmk.)

[4]*Smilasterias irregularis* H.L.C.
Uniophora obesa H.L.C.
Uniophora multispina H.L.C.
Uniophora uniserialis H.L.C.
Uniophora gymnonota H.L.C.
Uniophora nuda (Per.)

Ophiuroids:—

Astroconus australis (Verrill)

Astroconus pulcher H.L.C.
Astroboa ernae Död.

Ophiomyxa australis Lütken
Ophiacantha alternata sp. nov.

Ophiacantha brachygnatha H.L.C.

Amphipholis squamata (D. Chiaje)
Amphiura constricta Lyman

Amphiura trisacantha H.L.C.

Amphiura poecila H.L.C.
Amphiura elandiformis sp. nov.

Amphiodia ochroleuca (Brock)

Amphiura (Ophiopeltis) parviscutata sp. nov.
Ophiocentrus pilosus (Lyman)

Ophiactis tricolor H.L.C.
Ophiactis resiliens Lyman
Ophiothrix aristulata Lyman
Placophiothrix spongicola (Stimpson)
Ophiocoma pulchra H.L.C.
Ophiocomina australis H.L.C.
Ophionereis semoni (Död.)
Pectinura assimilis (Bell)
Ophiurodon opacum H.L.C.
Ophioplocus bispinosus H.L.C.
Ophiura ooplax (H.L.C.)
Ophiozonella elevata (H.L.C.)

Ophiothrix caespitosa Lyman

Ophiocoma canaliculata Lütken

Ophionereis schayeri (M. & Tr.)
**Pectinura arenosa* Lyman
Ophiarachnella ramsayi (Bell)
**Ophiocrossota multispina* (Ljungman)
Ophiura kinbergi Lj.

Echinoids:—

Goniocidaris tubaria forma *impressa* Koehler

Phyllacanthus irregularis Mtsn.
Temnopleurus michaelseni (Död.)

**Microcyphus zigzag* L. Agassiz
**Microcyphus compsus* H.L.C.
**Microcyphus annulatus* Mtsn.

Microcyphus pulchellus H.L.C.

Amblypneustes ovum (Lmk.)

Amblypneustes pachistus H.L.C.
Amblypneustes grandis H.L.C.
Amblypneustes formosus Valenciennes
Amblypneustes pallidus (Lmk.)

**Holopneustes porosissimus* L. Ag.
**Holopneustes inflatus* Lütken *in* A. Agassiz
Heliocidaris erythrogramma (Val.)
Pachycentrotus australiae (Michelin *in* A. Agassiz)

4. H. L. Clark (1946) mentions some small specimens from Port Phillip which might belong to this species.

Echinoids—*continued.*

**Clypeaster australasiae* (Gray)	*Ammotrophus cyclius* H.L.C.
	Ammotrophus platyterus H.L.C.
	Peronella peroni (L.Ag.)
	Fibularia ovulum Lmk.
**Echinocyamus platytatus* H.L.C.	*Fibularia plateia* H.L.C.
	Protenaster australis (Gray)
	Moira stygia Lütken *in* A.Ag.
	Moira lethe Mtsn.
Echinocardium cordatum (Pennant)	*Brissus meridionalis* Mtsn.
	Eupatagus valenciennesi L.Ag.

Holothurians:—

Stichopus mollis (Hutton)	*Stichopus ludwigi* Erwe
	Holothuria hartmeyeri Erwe
Pentacta australis Ludwig	*Cucumaria striata* Joshua & Creed
Stereoderma sp.	'*Cucumaria squamatoides* H.L.C.'—a nomen nudum
Staurothyone inconspicua (Bell)	
Thyone nigra J. & C.	*Staurothyone vercoi* (J. & C.)
	Neoamphicyclus lividus Hickman
Cucumella mutans (Joshua)	*Amphicyclus mortenseni* Heding & Panning
	Lipotrapeza ventripes (J. & C.)
	Lipotrapeza vestiens (J.)
	Neothyonidium dearmatum (Dendy & Hindle)
	Psolidium sp.
Paracaudina australis (Semper)	*Paracaudina tetrapora* (H.L.C.)
Leptosynapta dolabrifera (Stimpson)	*Leptosynapta ictinodes* H.L.C.
	Chiridota gigas Dendy & Hindle
Trochodota allani (J.)	*Trochodota roebucki* J.

5. Notes on the nomenclature of this and some other species are given in the relevant keys.

SPECIES OF ECHINODERMS COLLECTED BY J. B. WILSON AT PORT PHILLIP AND RECORDED BY BELL, 1888 [with the accepted name (where different) on the right].

Antedon Wilsoni sp. nov.	*Aporometra wilsoni* (Bell)
Antedon incommoda sp. nov.	Same
Actinometra trichoptera Müller	*Comanthus trichoptera* (Müller)
Asterias calamaria Gray	*Coscinasterias calamaria* (Gray)
Plectaster decanus M. & Tr.	Same
Nectria ocellata Perrier	= *Nectria multispina* H. L. Clark*
Tosia grandis Gray	*Tosia magnifica* (M. & Tr.)
Polmipes sp.	Not traced; one labelled '*Asterina*' is *Paranepanthia grandis* (H.L.C.)
Asterina Gunni Gray	*Patiriella gunni* (Gray)
Patiria crassa Gray	= *Austrofromia polypora* (H.L.C.)
Astropecten pectinatus Sladen	Same
Pectinura arenosa Lyman	Same
Ophiothrix sp.	*Ophiothrix caespitosa* Lyman
Ophiomyxa australis Lütken	Same
Goniocidaris geranoides Lamarck	*G. tubaria* forma *impressa* Koehler
Amblypneustes ovum Lamarck	Same
Microcyphus zigzag Agassiz	Some are *M. compsus* H.L.C. or *annulatus* Mortensen
Strongylocentrotus tuberculatus Lamarck	*Heliocidaris tuberculata* (Lamarck)
Strongylocentrotus sp. (juv.)	*Pachycentrotus australiae* (Agassiz)
Lovenia elongata Gray	Not traced; some labelled *Echinocardium australe* are *E. cordatum*
Molpadia sp.	*Paracaudina australis* (Semper)
Cucumaria inconspicua sp. nov.	*Staurothyone inconspicua* (Bell)
Colochirus australis Ludwig	*Pentacta australis* (Ludwig)
Holothuria, 2 or 3 species	*Stichopus mollis* (Hutton)

* An equals sign (=) signifies a mistake in identification by Bell, other changes of specific name are due to synonymy.

PORT PHILLIP ECHINODERMATA COLLECTED BY THE SURVEY 1957–63.

(With a few brief notes on some of the commonest species by J. Hope Macpherson).

Figures in brackets are the station numbers as shown on Chart 2.

CRINOIDEA—

Comanthus (Cenolia) trichoptera (J. Müller).
Areas 50 (267); 59 (36); 61 (37).

Aporometra wilsoni (Bell).
Area 58 (151).

Euantedon paucicirra H. L. Clark.
Areas 50 (233); 61 (241). Species new to Port Phillip.

Antedonid sp.
Areas 58 (150–4); 59 (36).

Antedon incommoda Bell.
Areas 58 (290); 59 (24, 36).

Antedon loveni Bell.
Areas 30 (10); 58 (151); 61 (37).

ASTEROIDEA—

Tosia australis Gray.
Areas 5 (168); 6 (65, 137); 7 (123); 10 (11, 103); 13 (82, 92–4); 14 (95); 20 (124); 27 (41); 28 (140); 29 (107); 30 (10, 280); 36 (75); 37 (40); 40 (101); 42 (38); 55 (39, 148); 58 (79); 59 (24); 61 (37); 62 (99); 63 (164); 68 (155, 218).

Tosia magnifica (Müller & Troschel).
Areas 5 (168); 10 (193); 13 (92); 16 (283); 18 (308); 19 (306); 22 (119, 120–1); 28 (315); 30 (280); 31 (273, 276); 39 (42); 42 (281); 55 (147); 63 (159); 69 (221).

Occurs in deeper water with a sandy-mud or mud bottom.

Pentagonaster duebeni Gray.
Areas 66 (292); 59 (36).

Nectria macrobrachia H. L. Clark.
Area 66 (292).

Nectria ocellata Perrier.
Area 59 (24).

New record for Port Phillip.

Nectria multispina H. L. Clark.
Areas 58 (150–4); 59 (24); 66 (—).

Petricia vernicina (Lamarck).
Areas 6 (65, 137); 15 (53); 24 (Mordialloc); 26 (41); 37 (40).

Austrofromia polypora (H. L. Clark).
Area 66 (292).

Patiriella calcar (Lamarck).
Areas 6 (118); 10 (103); 26 (126); 27 (41); 38 (127); 48 (34).

The most common starfish on the Victorian coast and occurring under stones at low tide on reefs in Port Phillip. Also it does occur in water up to several fathoms on offshore reefs.

Patiriella gunni (Gray)
Areas 14 (5); 26 (126, 300); 27 (41, 284); 30 (10); 39 (43, 47); 40 (101); 42 (38, 281); 50 (229, 230); 58 (81, 150–4); 59 (24).

Less common than *Patiriella calcar* but with a similar habitat in the intertidal zone and also occurring in deep water.

ASTEROIDEA—*continued.*

Paranepanthia grandis (H. L. Clark).
Area 14. (Ricketts Point.)

Nepanthia hadriacantha sp. nov.
Area 66 (292).

Plectaster decanus (Müller & Troschel).
Area 66 (292).

Coscinasterias calamaria (Gray).
Areas 6 (137); 13 (93, 95); 16 (142); 26 (126, 301); 27 (41), 28 (315); 30 (10), 38 (127); 39 (47, 312), 40 (101); 42 (108); 43 (303); 48 (34); 55 (39); 59 (36); 61 (37); 63 (161, 164).

Very common on sand and sandy mud areas often associated with *Ostraea* beds.

Allostichaster polyplax (Müller & Troschel)
Areas 5 (52); 6 (137); 9 (178); 10 (103); 11 (191); 27 (41); 49 (284); 29 (108); 30 (10); 40 (101); 42 (38), 55 (39); 59 (24, 36); 61 (37).

Common in low tide rock pools and also on reefs in deeper water.

Uniophora granifera (Lamarck)
Areas 10 (103); 23 (7); 27 (139), 42 (38, 281), 55 (39); 59 (24); 63 (163).

OPHIUROIDEA—

Ophiomyxa australis Lütken.
Areas 26 (41); 27 (141); 59 (24, 36).

Ophiacantha alternata sp. nov.
Areas 6 (137); 15 (284); 50 (233); 58 (150–4), 59 (36).

Ophiactes resiliens Lyman.
Area 58 (290).

Four of the ten half jaws have three rather than two distal oral papillae.

Amphipholis squamata (Delle Chiaje).
Areas 6 (118, 137); 23 (68) 32 (277), 58 (150–4), 59 (36); 61 (37).

Amphiura constricta Lyman.
Areas 7 (123); 11 (191); 12 (196, 198), 14 (117), 18 (59); 19 (304); 23 (71); 30 (10); 40 (101); 42 (108); 47 (30); 55 (145); 58 (150–4); 59 (24); 59 (36); 59 (214); 61 (37); 63 (164); 67 (216); 69 (96).

Amphiura poecila H. L. Clark.
Area 60 (96).

Amphiura elandiformis sp. nov.
Areas 7 (207); 13 (210); 20 (309); 21 (115); 23 (68); 32 (277); 33 (177); 35 (72); 43 (251, 263); 47 (258–9); 52 (252); 53 (253); 61 (241); 63 (246).

Amphiura (Ophiopeltis) parviscutata sp. nov.
Areas 25 (299); 26 (126); 27 (302); 39 (312); 55 (147).

Ophiocentrus pilosus (Lyman).
Areas 26 (126, 311); 27 (48); 29 (289); 39 (45, 312); 68 (220).

Ophiothrix caespitosa Lyman.
Areas 50 (233); 57 (294); 58 (150–4); 59 (24, 36, 79, 87, 214); 61 (239); 66 (292).

Ophiothrix sp. juv., prob. *caespitosa.*
Area 50 (234).

Ophiocoma canaliculata Lütken.
Areas 55 (22); 59 (24).

Ophionereis schayeri (Müller & Troschel).
Areas 11 (191); 59 (24).

The common intertidal species; specimens from shallow water are always smaller than those from Portsea Pier. Area 59 (24).

Ophiarachnella ramsayi (Bell).
Area 59 (24).

Ophiura kinbergi Ljungman.
Areas 43 (251); 62 (96).

ECHINOIDEA—

Goniocidaris tubaria forma *impressa* Koehler.
Area 59 (36).

Heliocidaris erythrogramma (Valenciennes).
Areas 6 (65, 137); 10 (103); 13 (93, 95); 16 (143); 27 (41); 30 (280); 31 (10); 37 (40); 42 (38, 281); 48 (34); 55 (39, 148); 58 (150–4); 59 (24); 61 (37); 63 (164); 69 (221).

A common species under rock ledges just below low tide on most rock platforms in Port Phillip. The commonest species of urchin along the whole Victorian coast line. Colour varies from a light pinkish mauve to the deep purple which is predominant in most areas.

Amblypneustes ovum (Lamarck).
Areas 5 (169); 18 (60); 27 (41); 31 (10); 39 (42); 42 (38).

Pachycentrotus australiae (Michelin).
Area 58 (293).

Echinocardium cordatum (Pennant).
Areas 6 (65, 200); 7 (123, 208); 10 (14, 194); 11 (190); 12 (111, 112, 196, 211); 13 (83, 92, 210); 18 (186, 307); 19 (304); 20 (124, 309); 21 (115); 22 (119; 23 (2); 29 (287); 32 (277); 35 (71); 39 (46, 314); 43 (251, 263, 274); 47 (28); 52 (252); 54 (254); 55 (146); 59 (36); 62 (244); 63 (159, 246); 68 (220).

A very common animal in suitable environment of sandy mud. It is one of the few species found in the central mud area of the bay within the 10-fathom line.

HOLOTHURIOIDEA—

Stichopus mollis Hutton.
Areas 5 (166); 6 (63–4); 7 (123, 208); 10 (14, 103, 193–4); 11 (125); 12 (110–3); 13 (92); 16 (283); 18 (187, 308); 19 (306); 25 (129); 26 (126); 27 (41); 28 (139, 285); 29 (109, 287); 31 (10, 273); 35 (73); 37 (279); 38 (127); 39 (42, 49, 314); 40 (101); 42 (38); 43 (274); 51 (270); 55 (148); 63 (18, 164); 68 (157, 220).

Pentacta australis (Lüdwig).
Areas 5 (52, 68); 6 (65, 137); 10 (11); 11 (125); 12 (110–3); 22 (119); 27 (49); 36 (75, 77); 55 (148); 56 (295); 60 (214); 61 (37); 63 (159).

Stereoderma sp.
Area 61 (37).

Staurothyone inconspicua (Bell).
Areas 58 (150–4); 61 (37).

Thyone nigra Joshua and Creed.
Areas 26 (300–1); 27 (41, 302).

Cucumella mutans (Joshua).
Areas 7 (123); 11 (125); 13 (92); 24 (Mordialloc); 26 (300–1); 27 (41); 28 (285); 36 (75, 77); 42 (38); 55 (39, 148); 59 (25); 63 (164).

Paracaudina australis (Semper).
Areas 68 (Rye Pier); 69 (Rosebud Pier).

Living in sand in approximately 20 feet of water.

Leptosynapta dolabrifera (Stimpson).
Areas 12 (196); 18 (308); 19 (306); 20 (309); 21 (115); 22 (119); 26 (126); 27 (302); 28 (285); 36 (78); 55 (145).

This species is associated with *Trochodota allani* in the central mud basin, within the 10-fathom line of Port Phillip, but is less common than the latter species.

Trochodota allani (Joshua).
Areas 11 (212); 12 (110–3, 196, 211); 13 (210); 21 (115); 33 (177); 51 (270); 55 (145); 59 (213).

A very common species in deep-water areas with a mud bottom. It is one of the dominant animals within the 10-fathom line of Port Phillip.

ADDITIONAL RECORDS OF ECHINODERMS FROM VICTORIA AND BASS STRAIT.

(From material sent by Miss J. H. Macpherson.)

Plectaster decanus (M. & Tr.)	Cape Schank	1
Pentagonaster duebeni Gray	„ „	3
Nepanthia hadracantha sp. nov.	„ „	4
Nectria multispina H. L. C.	„ „	2
Nectria macrobrachia H. L. C.	„ „	5
Nectria ocellata Perrier	Portland	1
Paranepanthia grandis H. L. C.	Flinders, Western Port	1
Petricia vernicina (Lamarck)	Merricks, Western Port	2
Petricia vernicina (Lamarck)	Flinders I., Bass Strait	3
Tosia australis Gray	Flinders I., Bass Strait	1
Uniophora granifera (Lamarck)	Stoney Point, Western Port	1
Astroconus australis (Verrill)	Off C. Woolamai, Phillip Is.	1
Ophiacantha alternata sp. nov.	Flinders, Western Port	2
Paracaudina australis (Semper)	Flinders I., Bass Strait	1
Lipotrapeza vestiens (Joshua)	Shoreham, Western Port	2

NOTE.—In the artificial keys that follow, together with details of certain species, the arrangement and dichotomies are often unnatural, having been chosen as the simplest and most obvious ones for students unfamiliar with the more obscure features of echinoderm morphology. If more nearly natural keys are required, H. L. Clark's 'Echinoderm fauna of Australia' is available, but in some cases I have found this to be a little misleading, particularly due to his frequent use of the alternative 'Not as above'. There are also one or two mistakes, notably in his key to the genera of the family Asteriidae (p. 154); the secondary division, B and BB, is derived from Fisher's key in the Asteroidea of the North Pacific but omits the final alternative 'or absent' in BB, so implying that pedicellariae are invariably present on the adambulacral spines in *Smilasterias*, *Allostichaster*, *Cosmasterias* and *Uniophora*. In fact such pedicellariae are absent in these genera. Also in *Smilasterias* and *Allostichaster* the size is rarely sufficiently great for there to be more than one series of actinal plates. Notwithstanding this and a few other minor errors, Dr. Clarks' monumental work is an immensely useful one. However, I think it is worth while to include here my own keys, limited as they are to the fauna of the eastern Flindersian region.

CRINOIDEA.

KEY TO THE CRINOIDS OF THE EAST FLINDERSIAN REGION.

1. (8) Proximal pinnules long, each with at least 25 short segments, the outer ones often curled up, bearing a tooth (or a pair of teeth) so that together they form a comb; mouth more or less eccentrically placed on the disc.
2. (3) Ten arms only; cirri very stout with no segments longer than broad. .. *Comatulella brachiolata* (Lamarck).
3. (2) More than ten arms; some of the middle cirrus segments longer than broad. *Comanthus*.
4. (5) Longest cirri almost a third as long as the arms* .. .. *Comanthus* (*Cenolia*) *plectrophorum* H.L.C.
5. (4) Cirri between a quarter and a tenth as long as the arms.
6. (7) Cirri numbering about twenty (XX) and 37 arms when the arm length is 65 mm. (in the unique holotype.)* *Comanthus* (*Cenolia*) *tasmaniae* A.H.C.
7. (6) Cirri numbering XXX or more and arms rarely exceeding 30 when their length is less than 100 mm.* *Comanthus* (*Cenolia*) *trichoptera* (Müller).

* As discussed on p. 298 I doubt whether these distinctions will stand up to the test of further material.

ADDITIONAL RECORDS OF ECHINODERMS FROM VICTORIA AND BASS STRAIT.

(From material sent by Miss J. H. Macpherson.)

Plectaster decanus (M. & Tr.)	Cape Schank	1
Pentagonaster duebeni Gray	„ „	3
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Nectria macrobrachia H. L. C.	„ „	5
Nectria ocellata Perrier	Portland	1
Paranepanthia grandis H. L. C.	Flinders, Western Port	1
Petricia vernicina (Lamarck)	Merricks, Western Port	2
Petricia vernicina (Lamarck)	Flinders I., Bass Strait	3
Tosia australis Gray	Flinders I., Bass Strait	1
Uniophora granifera (Lamarck)	Stoney Point, Western Port	1
Astroconus australis (Verrill)	Off C. Woolamai, Phillip Is.	1
Ophiacantha alternata sp. nov.	Flinders, Western Port	2
Paracaudina australis (Semper)	Flinders I., Bass Strait	1
Lipotrapeza vestiens (Joshua)	Shoreham, Western Port	2

NOTE.—In the artificial keys that follow, together with details of certain species, the arrangement and dichotomies are often unnatural, having been chosen as the simplest and most obvious ones for students unfamiliar with the more obscure features of echinoderm morphology. If more nearly natural keys are required, H. L. Clark's 'Echinoderm fauna of Australia' is available, but in some cases I have found this to be a little misleading, particularly due to his frequent use of the alternative 'Not as above'. There are also one or two mistakes, notably in his key to the genera of the family Asteriidae (p. 154); the secondary division, B and BB, is derived from Fisher's key in the Asteroidea of the North Pacific but omits the final alternative 'or absent' in BB, so implying that pedicellariae are invariably present on the adambulacral spines in *Smilasterias*, *Allostichaster*, *Cosmasterias* and *Uniophora*. In fact such pedicellariae are absent in these genera. Also in *Smilasterias* and *Allostichaster* the size is rarely sufficiently great for there to be more than one series of actinal plates. Notwithstanding this and a few other minor errors, Dr. Clarks' monumental work is an immensely useful one. However, I think it is worth while to include here my own keys, limited as they are to the fauna of the eastern Flindersian region.

CRINOIDEA.

KEY TO THE CRINOIDS OF THE EAST FLINDERSIAN REGION.

1. (8) Proximal pinnules long, each with at least 25 short segments, the outer ones often curled up, bearing a tooth (or a pair of teeth) so that together they form a comb; mouth more or less eccentrically placed on the disc.
2. (3) Ten arms only; cirri very stout with no segments longer than broad. .. *Comatulella brachiolata* (Lamarck).
3. (2) More than ten arms; some of the middle cirrus segments longer than broad. *Comanthus*.
4. (5) Longest cirri almost a third as long as the arms* .. .. *Comanthus* (*Cenolia*) *plectrophorum* H.L.C.
5. (4) Cirri between a quarter and a tenth as long as the arms.
6. (7) Cirri numbering about twenty (XX) and 37 arms when the arm length is 65 mm. (in the unique holotype.)* *Comanthus* (*Cenolia*) *tasmaniae* A.H.C.
7. (6) Cirri numbering XXX or more and arms rarely exceeding 30 when their length is less than 100 mm.* *Comanthus* (*Cenolia*) *trichoptera* (Müller).

* As discussed on p. 298 I doubt whether these distinctions will stand up to the test of further material.

Comanthus (Cenolia) trichoptera (J. Müller).

Comatula trichoptera J. Müller, 1846, p. 178.

Actinometra trichoptera: Bell, 1888, p. 404; Carpenter, 1890, p. 135.

Comanthus trichoptera: A. H. Clark, 1909, p. 30; H. L. Clark, 1928, p. 367; 1938, pp. 28–29.

Comanthus (Cenolia) trichoptera: A. H. Clark, 1931, pp. 579–586, pl. 3, fig. 4, pl. 74, fig. 203.

Cenolia trichoptera: H. L. Clark, 1946, p. 37.

MATERIAL.—Port Phillip Survey: Areas 59 (36) 12 [illegible] 8 specimens; 61 (37), some detached arms; 50 (267). There are also a number of specimens from Port Phillip and Port Phillip Heads collected by J. B. Wilson.

REMARKS.—All the specimens from the survey are large, while those collected by Wilson are mostly small, only one being intermediate in size.

Table 1 shows that the number of arms ranges from 17 (in a specimen with arm length between 30 and 40 mm.) to 42, but the specimens with the longest arms (up to 230 mm.) tend to have less than the maximum number, so that in order to assess the comparative sizes of the specimens it is necessary to take the product of arm length and number. Most of the smallest specimens have about 20 arms, though on some of them a few IIBr series are lacking and the number falls below twenty.

Another variant is the size of the dorsal pole of the centrodorsal, which was also noted by A. H. Clark (1931) in some specimens from Port Jackson. There seems to be a form exemplified by the two specimens marked with an asterisk in the table, in which the number of arms remains relatively small but the arms themselves grow very long and stout while the centrodorsal is thicker and less discoidal than usual, the dorsal pole being narrower and the cirrus sockets arranged in more than two rows around the sides. At the other extreme, the centrodorsal is very low, distinctly pentagonal in outline and fringed by only one staggered row of cirri. In either case the centre of the dorsal pole may be more or less sunken.

As usual, the cirrus segments increase in number with growth and also in coarseness, the ratio of length to median breadth of the longest segment (usually the fourth or fifth) ranging from 3·0 1 in smaller specimens to as little as 1·1 1 in larger ones. The maximum number of segments observed in these specimens is 30.

The largest specimens of *Comanthus trichoptera* recorded by H. L. Clark had an arm length of little over 100 mm., the number of arms ranging from twelve to 21 and the number of cirrus segments from fourteen to 21. A. H. Clark recorded a specimen (from an unknown locality) with the arm length 130 mm. He gave the cirrus segments as up to twenty and their length as up to 12 mm.

The only appreciably larger specimens of the subgenus *Cenolia* recorded from Australia are those which have been attributed to *Comanthus plectrophorum* described by H. L. Clark in 1916 from two specimens taken in the Bass Strait in 183–548 metres. These had 40 to 44 arms, the centrodorsal about 10 mm. in total diameter and 6 mm. across the dorsal pole, LV–LX cirri, with 29 to 37 segments, usually about 32, some of the proximal segments being longer than broad. The basal segments of the proximal pinnules he said are "conspicuous for their flaring, spinulose margins, which are prolonged on the aboral side into remarkable spinulose spurs."

TABLE I.

Species	B.M. Registered Number or Locality of Other Record	Number of Arms	Arm Length (mm.)	Arm Breadth (mm.) At First Syzygy After II. Br Series	Arm Breadth (mm.) At First Syzygy After III. Br Series	Centrodorsal Diameter of Dorsal Pole (mm.)	Cirri Number	Cirri Segments	Cirri Length (mm.)	Longest Cirrus Segment 1 : br
C. trichoptera ..	1885.11.19.101 ..	17	c.35	1·0	..	1·4	XXVIII	15	5	2·2 : 1
	1885.11.19.102 ..	18	..	1·0	..	2·0	XXXIII	16	7	3·0 : 1
	1885.11.19.103 ..	20	50	1·2	..	2·5	XXX	16	7	2·3 : 1
	1887.12.6.12	20	50	1·25	..	2·3	LV	18	9	2·8 : 1
	1885.11.19.104 ..	20	..	1·25	..	2·0	XXXV	17	8	2·8 : 1
	1888.11.9.129* ..	16 (?17)	c.55	1·5	..	1·3	XLII	18	8	2·0 : 1
	1893.7.8.1	21	..	1·4	..	2·5	XXX	19	9	2·0 : 1
	1884.11.12.4	26 (?28)	..	1·7	..	3·75	c. XL	20	12	2·1 : 1
	1885.11.19.105* ..	19	c.80	1·9	..	2·0	XXXVIII	20	15	1·5 : 1
	1961.9.11.65	28	150	3·2	2·6	..	..	25	26	1·4 : 1
	1961.9.11.66	39	110	..	2·7	10·0	L ±	27	30	1·3 : 1
	1961.9.11.67	37	120	..	2·0	6·5–7·0	XXXIII	20	17	1·5 : 1
	1961.9.11.64*	26	230	3·0	2·6	4·5	L ±	24	20	1·2 : 1
	1961.9.11.68	40	170	..	2·8	9·0	LVII	26	30	1·1 : 1
	1961.9.11.69	31	220	3·2	..	6·0	..	25	24	1·2 : 1
	1961.5.9.100	39	..	3·2	2·8	8·0	LXXX	25	24	1·2 : 1
	1961.9.11.70 (pt.) ..	42	170	3·0	2·8	8·5	LV	30	27	1·2 : 1
	1961.9.11.70 (pt.) ..	36 (?39)	205	3·2	2·6	9·0	LV	28	28	1·1 : 1
	Broughton I.	20	90	..	..	..	XXVI	21	12	..
	Port Jackson (Mtsn.) ..	30	80	..	..	3·5	XXXIV	17	9	..
	Holotype: S.W. Aust. ..	20	small	..	..	..	XXX	15	..	..
C. plectrophorum ..	Types	40–44	100	..	..	c.6	LV–LX	37	..	1·1 + : 1
	Gippsland	39	130	..	..	4	XL	30	40	1·5 : 1
C. tasmaniae ..	Holotype	37	65	..	..	4	XX	16	10	2·5 : 1
C. novaezelandiae ..	Holotype	20	..	..	..	5	XIII	17	11	2·5 : 1
	1938.12.7.194	12 (?13)	35	0·8	..	1·3	XVIII	14	6	1·8 : 1
	1938.12.7.195 (pt.) ..	17	90–110	2·2	..	4·5	XXXV	18	14	1·6 : 1
	1938.12.7.195 (pt.) ..	16 (?17)	80	1·8	..	3·7	XXXV	20	14	1·6 : 1
C. benhami ..	Holotype	28	115	..	..	..	L	27	25	..

Some measurements and counts of specimens of the subgenus *Cenolia* of *Comanthus* from southern Australia and New Zealand. (All the specimens of *C. trichoptera* from the B.M. collections are from Port Phillip except for number 1888.11.9.129, which is from Port Jackson. When some of the division series are broken, the possible maximum number of arms is given in brackets. The measurements of arm breadth and the proportions of the longest cirrus segments were made with a micrometer eyepiece, the latter being the median lengths and breadths.)

In 1931 A. H. Clark described, under the name of *C. plectrophorum*, a specimen from off the Gippsland coast, eastern Victoria in 274–475 metres. This had 39 arms 130 mm. long and XL cirri with up to 30 segments, their length from 35 to 40 mm., the fifth to seventh segments being half again as long as broad. He described the basal segments of the pinnules that arise from the division series (i.e. PD and PP) as bearing "high carbinate processes which are usually shaped like a thick T". On P_1 he said the processes on the second and third segments are "more or less T-shaped with a more or less sharp crest parallel to the axis of the pinnule. His photograph of a detached pair of arms (1931, pl. 23, fig. 62) shows that the pinnule arising from the division series has the crest of each proximal segment simply squared off, but this gives way on the arm pinnules to the usual flared, triangular crest that is found in most specimens of *C. trichoptera*.

The large Port Phillip specimens do not show peculiar squared-off crests on these basal pinnules, instead they have the dorsal side of these segments forming only a very slight rounded keel. However, the other proximal pinnules agree with H. L. Clark's description of the types of *plectrophorum*, since they have some of the segments markedly flared and spinous. Probably there is some variation in the extent of this modification in the species of the subgenus *Cenolia*. The numbers of segments in PD, PP and P_1 in one of these large specimens are respectively 78, 69 and 72 in one series counted, each with 20–24 outer segments forming the comb. This agrees with H. L. Clark's count of over 70 in PD in the types of *plectrophorum*. However, the numbers of pinnule segments are not usually significant in distinguishing the species of *Comanthus*, being correlated with size rather than with specific differences. A. H. Clark gives the number in PD of *Comanthus trichoptera* as only 30–35 with but nine forming the comb, however, this is at a size of 60–100 mm. arm length. In the ninth specimen in Table 1, with the arm length about 80 mm., the number of segments is about 40 and some 15 form the comb.

The other four specimens from off Gippsland identified as *Comanthus plectrophorum* by A. H. Clark, had 40, 38, 31 and 27 arms with the cirrus segments numbering respectively 29–30, 34–38, 18–21 and 28–32. Although the small number of cirrus segments in the third one brings it into the range supposed to be characteristic of *C. trichoptera*, the available data suggests that *C. plectrophorum* may be distinguished by the relatively large size of the cirri as well as their more numerous segments. The second of the Gippsland specimens has some cirri as much as 50 mm. long, whereas 30 mm. is the greatest length observed in the specimens I have attributed to *C. trichoptera*.

Three other temperate Australasian species of the subgenus *Cenolia* are currently recognized. These are *C. tasmaniae*, *C. benhami* and *C. novaezealandiae* (the last two both from New Zealand), all described by A. H. Clark.

Only two specimens of *C. tasmaniae* are known; both were taken at an unrecorded depth off Tasmania; the one described had 37 arms 65 mm. long and XX. cirri with 14–16 segments, the longest segments two and a half times as long as broad. A. H. Clark distinguished *tasmaniae* from *C. trichoptera* by the number of cirrus segments, which is 14

to 17, as opposed to "about 20" segments in *trichoptera*. The number is a little less than in the available specimens of *C. trichoptera* of similar size, but hardly significantly so. However, the small number of cirri and the relatively large number of arms may provide a significant distinction for *C. tasmaniae*, though I think that a really good series of specimens from the Bass Strait area will show that it comes within the range of variation of *C. trichoptera*. A similar doubt as to its validity was expressed by H. L. Clark.

As for the New Zealand species, *C. benhami* from the southern end and *C. novaezealandiae* from the northern, they are supposed to be distinguished from each other by the number of arms and cirri, which are both larger in *C. benhami*. Besides the type specimen of *C. benhami*, which had 28 arms, Mortensen (1925) records another with probably 38. So far no examples of *C. novaezealandiae* with more than 20 arms are known; of Mortensen's six, three had twenty and the others 18 or 19, while the "Discovery" specimens shown in Table 1 have only 17 or less, though one of them is almost equal in arm length to the holotype of *C. benhami*. Both species are clearly related to *C. trichoptera*, but it remains to be seen, when there is sufficient material available for a proper appreciation of the ranges of variation, whether or not they can be maintained as distinct. In A. H. Clark's key (1931, p. 531), *C. benhami* was distinguished from *trichoptera* by its larger cirri with 24–27 segments as opposed to about 20. The data given in the table, particularly for specimens 1961.9.11.65 and 66, show that the numerical characters of the holotype of *C. benhami* come within the range of variation of *C. trichoptera*. Whether there are any other characters by which the form from southern New Zealand may be distinguished remains to be seen from fuller descriptions of the existing and any additional material. The same key differentiated *trichoptera* and *novaezealandiae* again on the number of cirrus segments, not more than 17 in the latter. Here too, the table shows that this difference is probably not significant. The dorsal profile of the proximal pinnules, especially the genital ones, is extraordinarily spiky in the "Discovery" specimens of *C. novaezealandiae*, as shown also in Mortensen's figure (1925, fig. 65, p. 388), but if *C. plectrophorum* proves to be synonymous with *C. trichoptera*, then the ornamentation of these pinnule segments must be very variable and this character may not carry any weight.

Antedonid sp.

Fig. 1.

MATERIAL.—Port Phillip Survey: Areas 58 (150–4), 2 specimens; 59 (36), 7 specimens.

DESCRIPTION.—The centrodorsal is low hemispherical, 1·8 mm. in total diameter and 0·9 mm. across the dorsal pole, which is slightly convex and irregularly pitted. There are approximately XXXV cirri, which arise at about three levels around the sides and appear to alternate when seen in dorsal view. The longest peripheral ones have fifteen segments and measure about 7·5 mm. in length. The first two segments are short, the third has length to median breadth 1·4 : 1, the fourth is relatively the longest with length to breadth 1·9 : 1 while the fifth and sixth are slightly longer, each about 1·3 mm., but wider dorso-ventrally since the third to the tenth segments are all flared, both dorsally and ventrally, from near

their proximal ends right to their distal ends. The eleventh to thirteenth segments are almost rectangular in side view, the thirteenth (antepenultimate) segment having length to breadth 1·2 : 1, the breadth being half as much again as that of the third segment. The opposing spine is well developed and the terminal claw is stout, curved and about as long as the penultimate segment. In dorsal view the cirri appear hardly expanded at the joints, unlike those of *Antedon incommoda*.

The apical cirri are shorter with about thirteen segments and measure about 4·5 mm.; their terminal claws are relatively longer.

The adjacent division series are widely separated. The IBr are short, almost occluded in the middle by the proximal angle of the axillary and tapering distally so that the joint between the two ossicles is constricted. The axillaries are wider and rhombic with the four sides concave; the maximum breadth is located near the middle of the length, the ratio of length to breadth being 1 : 1·25.

The arms are about 25 mm. in length. The breadth at the first syzygy (brachials 3 + 4) is 0·85 mm. and the length from the proximal edge of the IBr, to the second syzygy (at brachials 9 + 10) is 5·0 mm. Like the axillary, the second brachial has a marked proximal angle.

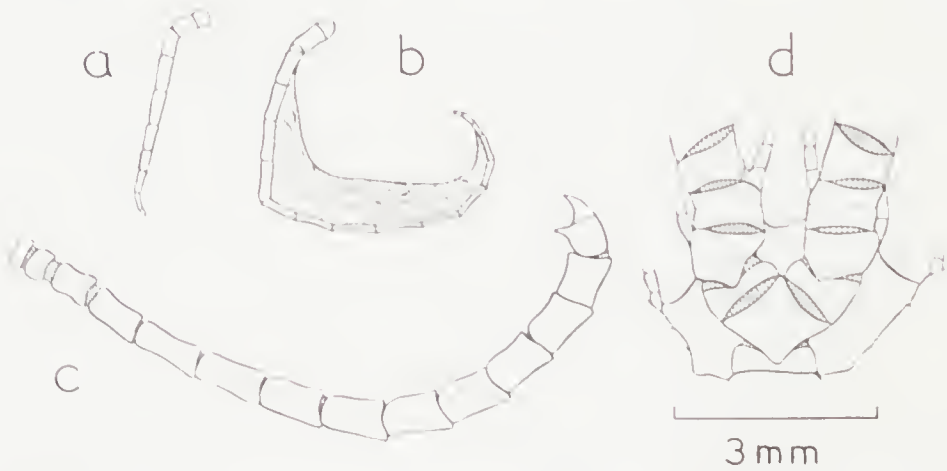

FIG. 1. Antedonid sp., Lonsdale Bight, Port Phillip, **a** P_1, **b** P_2, **c** cirrus and **d** a division series and the bases of two arms.

P_1 has nine or ten segments, the first two short and the rest longer than broad; it tapers evenly and measures 2·8 mm. in length. P_2 is much larger with fifteen to eighteen segments, all but the first one much longer than broad and most of them slender but expanded at the joints. It is the first genital pinnule and the long gonad, within which the large oval eggs can be seen, extends from the fourth segment to the thirteenth. The terminal part of the pinnule is very slender. The length of P_2 is about 5·8 mm. P_3 and P_4 are the last genital pinnules and are similar in size to P_2. The distal pinnules are long. P_5 has seventeen segments, all but the first one longer than broad, the longest having length to breadth 2·5 : 1; the pinnule measures 4·2 mm. in length. There are no ambulacral spicules.

The sacculi are not conspicuous.

On the disc the anal cone is very large and the mouth is displaced away from the centre.

The colour is reddish (after a year in spirit).

Some numerical details of this and seven other specimens are given in Table 2, the one described being the last one.

REMARKS.—This species appears to be referable to the subfamily Antedoninae, judging from the form of the cirri, which are very like those of *Antedon loveni*; the low hemispherical centrodorsal also supports this. However, the abruptly larger P_2 and the fact that it is the first genital pinnule suggest an affinity with the Bathymetrinae, a subfamily only known from deeper water, few of its species being found in depths of less than 50 metres. Until larger specimens are available to help clarify its relationship, it seems to me better that this species should go unnamed.

Euantedon paucicirra H. L. Clark.

Euantedon paucicirra H. L. Clark, 1928, pp. 369–370, fig. 109.

MATERIAL.—Port Phillip Survey: Areas 61 (241), 1 specimen; 50 (233), 1 specimen.

REMARKS.—Both specimens (as preserved in spirit) are predominantly purple in colour with a tendency to banding on the arms; the numerous sacculi along the pinnules are quite pale. One specimen has the disc exposed and conspicuously orange-red.

The arms are about 30 mm. long in both and the breadth at the first syzygy is about 0·5 mm. The centrodorsal is rounded with only a small bare dorsal pole. The more nearly intact specimen has about XXVIII cirri which are very slender, the longer ones with seventeen segments, the antepenultimate one just longer than broad. The cirri are much like those of *Antedon loveni* except for the additional segments. Both specimens have P_2 only two-thirds to three-quarters the length of P_1 which is about 1·2 mm. long, but in one specimen P_1 has only seven segments and P_2 eight while the other has nine segments in P_1 and seven in P_2. P_3 is the first genital pinnule and has nine or ten segments; the rather short gonad extends from the third to the sixth segments.

In H. L. Clark's type specimen from St. Vincent Gulf the size was slightly larger, the arms being 40 mm. long. This may account for the larger number of cirrus segments, 17–26, usually about 20, the cirri themselves numbering XXV. The proximal pinnules are considerably longer than in the Port Phillip specimens, P_1 being 5–7 mm. long with 10–12 segments and P_2 about 3·5 mm. with 7 segments. P_3 is again the first genital pinnule. The development of the proximal pinnules may be retarded in some species of macrophreate comatulids, which may account for their relatively small size in the present material, but more material is needed to show the range of variation and the growth changes of the species.

It is not impossible that the Port Phillip specimens I have identified as *Antedon loveni* are conspecific with these two; certainly their proximal pinnules are very similar. However, the fact that no more than 14 cirrus segments were found in the former, even at an arm breadth of 0·7 mm. suggests that they are distinct.

TABLE 2.

B.M. Registered Number	Br at 3 - 4 (mm.)	L to 9 - 10 (mm.)	Cirri		P_1		P_2	
			Segs.	Length (mm.)	Segs.	Length (mm.)	Segs.	Length (mm.)
Antedon loveni								
93.7.8.6 (pt.) ..	0·3	2·8	10, 11	3·3	6	1·2	5, 6	1·0
1962.4.9.1	0·35	3·0	12, 13	3·8	8, 9	2·0	7, 8	1·5
93.7.8.15 (pt.) ..	0·4	2·8	12, 13	5·3	7, 8	1·4	6	1·0
1961.9.11.71 (pt.) ..	0·5	3·5	14	5·8	8, 9	2·5	7	1·5
1961.9.11.71 (pt.) ..	0·5	3·7	14	5·0	9	2·6	7	2·0
93.7.8.6 (pt.) ..	0·6	3·5	12	4·8	7	2·4	7	1·6
93.7.8.15 (pt.) ..	0·6	3·5	12, 13	5·0	7	2·2	7	1·8
93.7.8.6 (pt.) ..	0·6	3·5	13	5·5	8, 9	2·6	7, 8	1·7
83.12.9.69 S ..	0·65	4·0	13	5·5	9, 10	3·5	7	1·8
93.7.8.6 (pt.) ..	0·7	4·5	14	4·8	9	3·1	8	2·1
Antedon incommoda								
1961.9.11.89 ..	0·3	2·7	13	3·7	6	1·2	6	0·9
1961.9.11.85 ..	0·35	2·1	11	2·9	6, 5	1·0	5	0·8
1961.9.11.84 ..	0·35	2·9	12	..	6	1·2	6	1·0
1962.4.9.2 (pt.) ..	0·4	3·0	12	4·0	7, 8	1·6	5, 6	1·2
1961.9.11.83 ..	0·4	3·0	13	3·8	6, 7	1·5	6	1·1
1962.4.9.2 (pt.) ..	0·45	3·5	12	3·5	7	1·8	6, 7	1·3
1961.9.11.86 ..	0·45	3·0	13	..	7	1·7	6	1·2
1961.9.11.87 ..	0·45	..	13	4·3	..	..	..	..
1961.9.11.90 ..	0·6	4·4	13	5·8	14, 15	4·2	8	1·7
87.12.6.13 S ..	0·7	5·0	12	6·0	17	5·5	8	2·0
87.12.6.13 S ..	0·8	5·3	13	..	15, 16	5·0	8	2·0
1962.4.9.2 (pt.) ..	0·8	4·5	13		16	6·4	8	2·4
					9	3·5	7	1·6
1961.9.11.91 ..	0·9	..	15	6·8	18, 20	6·1	9	2·1
84.11.12.5 (pt.) S ..	0·9	5·5	13	6·5	16	6·0	9	2·3
84.11.12.5 (pt.) S ..	0·9	5·5	13	7·0	..	..	9	2·3
93.7.8.2	0·9	5·5	13	7·0	16	4·5	8	2·0
93.7.8.3	0·9	5·5	13	7·0	15	..	8	2·2
87.12.6.13	0·9	6·0	13	7·5	16	6·0	9	2·5
1961.9.11.88 ..	1·0	5·3	13	5·5	15	5·3	9	2·2
93.7.8.4	1·0	5·5	14	8·0	17	6·5	9	3·0
1961.9.11.92 ..	1·1	..	14	7·1	15	5·3	9	2·9
84.11.12.6 S ..	1·1	6·0	14	8·0	24	10·0	12	4·5
1961.5.9.101 ..	1·1	5·3	14	8·7	20	6·6	8	2·6
1961.9.11.72 ..	0·35	2·5	12	3·0	7	1·3	7	1·0
1961.9.11.73 ..	0·4	3·0	..	..	6	1·3	5	1·0
1961.9.11.74 ..	0·45	3·5	14	5·0	7	1·4	15	3·0
1961.9.11.75 ..	0.45	3.5	14	5.0	6	1·2	13	3·0
1961.9.11.82 ..	0·5	3·1	14	4·8	6	1·1	13	..
1961.9.11.81 ..	0·75	4·0	16	6·8	10	2·2	17	5·5
1961.9.11.76 (pt.) ..	0·75	4·5	15	6·5	10	2·1	17	5·5
1961.9.11.76 (pt.) ..	0·85	5·0	15	7·5	9, 10	2·8	18	5·8

Measurements and counts of some Antedonids. The registration numbers starting with 83, 84, 87 or 93 are of Wilson's specimens from the vicinity of Port Phillip Heads, the rest were collected by the Survey, 1961.9.11.72–76 and 83.9.5 also 1962.4.9.2 from Pope's Eye Annulus, 1961.5.9.101 from Pope's Eye Bank, 1962.4.9.1 from Prince George Bank, 1961.9.11.71 from Prince George Light and 1961.9.11.81–82 from Lonsdale Bight. S signifies a syntype. All the specimens are from Port Phillip except for the syntype of *Antedon loveni* which is from Port Stephens, N.S.W. The second and third columns provide an assessment of size; Br is the arm breadth at the first syzygy (to the nearest 0·05 mm.) and L the length from the proximal end of the division series to the second syzygy (to the nearest 0·1 mm.). All measurements were made with a micrometer eyepiece. The smallest specimens have an arm length of about 15 mm. and the largest about 50 mm.

Genus *Antedon* de Freminville.

In 1955, Gislén (Atlantide Rep., No. 3) referred *Compsometra* A. H. Clark (type species *Antedon loveni* Bell) to the synonymy of *Antedon*, having decided that the difference in the degree of spinous development of the pinnule segments, upon which the distinction of *Compsometra* depended, does not hold good. Two species from southern Australia are involved in the change, namely *Compsometra loveni* (Bell) and *C. incommoda* (Bell), both of which revert to their original combination with the name *Antedon*.

Both species are small and delicate, at least as collected in Port Phillip; in neither does the arm length exceed 50 mm. and the largest specimen of *A. loveni* from the bay probably had an arm length of only about 30 mm. However, sexual maturity is reached at a small size, some specimens of both species with arms probably less than 20 mm. long (when complete) having noticeable short thick gonads, those of the females with large eggs inside.

Most of the characters distinguishing *A. loveni* from *incommoda* are juvenile features, for instance the more slender cirri, smaller number of pinnule segments and the tapering rather than discoidal centrodorsal. Indeed, as Table 2 suggests, the smallest specimens with the arm breadth at the first syzygy less than 0·5 mm. are indistinguishable and can only be named by their association with others of larger size which are sufficiently divergent in the form of their cirri and pinnules. Unfortunately only two specimens of *A. incommoda* available to me are comparable in size with the material of *A. loveni* from Port Phillip that exceeds the critical size of 0·5 mm. arm breadth. Both of these have P_1 more than twice as long as P_2 and with about twice as many segments, whereas the five examples of *A. loveni* with Br. 0·6–0·7 mm. retain the juvenile relative proportions of these pinnules.

Possibly *A. loveni* can be interpreted as a neotenous form of *incommoda*, in which case the distinction between them may be at the infraspecific level.

The history of the Australian Antedons is rather involved. In 1882 Bell published the name *Antedon loveni* with a diagnostic formula which A. H. Clark accepts as sufficient indication to validate the name. However, in 1884 Bell described what was evidently this same species, on the basis of a specimen from Port Jackson, under the name of *Antedon pumila*. At the same time he transferred the name *A. loveni* to a second species, from Port Denison, Queensland, which in 1882 he had called *A. insignis;* this latter species is now called *Colobometra perspinosa* (P. H. Carpenter), 1881, *A. insignis* being a synonym. In 1910 (Proc. U.S. Nat. Mus. 38, p. 275) A. H. Clark described what he thought to be a new species from Port Jackson under the name of *Compsometra lacertosa* but in 1911 (and 1911a) he referred *lacertosa* to the synonymy of *Compsometra loveni*. The cirri of the type of *lacertosa* were relatively much smaller in comparison to the arms than in the Port Phillip specimens of *A. incommoda;* nevertheless if both species occur at Port Phillip it is probable that they also both occur at Port Jackson.

Antedon loveni Bell.

Antedon lovent Bell, 1882, p. 534; A. H. Clark and A. M. Clark, Bull. U. S. National Museum (in the press).

Compsometra loveni: A. H. Clark, 1911a, p. 442, H. L. Clark, 1946, p. 61.

MATERIAL.—Port Phillip Survey: Areas 30, (10), 3 specimens; 58 (151), 6 specimens; 61 (37), 5 small specimens. Also several others from J. B. Wilson's collection.

The type locality of *A. loveni* is Nelson's Bay, New South Wales.

Antedon incommoda Bell.

Antedon incommoda Bell, 1888, pp. 402, 404; A. H. Clark and A. M. Clark (in the press).

Compsometra incommoda: A. H. Clark, 1911a, pp. 442–444, 464, 465; H. L. Clark, 1916, pp. 5, 26; Cotton and Godfrey, 1942, p. 232; H. L. Clark, 1946, p. 60.

MATERIAL.—Port Phillip Survey: Areas 58 (290), 1 specimen; 59 (36), 18 specimens; 59, (24), 1 specimen. Also the types and other specimens in the British Museum from J. B. Wilson's collections.

The type locality of *A. incommoda* is the outer part of Port Phillip Harbour and outside the Heads.

ASTEROIDEA.

KEY TO THE ASTEROIDS OF THE EAST FLINDERSIAN REGION.

1. (24) Interbrachial areas extensive, the interbrachial arcs rounded and arms merging into the disc; body flattened more or less and the two series of marginal plates noticeable or prominent.

2. (15) Margin thick, formed by both series of marginal plates almost equally; dorsal surface flat or convex.

3. (4) A pair of large valvate pedicellariae prominent in each interradius dorsally (sometimes one or both lacking in some interradii); body smooth, plates obscured by skin in live and spirit specimens; no granules . . . . . *Petricia vermicina* (Lamarck), 1816

4. (3) If any valvate pedicellariae are present then these are scattered on the dorsal and ventral plates, which are partially or completely covered with granules and not obscured by smooth skin.

5. (10) Marginal plates large and few in number, not more than eight superomarginals on each side of each arm (or sixteen across an interbrachial arc), most often only three or four; dorsal plates smooth, with only single rows of marginal granules.

6. (7) Pedicellariae present, each with two or three narrow valves less than 0·5 mm. long, normally opened out and sunk into grooves in the smooth surfaces of the dorsal and ventral plates; interbrachial arcs usually fairly deep, R r more than 2 1. . . . . *Pentagonaster duebeni* Gray, 1847

7. (6) Pedicellariae rare or absent, occurring most often on the adambulacral plates, resembling a split granule in form, the two valves being short and wide, not sunk into elongated grooves; R r less than 2 1, usually about 1·5 1. *Tosia*

8. (9) Three (rarely four) supero-marginal plates on each side, the distal-most one sometimes (forma *astrologorum*) conspicuously swollen; ventral plates often bare like the dorsal ones. . . . . *Tosia australis*, Gray, 1840

9. (8) Supero-marginal plates numbering three only when R is less than 12 mm., increasing in number as growth proceeds, the distal ones never conspicuously swollen; ventral plates always largely or completely granule-covered. . . . . *Tosia magnifica* (M. & Tr.), 1842

10. (5) *Marginal plates fairly numerous, fourteen or more (often over 20) on each side; dorsal plates high tabulate or markedly tubercular with extensive granulation.

11. (14) Dorsal plates flat-topped, the proximal ones high tahular, their free surfaces covered with a continuous layer of granules; pedicellariae with valves not much wider than long sometimes present, particularly just below the granule-crown of the proximal tahula or on the adambulacral plates. [See also no. 26]. .. .. *Nectria* (part)

12. (13) Central granules of each tabulum crowded and larger than the peripheral granules, the surface of the tabulum often convex and its outline angular; pedicellariae usually present. .. *Nectria multispina* H. L. Clark, 1928

13. (12) Central granules of each tahulum not crowded and usually similar in size to the peripheral ones, tabula with horizontal tops and rounded in outline; pedicellariae rare. [These two species seem to intergrade].
Nectria ocellata Perrier, 1875

14. (11) Dorsal plates not tabular, some bearing very convex single tuhercles, others with several, in between a continuous granulation; pedicellariae valvate and very wide, more or less numerous among the granules.
Anthaster valvulatus (M. & Tr.), 1842

15. (2) Margin thin and low, formed mainly by the infero-marginal plates, the ventral surface flat and the dorsal markedly convex.

16. (17) All the ahactinal plates of about the same magnitude and rhombic or oval in shape, with very fine, peripherally-placed spinelets.
Asterina atyphoida H. L. Clark, 1916

17. (16) Abactinal plates of two magnitudes, the primary ones more or less crescentic in shape, the spinelets or granules not limited to their peripheries.

18. (19) Actinal plates each hearing a cluster of fine spinelets; five-armed and growing to a large size (R up to 70 mm.) but with fairly deep inter-brachial arcs R r being about 1·75 1. .. *Paranepanthia grandis* (H. L. Clark), 1928

19. (18) Actinal spines coarse and few; if only five arms then the size is small (R < 20 mm.) and the shape almost pentagonal .. .. *Patiriella*

20. (21) Five arms, rarely six; size small; form nearly pentagonal.
Patiriella exigua (Lamarck), 1816

21. (20) More than five arms (with rare exceptions); size often large; R up to about 50 mm.

22. (23) Seven to nine arms, usually eight; normally only one spine on each actinal plate. *Patiriella calcar* (Lamarck), 1816

23. (22) Six, sometimes seven, arms, rarely five; normally two spines on each actinal plate. .. .. *Patiriella gunni* (Gray), 1840

24. (1) Interbrachial areas small, the arcs deep and angular, arms well-defined, usually almost round in cross-section; marginal plates not conspicuous.

25. (30) Abactinal, marginal and actinal plates all covered with a continuous coat of granules or granuliform spinelets.

26. (27) Peripheral granules of the abactinal plates markedly enlarged, standing out from the surface and outlining the plates. [See also nos. 11–13 since *N. multispina* may run down to here].
Nectria macrobrachia (H. L. Clark), 1923

27. (26) Peripheral granules of the abactinal plates not conspicuously enlarged.

28. (29) Papular pores extending on the ventral side right up to the adamhulacral plates; granules or granuliform spinelets low, coarse and with their tops flat or rounded. .. .. *Austrofromia polypora* (H. L. Clark), 1916

29. (28) No pores between the actinal plates; granuliform spinelets about twice as high as wide (the peripheral ones relatively higher), their tops very rugose under magnification. .. *Nepanthia hadracantha* sp. nov.

30. (25) Abactinal plates forming an open reticulum, bearing isolated large spines or else irregular spinelets or granules not forming a continuous coat.

* Young specimens of *Austrofromia polypora* with R about 30 mm. or less may run down here; they can be distinguished by the presence of ventral papulae. See p. 322.

31. (36) Two series of tube feet along each furrow.

32. (33) Abactinal plates forming a coarse reticulum with low, thick granules running along the meshes; adambulacral spines arranged in two longitudinal series. . . . . *Plectaster decanus* (M. & Tr.), 1843

33. (32) Abactinal reticulum indistinct, not very coarse, the meshes bearing small, pointed spines, not in continuous series; adambulacral plates with spines and spinelets forming transverse series at right angles to the furrow. . . *Echinaster*

34. (35) Abactinal spines in clusters, usually of five or more. . . . . *Echinaster glomeratus* H. L. Clark, 1916

35. (34) Abactinal spines spaced from each other. . . . . *Echinaster arcystatus* H. L. Clark, 1914

36. (31) Four series of tube feet along each furrow.

37. (40) Compact wreaths of numerous, fine, crossed pedicellariae around each of the large, isolated, sharp, abactinal and marginal spines.

38. (39) Five arms. . . . . *Australiaster dubius* (H. L. Clark), 1909.

39. (38) Seven to eleven arms. . . . . *Coscinasterias calamaria* (Gray), 1840.

40. (37) Crossed pedicellariae not forming compact wreaths around the abactinal and marginal spines, which are usually small and numerous, or, if large and spaced, then very blunt at the tip (in the latter case the pedicellariae are usually infrequent).

41. (42) Six to nine arms, usually unequal in size owing to regeneration, the species being self-dividing. . . . . *Allostichaster polyplax* (M. & Tr.), 1842.

42. (41) Five arms.

43. (46) Only one series of actinal plates (if any) between the adambulacrals and the infero-marginals; abactinal skeleton a close reticulum with several spinelets and pedicellariae on most plates. Size not known to exceed R 33 mm.

44. (45) Arms fairly thick, R br (the basal breadth) about 4 1; abactinal plates and spinelets forming regular longitudinal series . . . . . *Allostichaster regularis* H. L. Clark, 1928.

45. (44) Arms slender, R br 6 or 7 1; no obvious longitudinal arrangement distinguishable dorsally. . . *Smilasterias irregularis* H. L. Clark, 1928.

46. (43) Two or three series of actinal plates present, though some or all of them may be spineless; abactinal skeleton a close or open reticulum, usually with coarse, very blunt spines, rarely absent; growing to a large size, R often well over 50 mm.
Uniophora [for which see H. L. Clarks' keys of 1928 and 1946].

Pentagonaster duebeni Gray.

Pl. IV. fig. 4.

Pentagonaster dübeni Gray, 1847, p. 79; 1866, p. 11, pl. 3, fig. 2; H. L. Clark, 1928, p. 380; Livingstone, 1932, pl. 44, figs. 4, 5; H. L. Clark, 1946, pp. 88–89; A. M. Clark, 1953, pp. 400–403, text-fig. 13b, pls. 43, 44.

Astrogonium crassimanum Möbius, 1859, p. 8, pl. 2, figs. 1, 2.

Pentagonaster gunni Perrier, 1875, p. 203.

Pentagonaster stibarus H. L. Clark, 1914, p. 136, pl. 17.

Pentagonaster crassimanus: H. L. Clark, 1946, pp. 89–90.

MATERIAL.—Port Phillip Survey: Areas 59 (36), 2 specimens; 66 (292), 4 specimens; Cape Schank, Victoria, 3 specimens.

The Cape Schank specimens are interesting in having the distal supero-marginal plates markedly thickened and swollen; in one specimen this enlargement is decidedly greater than in Möbius' figure of the type specimen of *Astrogonium crassimanum*. The holotype of the New Zealand species *P. pulchellus* exhibits a parallel condition. One of the three from

Cape Schank has only three supero-marginal plates on each side of each arm, whereas four or more is the usual number in this Australian species, in contrast to *pulchellus* which normally has but three. Clearly the swollen-armed form of *P. duebeni* occurs throughout its range, not just in Western Australia.

Genus *Nectria* Gray.

Pls. I, II and III. figs. 2, 3.

Nevtria Gray, 1840, p. 287; 1866, p. 15; H. L. Clark, 1928, p. 379; 1946, p. 85. (Type species *Asterias ocellifera* Lamarck, 1816 [*oculifera* lapsus cal. of Gray, 1840, corrected in 1866*]).

Six species have so far been referred to this australasian genus, of which one, originally *Mediaster monacanthus* H. L. Clark, was placed here by Fisher in 1917 (Ann. Mag. Nat. Hist. (8) *20*, p. 167) and removed to a new genus *Nectriaster* created for it by H. L. Clark in 1946. The remaining species, other than the type, in chronological order are:—

Nectria ocellata Perrier, 1875

Nectria macrobrachia H. L. Clark 1923

Nectria pedicelligera Mortensen, 1925, and

Nectria multispina H. L. Clark, 1928.

Lamarck apparently included two species under the name of *Asterias ocellifera*. The second of these was referred by Perrier to a new species *Nectria ocellata* when he described the type specimen of *N. ocellifera*. Most of Lamarck's echinoderm species have proved to be common ones, but only a single record of *N. ocellifera* besides that of the type (which was from ' les mers australes? '—presumably the southern seas), is known. This record is one published by H. L. Clark in 1914 for two specimens from between Fremantle and Geraldton, Western Australia, in 60–100 fathoms (c. 110–180 metres).

The type specimen of *N. ocellifera* was figured by Oudart in a work published in 1815, according to Perrier's reference. However, in another reference to the same work, Perrier (1875, p. 296) omitted Oudart's date (as if it was only a manuscript) but gave a title—' Règne animal—Zoophytes '. The only record I can find that corresponds to this is a publication in Parish by G. Engelmann in 1826 called ' Cours d'Histoire naturelle, contenant les principales espèces du règne animal, classées méthodiquement. dessinées par Paul Oudart '. This work is not available to me but Gray evidently saw it (or Oudart's original drawing of *N. ocellifera*) since he referred to it in his works of 1840, 1847 and 1866, not only under the heading of *Nectria* but also in connection with his new species *Patiria ocellifera*. In fact he commented (1847, p. 82) that the *Patiria* species ' more nearly resembles Oudart's figure than the species

* Strictly speaking, *N. ocellata* Perrier might be considered as the type species since that is the one that Gray had before him when he diagnosed the genus *Nectria*, though he mistakenly identified it with Lamarck's species. There seems to be little likelihood that *ocellifera* and *ocellata* could ever be considered as other than congeneric so there is no point in contradicting the statement of H. L. Clark that *Asterias ocellifera* Lamarck is the type species of *Nectria*.

I have described under the name of *Nectria oculifera*'. This remark and its context imply that Gray's 1840 spelling '*oculifera*' may not after all have been a mistake and that he did think that he had a species distinct from Lamarck's, although his correction in 1866 suggests that the 1840 spelling was a *lapsus calami*. The type specimen of *Patiria ocellifera* is in the British Museum collection. A redescription and figures of it are given in A. M. Clark, (1963, Doriana, Genoa, **3** No. 127 1–1). It has a finely granulose appearance with numerous minute, forceps—like pedicellariae scattered over the whole dorsal surface and some isolated enlarged rounded primary plates on the distal parts of the arms showing up among the many small secondary ones by their slight elevation and uniform granulation. If Oudart's figure is something like this (which Perrier denies anyway), then it cannot be a very good representation of the type specimen of *N. ocellifera*. Consequently, in the absence of a readily available illustration of *N. ocellifera*, I am including here photographs of a specimen (unfortunately lacking locality data) from the collection of the Western Australian Museum (Pl. 1, figs. 1–3).

Nectria ocellifera is not included in the collections from Victoria but three other species were obtained in the vicinity of Port Phillip, namely, *N. macrobrachia*, *N. ocellata* and *N. multispina*. In an attempt to assess the variation of *N. multispina* and its distinction from *N. ocellata* I found that the British Museum collection of specimens of *Nectria* from south and west Australia includes a number which are intermediate between *ocellata* and *multispina* and at the same time indistinguishable from *N. pedicelligera* Mortensen 1925, of which the type and only recorded specimen was from Gisborne in the north island of New Zealand. Also the status of *N. multispina* becomes doubtful since some of the characters by which it was distinguished are among those that are variable and do not always occur in combination. Cotton and Godfrey (1942) noted that some specimens are difficult to place as *ocellata* or *multispina*; they certainly seem to intergrade, as Table 3 suggests, though the two extremes of form are very easily recognized.

In his key to the species of *Nectria*, H. L. Clark (1928 and 1946) distinguished them by the number of furrow spines, the degree of crowding of the granules on the actinal plates, the apparent shape of the abactinal tabula and of their peripheral granules and the occurrence of pedicellariae on the actinal plates.

The low tabula of *N. macrobrachia* characterize that species and the enlargement of the peripheral granules of the proximal tabula serve to distinguish *N. ocellifera* from *ocellata* and *multispina*. The other characters I find to be variable. Nevertheless, I think there is sufficient justification for maintaining *N. multispina* distinct from *N. ocellata*, though a really good series of specimens may serve to prove otherwise.

Sluiter (1895, Bijdr. Dierk. *17*, p. 55) has recorded a specimen from Amboina in the Moluccas as *Nectria ocellifera*. I think this must be a mistake, either in locality or in identification. Sladen (1889, p. 318) also mentions a specimen from the Fiji Islands which he referred to *N. ocellifera* (i.e. to *N. ocellata* since he confused the two). H. L. Clark (1946) has already speculated on the possibility of a mistake in this locality.

Nectria macrobrachia H. L. Clark.

Pl. III, figs. 2, 3. Text fig. 2.

Nectria macrobrachia H. L. Clark, 1923, pp. 236–237, pl. 13, figs. 5, 6; 1946, p. 86.

MATERIAL.—Port Phillip Survey: Area 66 (292), 5 specimens; Cape Schank, Victoria, 5 specimens. British Museum collection, probably from J. B. Wilson; 1 specimen.

REMARKS.—At first I was inclined to refer these specimens to *Nectria ocellifera* (Lamarck) of which I believed *N. macrobrachia* must be a synonym, since the type specimen of the latter (which is in the British Museum collection) seemed to agree with Perrier's redescription of the type of *ocellifera*. In response to a request from me, Dr. G. Cherbonnier very kindly examined the type of *N. ocellifera* and compared it with the published photographs of the type of *macrobrachia*, sending me at the same time a drawing of tabula of the two species *N. ocellifera* and *oceliata* which perfectly justifies Perrier's assertion that two species were included by Lamarck under the name *Asterias ocellifera*. Dr. Cherbonnier agreed with me in thinking that the granule covering of the tabula in *ocellifera* appears very similar to that of *macrobrachia*.

However, following correspondence with Dr. R. W. George of the Western Australian Museum, Perth, I was lent eleven specimens of *Nectria* by him and three further ones by Dr. E. P. Hodgkin of the University of Western Australia. My thanks go to both of them for their help. Among the first eleven specimens were three of *N. ocellifera* two of which (from between Fremantle and Geraldton) had been seen also by H. L. Clark. These show that although there is a superficial resemblance between the granule coverings of the tabula in *N. ocellifera* and *macrobrachia*, the tabulum of each proximal plate is several times higher in *ocellifera*, the column being hour-glass shaped, as Perrier described it, while the height is usually about 3 mm. Also each tabulum is widely separated from its neighbours and the granules covering the central part of its apex are very low, while the marginal ones are flattened and resemble the petals of a daisy. The proximal tabula of *N. macrobrachia* when denuded are seen to be very low, only about 1 mm. high and hardly, if at all, higher than the distal ones, all the tabula having vertical sides; also the low columns of neighbouring tabula are often in direct contact with each other or else are linked by short bridges sunk only a little below the level of their upper surfaces (text-fig. 2G). Consequently the peripheral granules of neighbouring tabula are always very close.

The granules of the proximal plates of the two species are also rather different when examined under magnification. Taking specimens with R about 60 mm., the central granules of *ocellifera* are very low, almost discoidal, their height only about 0·1 mm., that is less than a quarter of their diameter, which is usually between 0·5 and 0·75 mm.; they are slightly spaced and tapered towards the top, which, together with their squat form, makes them appear to merge into the underlying tabulum. These granules in the Port Phillip specimen of *N. macrobrachia*, on the other hand, are still not as high as wide but their height is about 0·25 mm. while the diameter is usually about 0·4 mm., a ratio of nearly two-thirds; in dorsal view they appear similarly polygonal but much closer together,

since each granule is capitate and widest at the top, consequently they appear to stand out sharply from the surface of the plate. The peripheral granules of *N. ocellifera* are distinguished from the central ones much more sharply than are those of *macrobrachia*. They are all more or less flattened in such a way that in the radial plane (relative to the centre of the tabulum) they are wedge-shaped in the outer half (text-fig. 2c) and their total size is greater, the length of many of them exceeding 1 mm. Most peripheral granules of *N. macrobrachia* also tend to be wedge-shaped outwardly, but they are shorter and relatively thicker, so that when seen from above their thickness in the radial plane is not much less than that in the tangential plane.

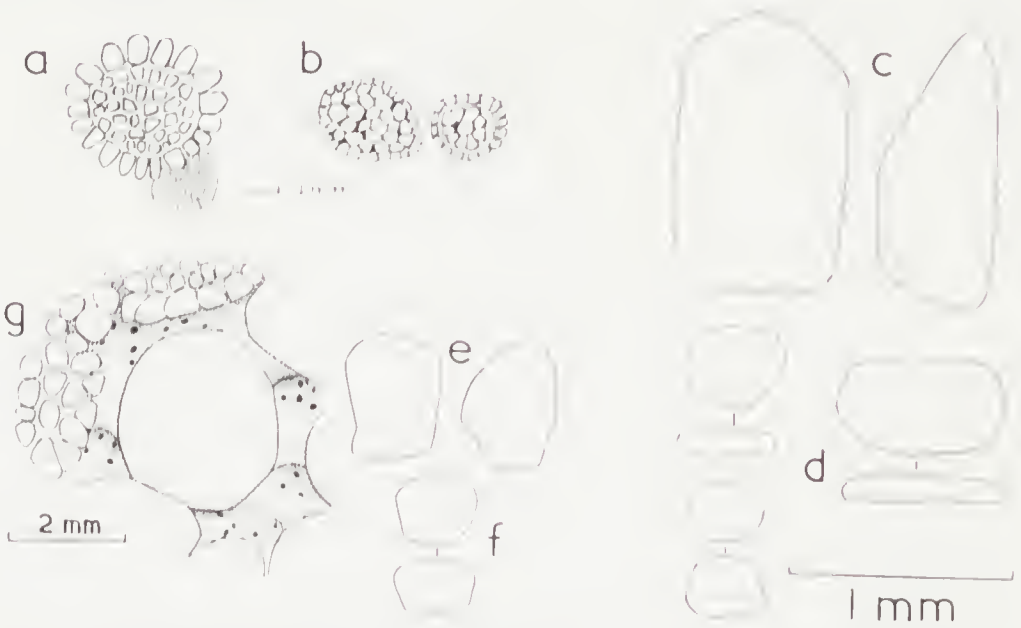

FIG. 2. *Nectria* spp.— **a** tabulum and madreporite of the type of *N. ocellifera*, **b** two tabula of the type of *N. ocellata* (both drawn by Dr. G. Cherbonnier), **c** a peripheral tabular granule of *N. ocellifera*, W. Australian Museum No. 3-62, in radial (left) and tangential (right) views, **d** three central tabular granules of the same specimen viewed from above (upper) and the side (lower), **e** peripheral and **f** a central tabular granule of *N. macrobrachia*, B. M. No. 1958.7.30.19, Port Phillip, as for **c** and **d**, **g** *N. macrobrachia*, detail of a denuded tabulum showing the close approximation of adjacent ones, with one column even in direct contact with another. (The large 1 mm. scale applies to **c**–**f**).

Along each arm at about half R from the centre, in all the species of *Nectria* except *N. macrobrachia*, there is a sudden transition in the form of the tabula. The distal ones are much lower than the columnar proximal tabula and usually distinctly convex at the top. In all three specimens of *N. ocellifera* that I have seen, the distal tabula have the peripheral granules abruptly *smaller* than the central granules which are enlarged in comparison with the central granules of the proximal tabula. This is just what is found on both the proximal *and* the distal tabula of *N. multispina*—the peripheral granules are the smallest, the whole surface is convex and the central granules are enlarged and closely crowded together. In most

specimens of *N. ocellata* the peripheral granules of the distal plates are not conspicuously smaller than the central ones and the surface of each tabulum is more or less flat, so that the limits between the plates are less obvious than in *N. multispina* and *ocellifera*.

In *N. macrobrachia* the distal plates have low, flat tabula like the proximal ones and their peripheral granules are reduced in size relative to those of the proximal tabula, but not to such an extent that they are smaller than the central granules. The resulting approximate uniformity in granule size obscures the limits of these plates which are only discernable by the positions of the papulae in the interstices between them.

The Cape Schank specimens of *N. macrobrachia* all have the abactinal granules rather coarser than in the three other specimens studied—namely the one from Port Phillip, the holotype and another specimen from Western Australia (4 miles off Dunsborough, Geographe Bay south from Fremantle) lent to me by Dr. Hodgkin. In a Cape Schank specimen with R 50 mm. one of the largest proximal tabula has its greatest diameter (including the spread of the peripheral granules) 3·5 mm. and there are 30 central granules and 25 peripheral ones. The Port Phillip specimen with R 45 mm. has the largest tabula over 4 mm. in diameter, some of them with more than 50 central granules but only 18 to 24 peripheral ones. Two out of five specimens collected in 1963 off Port Phillip Heads in areas 58 and 66 have the peripheral granules of the proximal tabula much larger, more angular and more outstanding than in the specimen photographed.

These Victorian specimens therefore extend our knowledge of the range of variation of the species as well as its geographical range. Previously the only record was the type locality, Houtman's Abrolhos, Western Australia.

Nectria ocellata Perrier.

Pl. II., figs. 3, 4.

Asterias ocellifera (part) Lamarck, 1816, p. 553.

Nectria oculifera (lapsus for *ocellifera*) Gray, 1840, p. 287.

Nectria ocellifera Gray, 1866, p. 15; Sladen, 1889, pp. 319–321, pl. 55, figs. 1–7.

Nectria ocellata Perrier, 1875, pp. 188–190; H. L. Clark, 1916, pp. 34–35; 1928, p. 378; 1938, p. 78; 1946, p. 85.

MATERIAL.—Port Phillip Survey: Area 59 (24), 1 specimen. Portland, Victoria, J. Wilson, 1 specimen.

REMARKS.—The two specimens have R respectively 56 and 70 mm. They were only collected in 1963 after this report had been completed and so are not included in Table 3. However, both are worthy of comment with regard to the distribution of the pedicellariae, since the one from Portsea Pier [Area 59 (24)] has some marginal pedicellariae while the Portland specimen has a few actinal ones, unlike any of the examples of *N. ocellata* included in the table. Both specimens have rounded proximal tabula, well spaced in the preserved condition.

Nectria multispina H. L. Clark.

Pl. II, figs. 1, 2.

Nectria multispina H. L. Clark, 1928, pp. 375–378, fig. 111, 1938, p. 77. Cotton and Godfrey, 1942, p. 197; H. L. Clark, 1946, p. 86.

?*Nectria* sp. possibly new, Fisher, 1911. Bull. U.S. Nat. Mus. 76, pp. 163–164.

MATERIAL.—Port Phillip Survey. Areas 58 (150–4), 1 specimen, 59 (24); 66 (—), 2 specimens; Cape Schank, 2 specimens; Port Phillip Heads, British Museum collection J. B. Wilson, 1 specimen.

REMARKS:—The specimen from Lonsdale Bight is large with R/r 102/37 mm. It is very like the photographs of the holotype. The specimens from Cape Schank have R/r 75/26 mm. and 82/28 mm. They differ from the type in having the larger proximal tabula markedly convex with the polygonal granules, except for the peripheral ones, quite smooth on top and so expanded and closely welded together that their limits are indistinct if not lost altogether on the most convex plates. Both specimens have usually four or five furrow spines, occasionally three on odd plates; the numbers seem to be distributed at random along the furrow and there is no regular diminution in number distally. These specimens have a number of pedicellariae, usually with three wide, blunt valves coarser than the adjacent granules on the proximal actinal plates bordering the adambulacrals, as in the holotype. There are also a few pedicellariae, mostly bivalved, on some of the interradial infero-marginal plates, especially near their upper edges, besides the usual adambulacral pedicellariae. The abactinal tabula are so crowded together that it is not possible to see whether there are pedicellariae also on their sides below the crowns of granules. Such pedicellariae were described in the type specimen of *Nectria pedicelligera* Mortensen, from New Zealand which also had some on the marginal and actinal as well as on the adambulacral plates. The valves of all these pedicellariae of *N. pedicelligera* were spiniform and more slender than the adjacent granules, besides numbering four to six rather than two or three, sometimes four, as in these specimens of *multispina*. However, two specimens from Rottnest Island, Western Australia, lent to me by Dr. Hodgkin, have actinal pedicellariae with relatively narrow valves, so the coarseness of the pedicellariae is probably not a distinguishing character.

Table 3 includes data derived from a number of specimens of *Nectria ocellata* mostly from the British Museum collection, unfortunately some of them without any locality and others simply labelled 'Tasmania' or 'Western Australia'. Also included are details of the holotype of *N. pedicelligera* Mortensen from New Zealand and of these Victorian specimens as well as of the holotype of *N. multispina* and a number of specimens lent to me by Dr. R. W. George of the Western Australian Museum, and Dr. E. P. Hodgkin of the University of Western Australia.

The specimen from B.A.N.Z.A.R.E. station 113 off Maria Island, Tasmania, in 122 metres is unusual in having very short arms, R/r being only 2·3/1, whereas ten undoubted specimens of *N. ocellata* with R more than 30 mm. have the ratio varying from 2·5 to 3·25/1, averaging 2·9/1 (the specimen with the minimum value having the disc unnaturally flattened giving an abnormal r measurement). Unfortunately the only

TABLE 3.

B.M. Registered Number or Designation	Locality	R (mm.)	r (mm.)	Marginal Plates	Tabular Outline (R Round, A Angular)	Tabular Granules: Central	Tabular Granules: Peripheral	Furrow Spines	Pedicellariae: Tabular	Pedicellariae: Adambulacral	Pedicellariae: Actinal	Pedicellariae: Marginal
90.5.7.442 ..	Bass Strait ..	20	9	14	R (A)	1	2	(4) 3	+		–	–
90.5.7.443 ..	Bass Strait ..	23	9–5	14	R (A)	1	2	(4) 3		–	–	–
..	? ..	35	13	27, 28	R–A	2	1, 2	3 (2)	+		–	–
90.5.7.444 ..	Bass Strait ..	47	18	27, 28	R	2	3	2 (3)		(–)		–
62.7.9.52 ..	Dirk Hartog I. ..	48	16	25	R–A	2	2	3 (2)	+	+		–
1953.4.27.24 ..	? ..	50	15	26	R	1	1, 2	(4) 3	(–)	(+)	–	–
BANZARE st. 113	Tasmania ..	50	22	20	R	1	3	4, 3				
W.A.M. 6.62 ..	Gt. Aust. Bight ..	65	20	23	R	2	2	5 3	–	–	–	–
1953.4.27.23 (pt.)	Tasmania ..	65	23	28	R–A	1	1	3	–	(–)	–	–
1953.4.27.23 (pt.)	Tasmania ..	65	21	31	R–A	1	1	3	–	(+)	–	–
62.7.9.51 ..	Western Australia	68	24	27, 28	R	1	1	(4) 3	(–)		–	–
1958.7.30.20 ..	Tasmania ..	70	27	26	R	1	1	3		(–)	–	–
62.1.8.18 ..	Tasmania ..	80	32	24	R	1	1	(4) 3	(–)	–	–	–
W.A.M. 18.59 ..	C. Naturaliste ..	62	20	25, 26	R	1	0	3 (2)	–	–	–	–
W.A.M. 19.59 ..	Dunsborough ..	80	25	26, 27	R	1	0	3	–	(–)	–	–
W.A.M. 2.62 ..	Leeuwin ..	90	30	26	R	1	0	(4) 3	–	–	–	–
62.1.8.10 ..	Tasmania ..	48	15	25	R–A	2	2	4		+	–	–
62.1.8.11 ..	Tasmania ..	50	18	23, 24	(R) A	3	3	(5) 4 (3)	+			
N. pedicelligera T.	New Zealand ..	53	19	26, 27	A R	2	3	3			(–)	(–)
46.8.3.14 ..	Tasmania ..	57	18	26	R (A)	2	3	3, 4	+	(–)		
W.A.M. 5.62 ..	Albany	18	7	14, 15	A	3	3	3	(+)	–	–	
W.A.M. 4.62 ..	Recherche Arch ..	58	18	25, 26	(R) A	3	3	4	(–)		(–)	–
85.11.19.40 ..	Port Phillip ..	65	17	31	R–A	2	3	3	–	–	–	+
W.A.M. 1.62 ..	Albany	66	18	24	A	3	3	3				
1962.4.9.7 (pt.)..	Cape Schank ..	75	26	30–32	A	3	3	3–5		+	+	–
Dr. Hodgkin's ..	Rottnest I. ..	77	22	24	A	3	3	(4) 3	–	–		
Dr. Hodgkin's ..	Rottnest I. ..	77	22	c.27, 28	A	(2) 3	3	2–4 (1)			(+)	
1962.4.9.7 ..	Cape Schank ..	82	28	36	A	3	3	3–5	+		+	–
N. multispina T.	South Australia ..	80–85	30–32	32, 33	A	2	3	(6) 5 (4)		+	+	

Details of some specimens of *Nectria*; top—13 specimens of *N. ocellata*, next—3 Western Australian specimens affiliated to *ocellata*, next—four specimens including the holotype of *N. pedicelligera* all intermediate between *ocellata* and *multispina*, finally—9 specimens including the holotype of *N. multispina*. In the first column, "W.A.M." signifies a specimen belonging to the Western Australian Museum. In the "Tabular Outline" column, "R (A)" signifies that a few tabula are slightly angular, but most are rounded, while "A (R)" is the opposite; "R–A" signifies an intermediate condition, the general impression being if anything rounded, while "A–R" suggests something a little more angular. The numbers under "Tabular Granules" show gradation of shape and crowding; for central granules 1 is slightly spaced, 2 close and angular, 3 tightly pressed together; for peripheral ones, 0 signifies longer, 1 similar, 2 slightly smaller and 3 distinctly smaller than the central granules. Furrow spine numbers on the left are limited to the proximal plates and on the right to distal ones, while mixing of numbers is shown by reversal of the magnitude with a hyphen (e.g., "3–5"). Brackets round positive pedicellaria records as well as furrow spine numbers signify rarity.

depth available for any of these ten specimens is 69–73 metres for the 'Challenger' one from Bass Strait which has R/r 2·6/1; it can only be presumed that most of the others were obtained by shore collecting or were from shallow water, since all were taken at least a hundred years ago. It is premature to suggest that there may be a short-armed form of *N. ocellata* from deeper water on the basis of this one specimen.

The variable characters covered in Table 3 include the apparent angularity or roundness of the proximal abactinal tabula, the relative size of their peripheral granules (similar to or smaller than the central granules), the spacing or crowding of the central granules, the number of marginal plates relative to size, the number of furrow spines and the occurrence and distribution of pedicellariae. The first character may be affected by the state of preservation of the specimen, resulting in a varying degree of contraction of the granule covering, but this is also influenced by the degree of crowding of the granules of the tabula. If these are expanded on their upper surfaces and fit closely together when the specimen is preserved, then, in life, they could not have contracted further and the outline of the whole tabulum must have been the same shape as now. The 'Challenger' specimens of *N. ocellata* (named *N. ocellifera* by Sladen) are particularly well-preserved so that the skin is not at all shrunken but envelops and softens the outlines of the tabula making their columns appear cylindrical rather than hour-glass-shaped; when the skin has been dissolved away, each tabulum is seen to be constricted below the crown as in most dry specimens of *ocellata*.

As Sladen pointed out, the smaller 'Challenger' specimens are interesting in the numerous pedicellariae they show at the edges of the flat surfaces of the tabula, taking the place of some peripheral granules. In most larger specimens of *N. ocellata*, as in the holotype of *N. pedicelligera*, the pedicellariae have shifted their relative position over the edge so that they lie just below the granule-crown.

H. L. Clark distinguished *N. multispina* from the other species of *Nectria* 'in the characters of the dorsal tabulae, in the adambulacral armature and oral plates and in the pedicellariae'. The present material shows that the great number of furrow spines in the holotype of *N. multispina* (six proximally) is exceptional, since I have seen no specimens with more than five furrow spines, even though some of these specimens are more divergent than the holotype in the shape and armament of the tabula compared with the usual condition in *N. ocellata*. Also one of Dr. Hodgkin's fine specimens of *multispina* from Rottnest Island off Fremantle has only a single very wide furrow spine on odd plates here and there, the other plates having two to four spines. The occurrence of pedicellariae is clearly variable, though they are more frequent in *N. multispina* and actinal ones were found only in one (see p. 311) of the 'typical' specimens of *ocellata* (as opposed to the intermediate specimens distinguished in the table).

Mortensen distinguished *N. pedicelligera* from *ocellifera* and *ocellata* by its tabula of differing shape, size and arrangement, its more numerous (26–27) marginal plates and its many pedicellariae. His knowledge of the two latter species appears to have been confused by Sladen's identification of the 'Challenger' specimens of *N. ocellata* as *ocellifera*, which made Mortensen doubt the validity of *ocellata*.

It is clear from the table that the number of marginal plates in *N. pedicelligera* is not distinctive. As for the tabula, I include here a photograph (Pl. II, fig. 4) of one of the intermediate specimens from the British Museum collection (No. 62.1.8.10, Tasmania) for comparison with Mortensen's photographs of the type of *N. pedicelligera*. Possibly the Tasmanian specimen should be considered as conspecific with the type of *multispina*. In that case there would be no alternative but to refer *multispina* to the synonymy of *N. pedicelligera*. Until we know more about the range of variation of the *Nectria* of New Zealand waters, such a move is premature.

Included in table 3 are details of three specimens from the Cape Naturaliste–Cape Leeuwin peninsula, south-west Australia, lent to me by Dr. R. W. George (one of them illustrated on pl. I, figs. 4–6). These are labelled '*Nectria* cf. *ocellifera*' but I am inclined to refer than rather to *N. ocellata*. Although the peripheral granules of their proximal tabula are higher than the central ones and some of them are slightly flattened, there is nothing like the difference between peripheral and central granules that is so conspicuous a feature of the three specimens of *N. ocellifera* from the collections of the Western Australian Museum. The peripheral granules in the three doubtful specimens are not at all splayed out, also they are only slightly higher and their thickness is hardly, if at all, greater than that of the central granules, which are rounded in outline and convex above, though similarly spaced to those of *N. ocellifera*. Also all the tabular granules are distinctly coarser than those of *ocellifera* and those of the distal plates are not clustered into well-defined convex groups corresponding to the underlying plates. The coarseness of the granules also distinguishes them from the specimens of *N. ocellata* in the British Museum collection as well as the example of *ocellata* from the Great Australian Bight borrowed from the Western Australian Museum. Instead of having more than twenty central granules and a similar number of peripheral ones on the larger tabula, as is usual in *ocellata*, these have only five to ten central granules and ten to fifteen peripheral ones, rarely more. At about three-eighths R from the centre there is often only a single central granule on each tabulum and distal to this, whether the tabula are low, the one or more central granules of each plate are distinctly enlarged and outstanding, though the peripheral granules of adjacent plates tend to become almost contiguous, obscuring the outlines of the individual plates. In specimens of *N. ocellata* from the vicinity of Tasmania, the granules of the distal plates may appear in convex groups or flat and almost continuous but usually one or more central granules are distinctly wider, if not higher than the rest, at least at the tip of the arm. In *N. multispina* the arrangement in convex groups with several enlarged central granules seems to be the normal condition.

It is possible that *Chaetaster munitus* Möbius, 1859, is conspecific with *Nectria multispina*. Sladen, 1889, thought that it is a synonym of *N. ocellifera* (i.e., of *ocellata* since Sladen confused the two), but the tabula of *munitus* appear to be rather angular in Möbius' figure, more like those of *multispina*. The holotype of *C. munitus* was in the Kiel or the Hamburg museum and came from an unknown locality; the species does not appear to have been recorded since so that the name could be regarded as a nomen oblitum.

Petricia vernicina (Lamarck).

Asterias vernicina Lamarck, 1816, p. 554.

Petricia punctata Gray, 1847, p. 80, 1866, p. 16, pl. 6, fig. 1.

Petricia vernicina: H. L. Clark, 1928, p. 388; Cotton and Godfrey, 1942, p. 200; H. L. Clark, 1946, p. 110.

?*Petricia obesa* H. L. Clark, 1923, pp. 241–243, pl. 13, figs. 1, 2; 1938, pp. 142–143, pl. 10, fig. 1; 1946, p. 110.

MATERIAL.—Port Phillip Survey: Areas 6, (65, 137), 2 specimens; 26 (41), 1 specimen; 15, (53), 1 specimen; 24, (Mordialloc) 4 specimens. J. B. Wilson: Port Phillip Heads, 1 specimen. Also two specimens from Merricks, Westernport, Victoria, 29 10 61.

REMARKS.—Out of the eleven specimens recorded above, all but two have the arms tapering evenly. The other two—one from Williamstown and the other from Port Phillip Heads—have the arms finger-like, not diminishing significantly in width distally and ending in a broad, rounded tip, just as in the holotype of *P. obesa* H. L. Clark from the Abrolhos, Western Australia. H. L. Clark distinguished his species from *vernicina* of south-east Australia, not only by the broad-tipped arms, but also by the absence of " tubercles, spinelets on even granules " on the distal marginal plates and the thick skin which is " not at all smooth and shiny when dry ".

Beside the Victorian specimens, all of which are in spirit, I have examined ten dry specimens of *P. vernicina* from localities ranging between Tasmania and Moreton Bay, Queensland. Not one of these has any trace of tubercles or other projections on the distal marginal plates and I can only think that H. L. Clark was labouring under a misapprehension when he said that such projections were characteristic of Lamarck's species. I must admit that all the dry specimens in the British Museum collection have the skin semi-transparent, revealing the positions of the underlying plates, though it is not particularly shiny. Possibly the dry holotype of *P. obesa* had previously been soaked in formalin or corrosive sublimate, which might account for its different appearance.

H. L. Clark (1938) recorded three other specimens of *P. obesa* from localities in Western Australia, but commented only on their size and colour, making no mention of the shape of their arms. It remains to be seen from further specimens from the west coast, whether or not the arms are consistently finger-like.

Austrofromia polypora (H. L. Clark).

Pl. III, fig. 1.

Fromia polypora: H. L. Clark, 1916, pp. 51–53, pl. 14, figs. 1, 2.

Austrofromia polypora: H. L. Clark, 1921, pp. 48–49; 1928, pp. 387–388; 1938, p.132; 1946, p. 114.

MATERIAL.—Port Phillip Survey: Area 66 (292) 1 specimen; J. B. Wilson, British Museum collection, 3 specimens, Port Phillip Heads.

REMARKS.—Wilson's specimens were named *Patiria crassa* by Bell. That Western Australian species has since been referred to *Parasterina*, which is distinguished by having large rounded primary abactinal plates surrounded by many small secondary ones, whereas in the Port Phillip examples all the plates are of similar small size.

One Wilson specimen is regenerating the tips of two arms, but in all three, the intact arms are more nearly cylindrical and blunter at the tip than in the photograph of the holotype of *polypora* or in three specimens from the type locality (off Maria Island, Tasmania) collected by the B.A.N.Z.A.R. Expedition at station 113, all of which have the arms slightly wider at the base and tapering to a fairly acute tip. H. L. Clark gave the width at the arm tip in the large holotype (R 86 mm.) as 4 mm., but this measurement must have been slightly inset from the extremity. In the best preserved Port Phillip specimen R/r is 65 mm./14 mm., br at the base is also 14 mm. and at 2 mm. from the tip is about 6 mm. In a B.A.N.Z.A.R.E. specimen with R/r 65mm./16mm., br at the same distance from the tip is less than 5 mm.

H. L. Clark himself (1916) comments that a specimen from Westernport, Victoria with R/r 65 mm./16 mm. appears stouter than the type; he also notes that "the granulation and adambulacral armature are noticeably coarser and the papulae, especially on the actinal surface, seem large". There does not appear to be any appreciable difference in the size of the papulae or the coarseness of the granulation in the Port Phillip specimens as compared with the B.A.N.Z.A.R.E. ones, but the number of furrow spines is rarely more than two in two of the Wilson specimen and only basally three in the third. Also the adambulacral plates when denuded are seen to be much shorter in these specimens than in the Tasmanian ones, where they are almost square. At the same time the number of adambulacral plates corresponding to the neighbouring actinal plates is greater. In a Tasmanian specimen partially denuded, the actinal plates correspond exactly in position and number to the adambulacral ones, for the first half of the arm at least, while in the Port Phillip specimens there are about 26 actinal plates corresponding to 30 adambulacrals. Another difference is in the size and regularity of the marginal plates. In the Port Phillip specimens these are particularly irregular and inconspicuous, forming two ill-matched series along the side of each arm, whereas in the Tasmanian examples the series can easily be followed through and for much of the arm length two abactinal plates above or two actinal ones below correspond to each plate of the two marginal series.

Some comparitive remarks about *Austrofromia polypora* are also given under the heading of *Nepanthia hadracantha*.

I am doubtfully referring to this species a specimen from area 66 off Port Phillip Heads collected in 1963. It has R/r 27–28 mm./8·5 mm. and so its arms are only half as long as those of the smallest specimens of *A. polypora* known to me. The marginal plates number about fifteen in each series in comparison with about 30 rather irregular ones in a Wilson specimen from Port Phillip Heads with R about 55 mm. In the smaller specimen the marginals are quite prominent, making up the whole side wall of the body, since there is considerable dorso-ventral flattening in comparison with larger specimens of *Austrofromia*. The dorsal plates are relatively few in number and large and some of them are convex so that the general appearance approaches that of some tropical Indo-Pacific species of the related genus *Fromia*. The single papular pores extend to the innermost row of actinal plates and there are three furrow spines proximally, giving way to two distally.

Patiriella gunni (Gray).

Asterina gunnii Gray, 1840, pp. 289–290; 1866, p. 16; Perrier, 1875, pp. 298–299; McCoy, 1890, p. 372, pl. 200, fig. 2.

Patiriella gunnii: H. L. Clark, 1928, pp. 392–393; 1938, pp. 165–166; 1946, p. 135.

MATERIAL.—Port Phillip Survey: Areas 14 (5), 26 (126, 300), 3 specimens; 27 (41); 30 (10); 39 (43, 47) 6 specimens; 42 (38) 2 specimens; 50 (229–30) 4 specimens; 58 (81, 150–4) 4 specimens; 59 (24) 8 specimens; J. B. Wilson Port Phillip Heads, 8 specimens.

REMARKS.—At least one of the specimens, from Corio Bay Area 26, was dull purple dorsally when received, being still preserved in formalin. This is the colour supposed by H. L. Clark to be characteristic for his species *P. brevispina*. Colour notes were not supplied with the remaining specimens but it is possible that a proportion of them were also this colour since McCoy noted the colour of his Victorian specimens as generally purple rather than the variegated greens and browns usual for *P. gunni*.

The type locality of *P. brevispina* is Bunbury, south-west Australia. H. L. Clark distinguished it by the shorter, flatter and more truncate actinal spines, in comparison with those of *P. gunni*. However, he did comment that there is considerable doubt whether *brevispina* should be considered only as a colour variety of *gunni*. After an examination of twenty of Gray's specimens all collected by Gunn at George Town, Tasmania (and presumably the types though not designated as such) I too am doubtful whether *brevispina* can be distinguished morphologically from *gunni*. Although after 125 years in the dried state there is not a trace of colour on Gunn's specimens they are remarkably variable with regard to the relative size of the actinal spines. Ten of them have R between 20 and 28 mm. and the length of their actinal spines from about the middle of the interradii ranges from 0·45 mm. to 1·05 mm. The shape is always slightly but not markedly flattened, the minimum (dorso-ventral) thickness half-way along their length being generally 0·75–0·80 of the maximum (lateral) thickness at the same place. In about five of the twenty specimens the width of these spines is the same at the tip as at the base, usually with a "waist" in between but in the others the spines are slightly tapering towards the tip. The subambulacral spines also vary somewhat in shape, five specimens having them distinctly broadened and flattened at the tip. However, no correlation was found between flattening of the subambulacral spines and shortness of the actinal ones.

It remains to be seen from examination of specimens retaining their natural colour whether or not there is any correlation between that and the proportions of the spines.

Nepanthia hadracantha sp. nov.

Pl. III, figs. 4–6, Text. fig. 3 a, b.

Parasterina sp. cf *troughtoni*: A. M. Clark, 1956, pp. 378–380, text. fig. 3, pl. 11.

MATERIAL.—Port Phillip Survey: Area 66 (292), 2 specimens; Cape Schank, 9–12 metres, rock bottom, 4 specimens (Holotype National Museum No. H. 14); Port Phillip, British Museum Collection (1 specimen probably collected J. B. Wilson at or near the Heads).

REMARKS.—The specimen from "Port Phillip" was described and figured in 1956. The Cape Schank specimens, including the holotype, differ from it mainly in the narrower arms and the smaller and more

irregular abactinal plates. (Though foreshortening in the photograph of the abactinal view given in 1956 has exaggerated the relative breadth of the arms in the Port Phillip specimen.)

DESCRIPTION of the Holotype.—R/r is 55 mm./12 mm. = 4·4/1; br at the base of the arm is 12–14 mm. and at 2/3R from the centre of the disc is 9·5 mm.

The arms are somewhat flattened, particularly on the under-side where the surface from the marginal plates to the furrow is slightly sunken in the preserved specimen (though probably more nearly flat in life). The abactinal plates extend on to the ventral side. The arms taper from the base, but a little more quickly in their outer halves; the tips are blunt and rounded.

The triangular madreporite is inconspicuous and lies in one interradius between 4 and 5 mm. from the centre.

The abactinal plates are all similar in size, the largest of them having a maximum diameter (with the spinelets intact) of just 2·0 mm. though the majority are about 0·8 mm. in their greatest width. There are two "fields" of plates; a dorsal one where the order is irregular, though in some parts an arrangement in diagonal rows can be discerned and a lateral field where the arrangement is in regular longitudinal rows; the shape of the plates in the dorsal field is variable, but in the lateral field the shape is regularly oval or rhombic. At the base of the arm, the dorsal field is only about 4 mm. wide but it broadens distally to encompass the whole arm width.

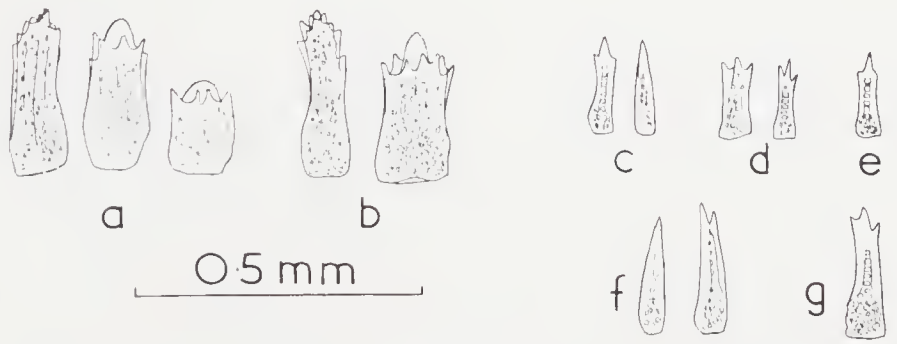

FIG. 3. Abactinal spinelets of *Nepanthia* spp.: a *N. hadracantha* holotype, R = 55 mm., **b** *N. hadracantha*, Port Phillip specimen, R = 53 mm., **c** *N. maculata* holotype, R = 39 mm., **d** *N. belcheri*, B. M. No. 1953.5.18.11, Moreton Bay, Queensland, R = 28 mm., **e** *N. brevis* holotype, R = 25 mm., **f** *N. variabilis* paratype, R = 35 mm. and **g** *N. briareus* syntype, R = 23 mm.

Most of the larger abactinal plates have 25–30 peripheral spinelets surrounding 35–40 others. On the disc the spinelet-covering of adjacent plates tends to be confluent. The spinelets are from 1·6 to 3·0 times as long as their maximum (basal) width, according to position, the peripheral ones being the longer and measuring about 0·3 mm. in length. Many of the spinelets have a distinct enlarged conical or blunted process in the middle of the free end between the terminal spinules.

When the spinelets are removed, most of the plates of the dorsal field are revealed as crescentic or triangular in shape with a large papular pore proximal (or adradial) to them in the hollow of the crescent or the middle of the hypoteneuse. The lateral plates are mostly triangular or quadrangular, but some have a concave side facing the corresponding pore.

The lateral plates extend on to the ventral surface for at least a quarter of the arm breadth at most points.

The inconspicuous elongated marginal plates are smaller than the adjacent abactinal plates and form two irregular longitudinal rows on each side in the distal half of the arm; proximally they are not distinct from the actinal plates of which there are three longitudinal series, the outermost very short and the second only reaching for about half the arm length. The plates of the inner series are larger and more nearly regular than the others; they are slightly more numerous than the marginal plates. There are no papular pores between the actinal and marginal plates or between the series of actinal plates.

The adambulacral plates when denuded have the shape of the sole of a foot, the heel directed laterally and bearing the subambulacral spinelets or spines. These number about ten and vary in arrangement from several rows parallel to the furrow to a semicircle around two or three other spinelets, or two rows at right angles to the furrow; they grade in size from the actinal spinelets to the furrow spines. The latter are similarly variable in arrangement, but usually there is an oblique or convex fan of four spines.

VARIATIONS.—The three other specimens from Cape Schank have R/r 55/12, 63/13·5, and 53/14 mm., while in the Port Phillip specimen it is 53/13 mm., a range from 3·8/1 to 4·7/1.

AFFINITIES.—The species probably most closely related to this one is *Parasterina troughtoni* Livingstone, 1934, with which I compared the Port Phillip specimen in 1956. At that time I commented that *troughtoni* is probably not congeneric with the type species of the genus, *Parasterina crassa* (Gray), which has rounded primary abactinal plates completely ringed by small, irregularly-placed secondary plates. In *Nepanthia*, if secondary plates are present at all, they lie in fairly regular positions with one to four of them proximal to the papular pore that lies in the hollow of each crescentic primary plate. Despite the similar finger-like outline of the arms of *troughtoni* and *P. crassa*, I believe that the former should be referred to the genus *Nepanthia*.

The type specimen of *N. troughtoni* came from King George's Sound, south-west Australia, while the type locality of *Parasterina occidentalis* H. L. Clark, 1938, which I consider is a synonym of *N. troughtoni* (1956, p. 380) is near Fremantle, Western Australia.

The holotype of *N. troughtoni* had R r 16 mm. 5·5 mm. or 2·9/1, while the type of *occidentalis* had the ratio 29 mm./7·5 mm. or 3·9/1. In both type specimens the arms are finger-like and not tapered at all and the abactinal plates appear large, rhombic and fairly regular. The spinelets of the type of *troughtoni* numbered about 40 to a plate and Livingstone described them as almost granule-like to the naked eye. So might the spinelets of *N. hadracantha* be described and the much larger size of the type specimen could account for their greater number. Nevertheless, the

fact that the Cape Schank specimens are less like the specimens of *troughtoni* so far described than is the Port Phillip specimen, particularly in the relative size of their abactinal plates, but are more like species such as *N. maculata*, together with the fact that all five Victorian specimens have tapering arms, prompts me to distinguish them as a new species. It remains to be seen whether or not *N. troughtoni* shares the peculiar form of the abactinal spinelets found in *hadracantha*. If it does, then the distinction between them may be less than a specific one.

In comparison with the other Australian species of *Nepanthia*, *N. hadracantha* comes closest to *N. tenuis* H. L. Clark from north-west Australia, though *tenuis* may itself be a synonym of *N. maculata* Gray, of which the type locality is the Philippines. The holotypes of all three nominal species have no secondary abactinal plates (though the "Challenger" specimen from Torres Strait identified as *maculata* by Sladen does have single secondary plates proximally). The arms of *N. maculata* are very slender, R r in the holotype being 39 mm./7mm. or 5·6/1, while br proximally is 5·5–6·0 mm. In the type of *N. tenuis* R/r is 64 mm./11 mm. = 5·8/1 and br similarly approximately equals r. Both of these are therefore considerably more slender than the Victorian specimens, all five of which have R/r less than 5·0/1, while in one it is only 3·8/1. Another difference is in the size of the spinelets covering the plates. These are very much coarser in the Victorian species and terminate in multiple spinules, many of them having a very thick central process. The spinelets of *N. maculata* taper to a single point or have only two or three terminal spinules; in both the holotype and the "Challenger" specimen with R 67 mm. the spinelets are only about 0·18 mm. long. H. L. Clark's description of the abactinal spinelets of the type of *N. tenuis* as "minute, short and glassy" agrees with the form of those of *maculata*. The abactinal spinelets are correspondingly coarser and fewer in the new species than in either *maculata* or *tenuis*.

Of the remaining Australian species of the genus, *N. belcheri* (Perrier) from New South Wales, southern Queensland and Lord Howe Island, comes nearest geographically, but *belcheri* is usually multibrachiate (and even when five-armed has several madreporites) besides having several secondary plates corresponding to each primary abactinal one; *N. brevis* (Perrier) from northern Australia similarly has R/r about 4/1 but it too has one or more secondary plates; *N. magnispina* H. L. Clark, from north-west Australia differs in having very coarse, convex abactinal plates (secondary ones apparently lacking) and finally *N. variabilis* H. L. Clark, also from north-west Australia, has secondary plates and resembles a five-armed specimen of *belcheri* (but for the single madreporite). The abactinal spinelets were described only as "short, sharp and glassy" in *magnispina* but in the other species I found that they are relatively small with few terminal spinules (fig. 3).

Three further species of *Nepanthia* are known but have not been recorded from Australian waters. Of these, *N. suffarcinata* Sladen, 1888, from the Mergui Archipelago, Burma, differs in having several secondary plates corresponding to each primary abactinal one, *N. briareus* (Bell), from the South China Sea, is multibrachiate, though it does lack secondary plates (see A. M. Clark, 1956), and *N. joubini* Koehler, 1908, from Cochin China and the Philippines (Fisher, 1919), is both multibrachiate and has secondary plates.

There is a superficial resemblance between *Nepanthia hadracantha* and *Austrofromia polypora* (H. L. Clark), 1916, of which Wilson took three specimens at "Port Phillip". The latter species is an aberrant temperate member of the Ophidiasteridae and does not run down easily to that mainly tropical family in H. L. Clark's keys of 1946 since the relatively poorly developed marginal plates are liable to lead one away from the old order Phanerozonia. Both species have rather similar proportions with single papulae between the slightly imbricating abactinal plates, which themselves are similar in size and superficially appear granulated. However, the papulae of *Ahpolypora* extend ventrally right up to the adambulacral plates, the abactinal plates are much more irregular in arrangement and their spinelets are much coarser and more nearly granuliform, besides being fewer in number correspondingly the adambulacral spines are fewer, with only two or three furrow spines on each plate.

Asterina atyphoida H. L. Clark

Asterina atyphoida: H. L. Clark, 1916, p. 57, pl. 17, figs. 1, 2; 1928, p. 389; Cotton and Godfrey, 1942, p. 201; H. L. Clark, 1946, p. 130.

MATERIAL.—British Museum collection, J. B. Wilson, Port Phillip Heads, 7 specimens.

These specimens were included with those named *Asterina gunni* by Bell. Since the species has never been properly described and the holotype was not very photogenic it seems worth while to give here some descriptive remarks. These are derived from a dried specimen from St. Vincent Gulf, South Australia, B.M. No. 1939. 6.15.91, named by H. L. Clark.

R/r is 9·5 8·5 mm., the specimen appearing perfectly pentagonal with the interradii straight.

The abactinal plates are in very regular series. There are five chevrons of rhombic ones in each interradius, while each radial area is occupied by five longitudinal series of rhombic, oval or oblong plates, most of which are very slightly indented proximally to accommodate the single papulae—these being restricted to the disc and the proximal two-thirds of each radial area. The five mid-radial series of plates each consist of eleven plates, but are stopped short of the terminal plates by the approximation of the distalmost three pairs of the adjacent adradial plates, the series of which each consist of thirteen plates.

The madreporite is small and triangular and lies close to the anus.

The surface of the abactinal plates has a granular texture, the convexities having a glassy appearance. Around the proximal edges of the plates are some minute conical spinelets, but these have mostly been rubbed off.

Along the margin is a short fringe of very fine spinelets, with two rows, each of about five spinelets, on each infero-marginal plate.

The actinal intermediate plates all have single spines which appear conical because of the sheath of skin which expands around the base of each one; a few of the distalmost plates have two spines.

There are about sixteen adambulacral plates in each series. Each plate has one large subambulacral spine and a furrow series of three webbed spines, except for the distalmost plates, which have two or even only one furrow spine.

The oral plates each have five (sometimes only four) furrow spines, the two innermost being the largest; on the ventral surface is a single suboral spine.

A spirit specimen from Port Phillip with R/r 11/10 mm. has the centre of the triangular madreporite only 2 mm. away from the anus. Its papulae are a little more distinct than in the dry specimen. Again they are limited to the disc and the radial areas. It is noticeable that they are absent between the plates of the mid-radial series, except for those on the disc, so that this row of plates appears to the naked eye as a slightly paler line. Some of the radial plates of this specimen could be termed crescentic in shape since they are distinctly notched proximally to accommodate a papula. More of the abactinal spinelets are intact in this specimen; the larger plates have 10–12 of them along their proximal edges.

This species is superficially very like *Patiriella exigua* (Lamarck), from which it differs in the much more conspicuous and regularly arranged abactinal plates, the smaller and distinctly triangular madreporite and the finer and exclusively peripherally-placed abactinal spinelets. A third pentagonal Asterinid from south-east Australia is *Asterina inopinata* Livingstone, but this has nearly all the abactinal plates much more markedly crescentic than *atyphoida*, also the furrow spines and actinal spines are more numerous.

OPHIUROIDEA.

KEY TO THE OPHIUROIDS OF THE EAST FLINDERSIAN REGION.

1. (8) Disc *and* arms covered with thick skin, concealing any underlying plates or scales when wet; arms branched or simple, cylindrical in cross-section.
2. (7) Arms branched.
3. (6) Arm spines present before the first fork .. .. .. *Astroconus*.
4. (5) Arms only annulated on the distal branches. *Astroconus australis* (Verrill), 1876.
5. (4) Arms annulated for their whole length. *Astroconus pulcher* H. L. Clark, 1938.
6. (3) Arm spines not developed before the fourth fork. *Astroboa ernae* Döderlein, 1911.
7. (2) Arms not branched. .. .. .. *Ophiomyxa australis* Lütken, 1869.
8. (1) Arms never and disc usually lacking opaque skin, disc often with spines, spinelets, thorny stumps or granules more or less obscuring the underlying scales, rarely skin; arms more or less flattened.
9. (12) Small species (disc diameter not known to exceed 6 mm.) with a large acute papilla at the apex of each jaw, the disc scaling obscured by spaced stumps and the arm spines large and projecting, the upper spines the longest, the lower ones rugose.
10. (11) Dorsal arm plates longer than wide and bell-shaped; oral shields with the distal side convex; only six arm spines proximally even when the disc diameter is 6 mm. .. *Ophiacantha brachygnatha* H. L. Clark, 1928.
11. (10) Dorsal arm plates wider than long and fan-shaped; oral shields (except the madreporite) with the distal side straight; seven arm spines on alternate proximal segments when the disc diameter is only 4 mm. .. .. *Ophiacantha alternata* sp. nov.

12. (9) Small or large; never a combination of a single *acute* apical papilla with spaced disc stumps obscuring the scales and projecting arm spines.

13. (28) A pair of large rounded or rectangular infra-dental papillae at the apex of each jaw. (Caution: a few other species, such as *Pectinura assimilis* and *Ophiozonella elevata*, may have the two innermost oral papillae infra-dental in position; they differ from the Amphiurids most obviously in having the arm spines appressed.)

14. (17) Two distal oral papillae on each side of each infra dental pair.

15. (16) Outermost oral papillae twice as wide as the others; oral shields about as wide as long. . . . . *Amphipholis squamata* (D. Chiaje), 1828.

16. (15) Outermost oral papillae not distinctly larger than the others; oral shields much longer than wide. . . . . *Amphiodia ochroleuca* (Brock), 1888.

17. (14) Only one distal oral papilla each side, well spaced from the infra-dental ones.

18. (27) No spinelets on the disc, which is covered with scales or naked skin.

19. (26) One or two tentacle scales present on each pore.

20. (23) One tentacle scale.

21. (22) Radial shields narrow, about four times as long as wide; three arm spines on most segments, four or five only basally, when the disc diameter is 9 mm. *Amphiura trisacantha* H. L. Clark, 1928.

22. (21) Radial shields about three times as long as broad; six arm spines already when the disc diameter is only 5 mm. . . *Amphiura constricta* Lyman, 1879.

23. (20) Two tentacle scales.

24. (25) About seven spatular arm spines; disc covered with scales on both sides. *Amphiura poecila* H. L. Clark, 1915.

25. (24) Second from lowest of the five arm spines with a single hook proximally, giving way to a bihamulate form further out on the arm; disc scale-less ventrally adjacent to the oral shield. *Amphiura elandiformis* sp. nov.

26. (19) No tentacle scales. . . *Amphiura* (*Ophiopeltis*) *parviscutata* sp. nov.

27. (18) Spinelets present on the disc; these are sheathed in skin, which also tends to obscure the scales. . . . . *Ophiocentrus pilosus* (Lyman), 1879.

28. (13) Either a single oral papilla, several irregularly placed ones, or a cluster of tooth papillae at the apex of each jaw, never a regular pair on all the jaws.

29. (32) A single blunt papilla below the lowest tooth at each jaw apex, separated by a wide gap from one or two distal oral papillae arising from the adoral shields or the bases of the oral plates. . . . . *Ophiactis*.

30. (31) One large, fan-shaped distal oral papilla each side. *Ophiactis tricolor* H. L. Clark, 1928.

31. (30) Two small, squarish, distal oral papillae. . . *Ophiactis resiliens* Lyman, 1879.

32. (29) No division of papillae into an infra-dental one and widely separated distal ones, but either a cluster of tooth papillae below the lowest tooth, or a single papilla in series with similar oral papillae on each side, or both tooth papillae and contiguous series of oral papillae.

33. (38) An isolated cluster of tooth papillae at each apex; no oral papillae on the sides of the oral plates.

34. (35) Radial shields not very conspicuous, bearing small, rugose stumps similar to those on the rest of the disc; disc diameter rarely over 8 mm. *Ophiothrix caespitosa* Lyman, 1879.

35. (34) Radial shields conspicuous, quite bare in contrast to the rest of the disc; maximum size larger, disc diameter often over 10 mm.

36. (37) Dorsal arm plates rhombic, only narrowly in contact. † *Ophiothrix aristulata* (Lyman), 1879.

† I believe that the form of the dorsal arm plates allies *aristulata* more closely with *O. fragilis*, the type species of *Ophiothrix*, than with *P. melanosticta*, the type of *Placothiothrix*, to which latter genus *aristulata* was only provisionally referred by H. L. Clark; accordingly the species is here referred back to *Ophiothrix*.

37. (36) Dorsal arm plates flaring distally but successive ones very widely in contact. *Placothiothrix spongicola* (Stimpson), 1855.

38. (33) Oral papillae present as well as one or more apical papillae.

39. (44) A cluster of tooth papillae at each jaw apex.

40. (41) One tentacle scale. . . . *Ophiocomina australis* H. L. Clark, 1928.

41. (40) Two tentacle scales.

42. (43) Arm spines plain coloured, not banded, a light longitudinal stripe on the underside of each arm. . . *Ophiocoma canaliculata* Lütken, 1869.

43. (42) Arm spines banded, ventral arm plates patterned. *Ophiocoma pulchra* H. L. Clark, 1928.

44. (39) Usually one and never more than two or three papillae at each jaw apex.

45. (48) Paired supplementary plates present on each arm segment lateral to each dorsal arm plate.

46. (47) Disc scales evident, not obscured by skin; maximum size large, disc diameter even exceeding 20 mm. . . *Ophionereis schayeri* (M. & Tr.), 1844.

47. (46) Disc scales and even the oral shields obscured by skin; not exceeding 10 mm. in disc diameter. *Ophionereis semoni* (Döderlein), 1896.

48. (45) No paired supplementary arm plates, though the dorsal plates may be fragmented irregularly (in *Ophioplocus*).

49. (56) Disc covered with granules, concealing the scales.

50. (51) Teeth wide and blunt, with hyaline edges; arm spines longer than the segments and standing out from them somewhat. *Ophiurodon opacum* H. L. Clark, 1928.

51. (50) Teeth narrow and more or less pointed, their edges not at all hyaline; arm spines short and appressed.

52. (55) Disc granulation concealing the radial shields.

53. (54) Supplementary oral shields (distal to the oral shields proper) small and narrow; maximum size large, disc diameter known to exceed 25 mm.; ten arm spines when the disc diameter is 23 mm. . . *Pectinura assimilis* (Bell), 1888a.*

54. (53) Supplementary oral shields about a third as long as the oral shield adjacent to them; not known to exceed a disc diameter of 12 mm.; ten arm spines already when the disc diameter is 10 mm. *Pectinura arenosa* (Lyman), 1879.*

55. (52) Radial shields left bare. . *Ophiarachnella ransayi* (Bell), 1888a.

56. (49) Disc not covered with granules, scales distinct.

57. (58) Dorsal arm plates fragmented. . *Ophioplocus bispinosus* H. L. Clark, 1918.

58. (57) Dorsal arm plates entire.

59. (60) A large, convex, regular, triangular plate between the distal ends of each pair of radial shields and the base of the arm. *Ophiocrossota multispina* (Ljungman), 1867.

60. (59) No such plate present

61. (62) Two tentacle scales on most of the pores, each scale covering about half of the pore. . . . . *Ophiozonella elevata* (H. L. Clark), 1911.

62. (61) Six or more scales on the pores of the first segment, the number rapidly falling to one on the following segments as the pore size decreases.

63. (64) Dorsal arm plates wider than long, the successive ones broadly in contact. *Ophiura kinbergi* Ljungman, 1866.

64. (63) Dorsal arm plates longer than wide, barely in contact. *Ophiura ooplax* (H. L. Clark), 1911.

* It is not impossible that these will prove to represent only a single species of *Pectinura*, large specimens having been attributed to *P. assimilis* and smaller ones to *arenosa*. Only a good series of specimens will settle this.

Ophiacantha alternata sp. nov.

Text–fig. 4.

MATERIAL.—Port Phillip Survey: Areas 6 (137), 4 specimens; 15 (284), 1 specimen, 50 (233), 1 specimen; 58 (150–4), 15 specimens (Holotype National Museum No. H 15, Paratypes No. H.16); 59 (36), 17 specimens.

DESCRIPTION of the holotype.—The disc diameter is 3 mm. and the arm length 10 mm. The arms are attenuate, tapering proximally more than they do distally. They appear slightly moniliform, especially in oblique view where the flaring of the lateral arm plates is most obvious.

The dorsal side of the disc is covered with spaced stumps, most of them slightly higher than wide and cylindrical or tapering, ending in several points. Among these stumps in each interradius close to the edge of the disc are about five short, blunt, tapering spines; similar spines also occur sparsely near the centre of the disc. The scaling is obscured everywhere except at the junctions of arms and disc. The radial shields are also obscured except at their widely-spaced distal ends, where they articulate with the upper ends of the genital plates, the latter being just visible through the skin in lateral view. On the ventral side, the stumps extend right up to the oral shields and the scaling is completely obscured.

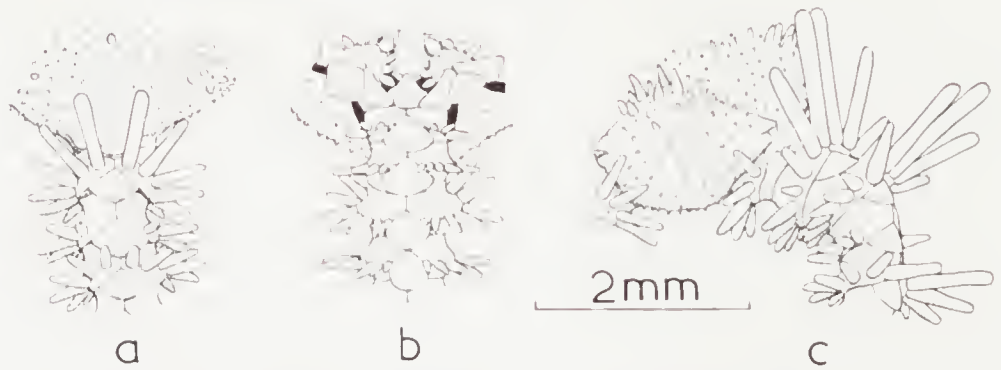

FIG. 4. *Ophiacantha alternata*: **a** and **b** holotype, part of disc and an arm base in **a** dorsal and **b** ventral views (the oral shield on the left being the madreporite), **c** paratype with disc diameter 4 mm., in oblique dorso–lateral view.

The oral shields are triangular, nearly twice as wide as long, with the proximal angle obtuse. The madreporite only is rhombic in shape with a distal angle. The adoral shields are large, meeting widely interradially and at their other ends separating widely the oral shield and the first lateral arm plate on each side.

There are three oral papillae each side, all of them borne on the oral plate. At the apex of the jaw is a single large, leaf-like papilla with an acute tip.

The ventral arm plates are at first fan-shaped, then become pentagonal by developing a slight angle at each of the small tentacle pores. All of them have the distal edge markedly convex. The consecutive proximal plates are just separated from each other (the third segment in the arm drawn has become displaced so that the gap is unnaturally widened) and the smaller distal plates are more widely separated.

The dorsal arm plates are all fan-shaped, though there may be a slight angle in the middle of the distal edge so that they could be described as rhombic. They are all much wider than long, the proximal ones having the length equal to about two-thirds of the breadth. All of them are widely separated.

The lateral arm plates are large, even the proximal ones meeting widely above, though narrowly below; they flare slightly towards their distal ends where each bears up to 7 spines. The first one or two free segments (i.e. the third and fourth), usually both of them, have seven spines on each side, the two series being almost continuous dorsally. The uppermost spines are the longest, measuring up to 0·8 mm. in length. The second spine is almost as long and like the top one is slightly clavate in shape, not tapering. The third spine is much shorter, measuring 0·4 mm. in length and, like the ones below it, tapers slightly to a very blunt tip. The middle spines are also distinctly rugose in contrast to the upper ones which are smooth. On three arms the third and fourth segments both have seven spines, as just described, the fourth arm (figured) has only the third segment with its full complement of spines and the fifth arm has only the fourth segment with the uppermost spines enlarged, though there are seven spines on the third each side. The following segment—the fifth on four arms and the fourth on the one drawn—has only five spines, the two uppermost of the series lacking, while the next segment again has seven spines, the next five, then seven, after which the numbers fall to four and six, with the regular alteration continuing.

The single tentacle scale is elongated and pointed.

The arm plates have their surfaces sculptured with concentric lines, particularly at the distal ends of the dorsal and ventral arm plates and around the proximal constricted part of each lateral plate.

In the centre of each oral shield there is a dark spot and in the hollow between each pair of oral plates a cluster of dark dots. Otherwise the colour in spirit is light brownish.

Another specimen from (Area 58), Lonsdale Bight is shown in partial lateral view in the figure; it has the disc diameter 4 mm. but its arms are all bent downwards sharply near their bases so that the ventral side is obscured. For this reason it was not selected as the holotype. It has more prominent interradial disc spines, which extend further towards the centre. The first two free arm segments have eight spines, the next one six, the next seven, then five and seven alternately. The uppermost spine of the eight is nearly 2 mm. long. Another specimen with the disc diameter 4 mm. has no more than seven spines, the uppermost about 1·3 mm. long, whereas the length of a proximal arm segment is about 0·4 mm., so that the longest spines are at least three times as long as the segment. Some of the other specimens have the disc spines arising not so much in the interradii as near the centre of the disc. The occurrence of the dark spots on the oral shields is not invariable; in some specimens they are very pale and in others absent altogether.

AFFINITIES.—At first I was inclined to refer these specimens to *Ophiacantha heterotyla* H. L. Clark, 1909, known from off New South Wales and Tasmania (H. L. Clark, 1938). Both have the disc covered with small stumps and some blunt spines (though in the type of *heterotyla* the spines are located only at the position of the inner ends of the radial

shields), in both species the distal ends of the radial shields are all that show, the dorsal arm plates are fan-shaped, the uppermost arm spines are the longest and there is a black spot on each oral shield (particularly well-marked in Tasmanian specimens of *O. heterotyla* where the proximal ventral arm plates are also spotted). However, there are a number of differences. The holotype of *O. heterotyla* similarly has a disc diameter of 3 mm. but it has fewer arm spines, only five on the first segments then four and these spines are tapering (at least in H. L. Clark's figure). Nor is there any mention in Dr. Clark's description of the alternation in the numbers of arm spines which is such a feature of these Port Phillip specimens. The oral shields of *O. heterotyla* are pentagonal rather than triangular and the adoral shields in the figure do not appear to separate the oral shield from the lateral arm plates. The ventral arm plates in *O. heterotyla* are pentagonal with the distal edge concave, in contrast to the markedly convex distal edge shown by the Port Phillip specimens. Finally, in the figure of *O. heterotyla* the outermost oral papilla is shown as arising from the adoral shield, whereas in the present species all three papillae are based on the oral plates, the outermost one being directed over the oral tentacle parallel to the edge of the adoral shield.

It may be noted here that *O. heterotyla* is very similar to the holotype of *O. vepratica* Lyman, 1878 (Bull. Mus. Comp. Zool. Harvard, 5, p. 137), which was from deep water (1097 metres) near the Kermadec Islands (north of New Zealand). Fell (1958, Zool. Publ. Victoria Univ. Wellington, No. 24, p. 25 and 1960, Bull. N. Z. Dept. S.I.R., 139, p. 67) has also recorded as *vepratica* two specimens from the Chatham Rise, to the south-east of New Zealand, in 476 and 549 metres, though these lacked spines among the disc stumps, like *O. sollicita* Koehler, 1922 (Austral. Ant. Exped., Sci. Rep., C8 [2]) from off Tasmania in 2377 metres.

Another related Australian species is *O. brachygnatha* H. L. Clark, 1928, from Spencer or St. Vincent Gulf, South Australia. The type specimen was larger with disc diameter 6 mm. and differs from *alternata* in having the dorsal arm plates bell-shaped and longer than wide, the oral shields with a convex distal side and an acute proximal angle, the third oral papilla wide and rounded and only six arm spines even on the proximal segments. The moniliform arms, stressed by H. L. Clark in his key of 1946, are not very obvious in his photograph, appearing to be developed to about the same degree as in *O. alternata*.

A third Australian species of *Ophiacantha* comparable to this one is *O. clavigera* Koehler, 1907, known from the vicinities of Fremantle and Bunbury. That species has the upper arm spines markedly clavate (apparently more so than in *alternata*, judging from Koehler's diagrammatic figures), the arm plates, oral and adoral shields are similar to those of *alternata*, but the disc is covered only with stumps, while the underlying scaling is distinct (at least in the figures) and there is no alteration in the number of arm spines.

Among the Australian species of *Ophiacantha* the only one which has anything approaching the same peculiarity of the arm spines is *O. gracilis* (Studer), 1882 (Phys. Abh. K. Akad. Wiss., Berlin), from Torres Strait, the East Indies and Phillippines, which has the uppermost of the four arm spines particularly long on the second free segment, though there is no alternation on the following segments.

Amphiura poecila H. L. Clark.

Text fig. 5a–e.

Amphiura poecila H. L. Clark, 1915, p. 230, pl. 5, figs. 12, 13; 1946, pp. 197–198.
Amphiura rapida Koehler, 1930, pp. 99–100, pl. 16, figs. 11, 12.

MATERIAL.—Port Phillip Survey: Area 61 (96), 2 specimens.

Since neither H. L. Clark's photographs of the holotype of *A. poecila* nor Koehler's of that of *A. rapida* are altogether satisfactory, I give here some drawings I made of the Holotype whilst visiting the Museum of Comparative Zoology.

One of the two Port Phillip specimens has six arms.

The type locality of *A. poecila* is Westernport, Victoria.

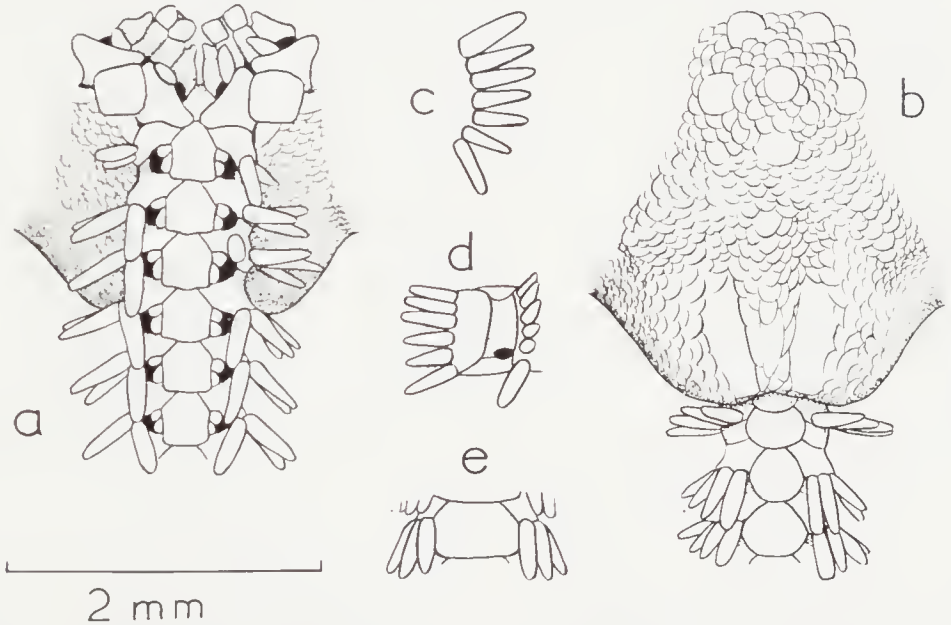

FIG. 5. **a–e** *Amphiura poecila* holotype, disc diameter 4 mm., a ventral and **b** dorsal views of part of the disc and an arm base, **c** arm spines in profile (the spatulate shape of the middle ones not apparent in this view), **d** lateral view of an arm segment, the spines more or less foreshortened, **e** arm segment with the fifteenth dorsal plate.

Amphiura elandiformis sp. nov.

Text fig. 6f–i.

MATERIAL.—Port Phillip Survey: Areas 7 (207) 3 specimens (two discs lacking); 13 (210) 6 specimens without discs; 20 (309) 7 complete and 7 specimens without discs; 21 (115) 2 specimens without discs; 23 (68) 1 specimen without discs; 32 (277) 2 specimen with disc detached but present; (Holotype National Museum No. H. 40); 33 (177) 2 specimens without discs; 43 (251) complete specimen, (263) 3 specimens, two discs lacking; 47 (258–9), 1 specimen without disc; 52 (252) 2 specimens without discs; 53 (253) 3 complete and 2 specimens without discs; 61 (241) 2 specimens without discs; 1 complete specimen; 63 (246) 8 complete specimens and 7 without discs; (249) 1 specimen without disc.

DESCRIPTION of Holotype.—Disc diameter probably 9 mm. originally but owing to interradial shrinkage now about 8 mm. Arms all broken but probably very long, over ten times the disc diameter.

The disc of this and all other specimens bulges out radially beyond the distal end of the radial shields and is strongly contracted interradially so that its shape is petaloid. The dorsal side is covered with small but thick scales, slightly larger around the radial shields. There are about fifteen scales on a line drawn across the interradius between the proximal ends of two radial shields. Not far from the centre of the disc there are two slightly larger circular scales, but neither is quite central and no primary radial scales can be detected. The radial shields are extremely narrow, just under 2 mm. long but only about 0·25 mm. wide, the ratio of length: maximum breadth being about 7·5: 1. Some of the shields are overlain by the scales more than others and so are reduced in area. The two shields of each pair are in contact only at their distal ends, from which point they diverge but curve towards each other again proximally so that they resemble the horns of an eland as viewed from the front. A similar shape is found in *Amphioplus falcatus* Mortensen, 1933, from South Africa.

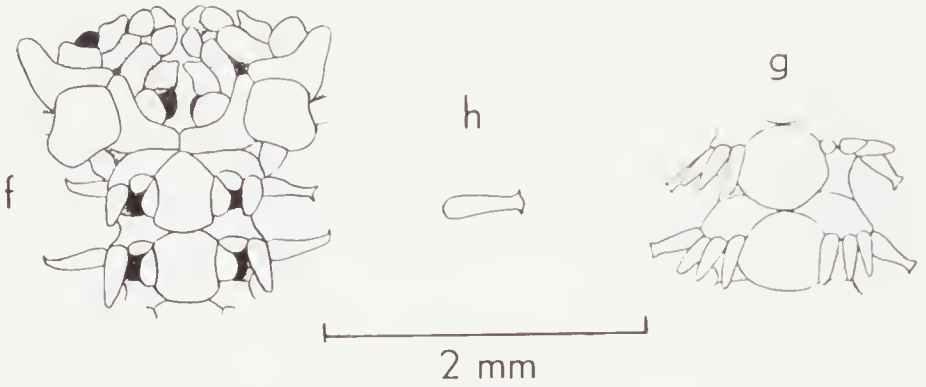

Fig. 6. f–i *Amphiura elandiformis*. Paratype, Port Phillip, disc diameter probably c 5–6 mm., f ventral view of two mouth angles and an arm base, g dorsal view of the ninth and tenth arm segments (with the second and third dorsal arm plates), h the second from lowest arm spine of the 23rd segment, i *A. elandiformis* holotype, part of disc and an arm base in dorsal view. (X marks the centre of the disc).

On the ventral side of the disc the scaling now stops short about halfway between the periphery and the distal edge of the oral frame, giving way to pale grey skin. This accounts for the frequent loss of the disc in this species. The extreme contraction of the ventral skin has probably pulled the scaling down to the ventral side and in life it is possible that the junction between scales and skin came at the ambitus or only a little below it. A similar condition is shown in all the other specimens that have the disc intact.

The oral shields have their widest part near the proximal end so that the proximal angle is obtuse; the distal lobe is long and hardly tapers until just short of its rounded end, so that the two longest sides are almost parallel. The length:breadth ratio is 1·3–1·5:1 and the length is about 0·57 mm. In the paratype figured orally the shields widen out more than in the holotype, the shape figured being the most common one found in the present specimens, though one or two are even narrower throughout than in the holotype, having quite parallel sides. The madreporite is huge and swollen, almost 1mm. long and broad in proportion in the holotype. The adoral shields are broadly contiguous, both radially and interradially in the paratype figured, having a radial lobe covering the first ventral arm plate with the corresponding part of the neighbouring shield. In the holotype and most of the other specimens this radial lobe is less well developed and the shields are only contiguous interradially, the shape being quadrilateral, with no distal lobe between the oral shield and the first lateral arm plate. Opposite the second oral tentacle the proximal edge of the adoral is slightly concave. The distal oral papilla is very wide and rounded, almost opercular in shape. This form is the most common in the other specimens but one or two have a more angular shape with a distinct peak in the free edge, though the base is still very wide and exceeds the height. Usually these papillae are found in a semi-erect position but some have been preserved in the horizontal plane. The infradental papillae are quadrilateral in shape and the blunt inconspicuous oral tentacle scale lies just at the level of their dorsal edges.

The dorsal arm plates are approximately oval but with slight lateral angles; the distal half may be more deeply curved than the proximal which forms a rounded angle. The basal plates are small but, as the arms broaden out beyond the base, the dorsal plates increase in width at the same time. The fifth dorsal arm plate (on the fifteenth segment) has the length: breadth ratio 1:1·3, the breadth being 0·55 mm. and the arm width between segments at this point 0·85 mm. The twenty-fifth dorsal plate is 0·65 mm. wide and the arm breadth proximal to it is 1·0 mm. The consecutive dorsal arm plates are barely, if at all, contiguous.

The ventral arm plates are truncated pentagonal, longer than broad, with the distal edge slightly convex or sometimes straight in its middle part. All are contiguous.

The arm spines number five just beyond the disc; all of them taper evenly except for the second from lowest but the second has a hyaline tip which is bent into a slightly proximally-directed hook on the basal segments or has a bihamulate form with the development of a second hook on the distal side. On the following segments this bihamulate spine increases in thickness and in the width of the tip but never reaches the size or convexity of tip attained by the comparable spine in *Amphiura*

(*Ophiopeltis*) *parviscutata*. The five spines of the fifth free segment on one arm (i.e. the fifteenth segment from the oral frame) measure respectively 0·40–0·45, 0·40, 0·29–0·31, 0·31 and 0·37–0·40 mm., beginning with the lowest one. By about the sixtieth segment (beyond which no arm remains intact) there are still five spines (except on one regenerated arm where the uppermost one is lost) and the first and bihamulate spines measure 0·53 and 0·47 mm.

The tentacle scales number two and are fairly large, especially the one on the ventral plate.

The colour in spirit is pale grey, though there are traces of light brown on the arm bases ventrally.

VARIATIONS.—A specimen with disc diameter c 6 mm. has the complete arm length 110 mm., a ratio of about 1:18. Another with similar disc size has the arms c 105 mm.

In a few specimens the primary central disc scale is distinct and the five primary radials may be just recognizable, more by a dark spot of colour on each than by larger size. The radial shields are just under half the radial disc radius and are narrow and curved in all but a few specimens. Nine specimens have the length: breadth ratio varying from 4·7 to 8·0:1, averaging 6·6:1, the lowest value being for the smallest specimen, disc diameter 5·0 mm. The exceptions are provided by three of the specimens from off Dromana in which the discs are obviously in process of regeneration, being diminutive in relation to the width of the arms basally and there being more missing proximal dorsal arm plates than could ever be accounted for by shrinkage of the disc alone. The radial shields are much wider and shorter in these specimens, the ratio being 3·75, 2·8 and 2·3:1, while the length of the shields is only about 1·2 mm. in the first two and 0·8 mm. in the third, compared with 1·7 mm. or 1·4 mm. in specimens with original (or at least fully grown) discs of about the same diameter. The disc scaling is also much coarser in these regenerating specimens and there are no traces of primary plates.

Several of the larger specimens with disc diameter 7·5 mm. or more have six arm spines on the proximal segments but still the second spine is the only one modified in shape.

There may be a conspicuous dark brown colour pattern on the proximal part of the arm, giving way fairly abruptly to the usual pale colour. One such specimen has the disc regenerating and conspicuously lighter in colour than the arm bases.

REMARKS.—Before 1963 this species was only represented in the Survey collections by a few discless specimens, so the original draft of my report only included figures of one of these under the name '*Amphiura* sp. aff. *diacritica*'. The discovery of complete specimens allowed me to name and fully describe the species which proved to be quite distinct from Queensland *A. diacritica* H. L. Clark. The latter has never been figured. It has long arms at least ten times the disc diameter, the dorsal side of the disc with very fine scales only around the radial shields the rest, together with the ventral side, being skin covered; the radial shields are hardly more than twice as long as wide and the distal oral papilla is thick as well as wide. The species does resemble *A. elandiformis* in having some modified arm spines but there are eight

spines and the third and fourth, or other middle ones, rather than just the second, have the tip modified and this modification takes the form of a single hook, not two divergent ones.

A number of species of *Amphiura* have naked skin on much of the ventral side of the disc. Most of these have been grouped together by Fell (1962) as a separate, but I believe unnatural, genus, *Hemilepis*. Several are Australasian species. One of the closest to *A. elandiformis* is *A. norae* Benham, which I consider to be a synonym of *Amphiura correcta* Koehler described from an unknown locality but collected by Dumont d'Urville's expedition on the 'Astrolabe' to the Southern Ocean. I have examined a syntype of *A. correcta* in the Museum of Comparative Zoology and cannot find any character by which to differentiate it from the very distinctive *norae* described by Benham about two years later. *A. correcta* has fairly long, curved radial shields and very wide distal oral papillae but differs from *A. elandiformis* in having the arms not quite as long, only ten times the disc diameter, conspicuous primary disc scales, scales bordering the genital slits, spearhead-shaped oral shields widest nearer the distal end and particularly in lacking the specialized second arm spine. I regard this last character as an important one in assessing the relationships of Amphiurids. There are several species of the 'Hemilepis' group which do have the second spine and sometimes also the next one or two spines with modified tips. One of these is *A. fasciata* Mortensen from the Persian Gulf, in which there are eight spines proximally, the second and other middle ones being bihamulate. The radial shields are also fairly long in *fasciata* but it differs from *A. elandiformis* in having the disc more extensively skin covered, the distal oral papilla narrower and the oral shields and ventral arm plates of different shapes.

In *Amphiura uncinata* Koehler from the East Indies to South Africa the distal oral papilla is also wide and rounded but the modified arm spines have the form of distally-directed hooks. The antarctic species *A. joubini* Koehler does have bihamulate or hooked spines but differs in having the distal oral papilla spiniform and the radial shields relatively short. The Atlantic species *A. latispina* Ljungman has the second spine modified and oral shields of similar shape to *elandiformis* but differs in having the adorals widely separated interradially and the distal oral papilla conical, as well as the skin of the disc extending to the dorsal side interradially.

In H. L. Clark's key to the Australian species of *Amphiura* this species runs down to *A. ambigua* Koehler, recorded by Koehler from the East Indies and Siam but also occurring at Darwin according to H. L. Clark. Since the latter's key gives *ambigua* as a species with the disc skin-covered ventrally, whereas Koehler's specimens, one of which I have seen, are fully scaled on both sides, I am doubtful of the identification of the Darwin specimens. *A. ambigua* has oral shields and small thick disc scales like *elandiformis* but the second *and* third arm spines are bihamulate, the radial shields are wider, the distal oral papilla is cylindrical and of course the disc is scaled ventrally. Zoogeographically it is improbable that the same species is found in Port Phillip as on the north coast of Australia but if H. L. Clark's specimens from Darwin do have the disc skin-covered below, narrow radial shields, long arms and hooks on two of the arm spines then they may be related to *A. elandiformis*.

Having examined the types of both species, I should point out that, contrary to H. L. Clark's key, the holotype of his species *A. multiremula* also has scales on the ventral side of the disc and *A. stictacantha* has two tentacle scales rather than one and so should come in the second half of the key.

To sum up, the combination of very long arms, very narrow radial shields, partial ventral skin covering, unusual oral shields, wide rounded distal oral papillae and bihamulate second arm spines is matched by no other species of *Amphiura* as far as I know.

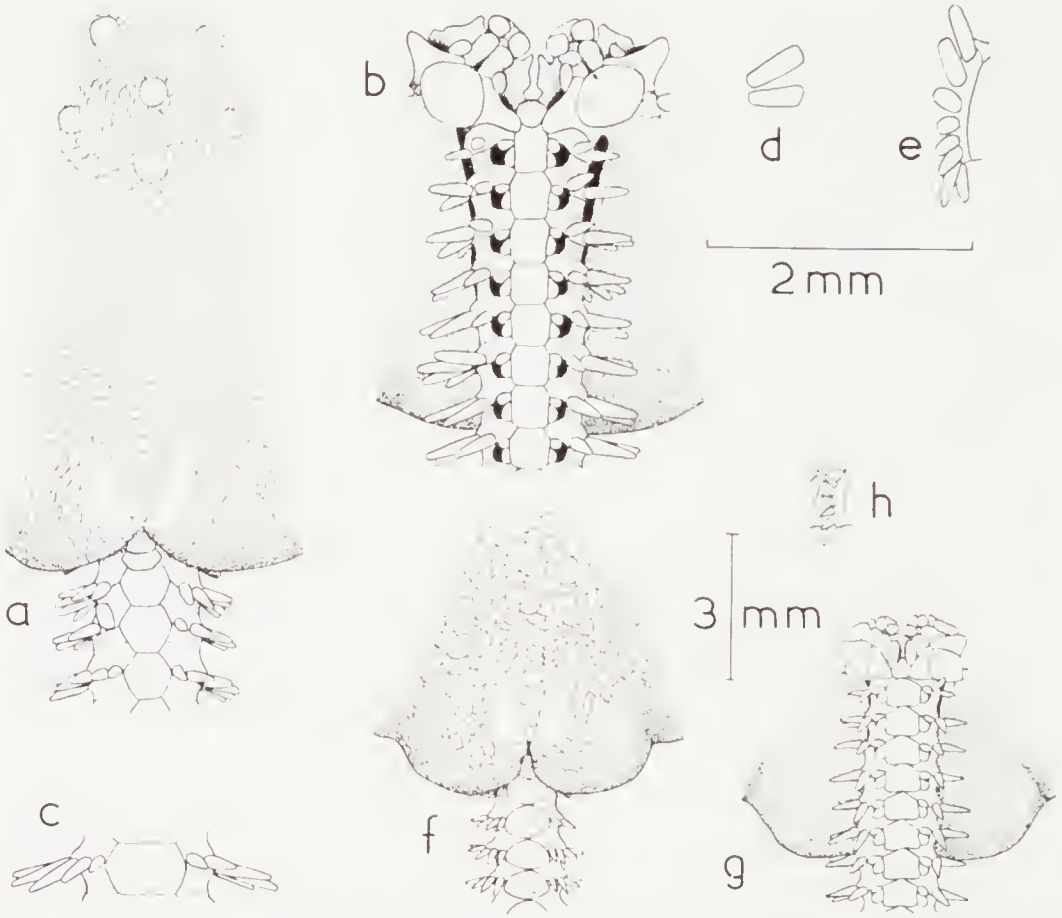

FIG. 7. **a–e** *Amphiura multiremula* holotype, disc diameter 7 mm., **a** dorsal and **b** ventral views of part of the disc and an arm base, **c** the segment with the 20th dorsal arm plate, **d** view of the two uppermost arm spines from the distal side, **e** lateral (and slightly dorsal) view of the second free arm segment, the middle spines foreshortened, **f–h** *A. dolia* paratype, Port Jackson, disc diameter c. 9 mm., **f** dorsal and **g** ventral views of part of the disc and an arm base (the oral shield on the right being the madreporite), **h** lateral view of the fourth free arm segment. (The 2 mm. scale applies to **a–e** and the 3 mm. one to **f–h**.)

There are two species of *Amphiura* with two tentacle scales known from New South Wales that have some features in common with this one, namely *A. dolia* and *A. multiremula* both of H. L. Clark, 1938. Neither of these has been properly figured and this seems to be a good opportunity

to publish drawings of a paratype of *A. dolia* and of the holotype of *A. multiremula* (fig. 7). It can be seen from these that *A. dolia* has opercular distal oral papillae like the Port Phillip form but differs in the shape of the oral shields, ventral arm plates and the absence of hooks on any of the spines, while *A multiremula* has similar ventral arm plates but spatular upper arm spines and small elongate distal oral papillae.

Amphuira (*Ophiopeltis*) *parviscutata* sp. nov.

Text–fig. 8.

MATERIAL.—Port Phillip Survey: Area 25 (299), 1 specimen (without disc); 26 (126), 3 specimens without disc; 27 (302), 1 specimen (without disc); 39 (312), 2 specimens complete one without disc; 55 (147), one complete specimen (Holotype National Museum No. H 17).

DESCRIPTION of the Holotype.—The disc diameter is about 4 mm. but it has probably shrunk since all the arms are pulled upwards basally and their exposed basal segments have their dorsal arm plates reduced or even absent. In life the diameter was probably about 5 mm. The arms are coiled up in a tangle and it is impossible to give an accurate estimate of their length; it was probably at least 20 times the disc diameter.

The disc is covered with very thin and completely transparent skin so that the underlying organs can be clearly seen. The radial shields are long and narrow, nearly 1 mm. long but only a fifth or a sixth as wide. Their sides are almost parallel and the two shields of each pair are in contact for most of their length. (This might be attributable to the shrinkage of the skin, but they were probably parallel in life, if not in actual contact.) There may be a very few fine scales proximal to the shields where the skin becomes slightly opaque when the specimen is half dried. On the ventral side the disc is equally transparent and the only scales are single rows along the edges of the genital slits. The skin is carried from the disc on to the oral plates so that the oral shields, except the one which is modified as the madreporite, are concealed in the skin and only become visible when the specimen is allowed to dry somewhat. Even so, one interradius completely lacks the oral shield and in the three others the shield is very small, not in contact with the widely separated triangular adoral shields which lie on each side of it. These three oral shields are about twice as wide as long. At the inner (interradial) tip of each adoral shield is a small conical distal oral papilla, about two or three times as long as wide; most of these papillae have been damaged. The infra-dental papillae and oral tentacle-scales are as usual, the latter are at a slightly higher level and have blunt tips.

The proximal dorsal arm plates are about as long as wide, widest in the middle of their length, with a proximal angle and a deep distal curve. Further out on the arm the widest part of the plate is nearer the proximal end and the proximal angle is nearly 180°. The widest plates have the length: breadth ratio 1 : 1·15. The successive plates are mostly just in contact. The ventral arm plates are pentagonal, slightly longer than wide and the proximal angle of each one just touches the distal side of the preceding plate (at least in the proximal part of the arm). The lateral arm plates bear four arm spines each side, of which the two uppermost and the lowest one taper to a point, while the second from lowest develops a conspicuous, flattened, bihamulate or axe-headed tip on the segments beyond the base of the arm.

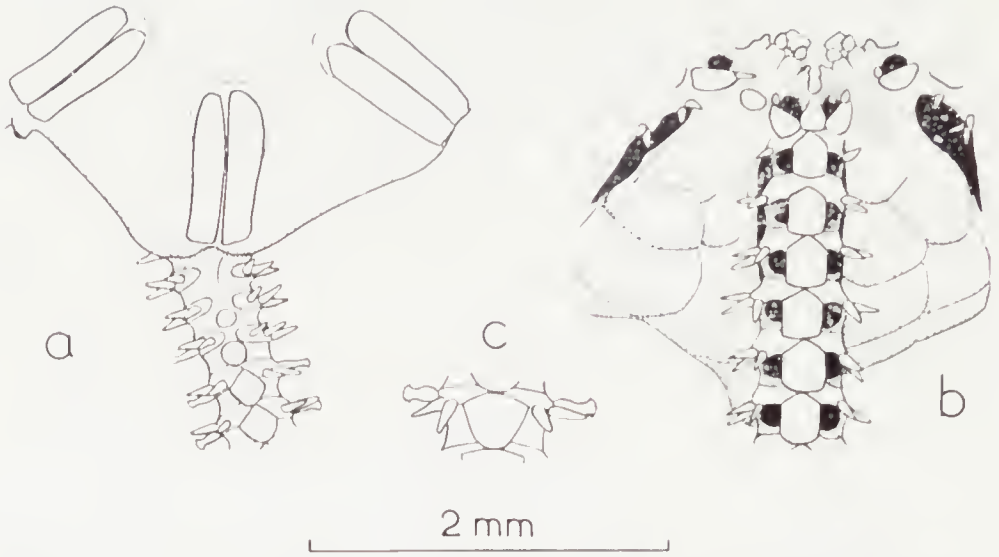

FIG. 8. *Amphiura* (*Ophiopeltis*) *parviscutata* holotype, disc diameter 3–4 mm., **a** dorsal and **b** ventral views of part of the disc and an arm base, **c** dorsal view of an arm segment, approximately the 45th.

The disc-less specimens are similar to the type in their mouth parts and arm plates, the oral shields being particularly small and either isolated or only just bridging the gap between the adoral shields; odd oral shields may be lacking altogether; the bihamulate arm spine is present in all of them.

AFFINITIES.—In trying too identify these specimens I thought at one time that they might be conspecific with *Ophiolepis perplexa* Stimpson, 1855. That species was referred to *Amphiura* by Lyman, 1882 and to *Ophionephthys* by H. L. Clark, 1946, while Fell, 1962, refers it to his new genus *Icalia* since its mouth parts differ from those of the West Indian type species of *Ophionephthys*, *O. limicola* Lütken. Also the dorsal side of the disc is described as covered with fine scales and its radial shields are inwardly divergent. Stimpson makes no mention of any of the five arm spines being other than pointed. The type locality of *perplexa* is Port Jackson and I can find no published records for it since the original one.

There is no doubt that *parviscutata* is very closely related to the North Atlantic species *Ophiopeltis securigera* Düben and Koren, 1845, the type species of the genus *Ophiopeltis* so long submerged in *Amphiura* but recently revived by Fell. Both species have the radial shields bar-like with only a suggestion of scaling proximal to them, the disc otherwise completely naked, the adoral shields separated, the second from lowest arm spine bihamulate, the number of spines proximally four and the arms extremely long. The only difference seems to be that the oral shields of the Port Phillip species are more reduced than those of *securigera*.

Other species which are related to *parvisculata* are *Ophionema hexactis* Mortensen and *Ophionephthys iranica* Mortensen (both from the Persian Gulf), also *Ophionephthys tenuis* H. L. Clark from north-west Australia. Of these, *O. iranica* was referred to *Ophiopeltis* by Fell and *O. tenuis* to

Ophionema, although Mortensen stated (after studying a syntype of *O. tenuis*) that the two species are closely related to one another. Since Mortensen commented that in one specimen of *iranica* the second spine is 'thorny or axe-shaped as in typical *tenuis*', it seems that both species approach *parviscutata* in this character and all three should be considered as congeneric. However, *parviscutata* is still distinguished by its reduced oral shields.

As for the generic position of this species, I believe that Fell's subdivisions of *Amphiura* are not sufficiently distinct from each other or natural in their limits to rank as genera, though some of the species he has referred to *Ophiopeltis* do form a natural group. However, the existence of intermediate species such as *Amphiura borealis* Sars suggests that this group should be ranked no higher than a subgenus. I must protest against Fell's assumption that subgenera are only a stage in time on the way to consideration as genera. The progress of taxonomic thought may also go in the opposite direction on occasion, reducing nominal genera to subgenera or even synonyms of others. Accordingly, I give this new species the trinomial *Amphiura* (*Ophiopeltis*) *parviscutata*.

Ophiocentrus pilosus (Lyman).

Pl. IV., figs. 1–3.

Ophiocnida pilosa Lyman, 1879, p. 32, pl. 12, figs. 341 343; 1882, pp. 153–154, pl. 19, figs. 7–9; H. L. Clark, 1909, pp. 541–542.

Ophiocentrus pilosus Gislén, 1926, p. 13; H. L. Clark, 1938, p. 237; 1946, pp. 199–200.

MATERIAL.—Port Phillip Survey: Areas 26, (126), 8 specimens; 27 (45) 1 specimen; 29 (289) 2 specimens, 38 (311) 2 specimens; 39 (312) 1 specimen; 68 (220) 1 specimen.

The holotype of *O. pilosus* from Bass Strait is in the British Museum. It has the disc only 5·2 mm. in diameter. Lyman gives the number of arm spines as five but in fact there are six spines on each side of the first three to five segments. The smallest specimen collected by the Survey has the disc 7 mm. in diameter and the proximal arm segments have seven spines each side, which might be expected at this size. The largest specimen has the disc diameter 17 mm. and the arms at least 140 mm. long; it has ten spines proximally. Although in the holotype the disc scales are mostly distinct even when wet, in all these specimens the scales are obscured by skin, which is thickest and most nearly opaque in the larger specimens. Even in these, there is a wrinkling of the skin which may give the impression of fine scaling and possibly does correspond to the underlying scales.

In 1926 Gislén split off as *Ophiocentrus novaezelandiae* the specimens from New Zealand (and provisionally also those from New South Wales) which were described under the name of *Amphiocnida pilosa* by Mortensen in 1925 (pp 154–157). In the British Museum collections, apart from the very small specimen with disc diameter only 2 mm. collected by the 'Discovery' Investigations in New Zealand waters, there is only a single arm of a specimen of *O. novaezelandiae* from Cook Strait. This is comparable in size to the arms of the largest Port Phillip specimen but differs in having the arm plates relatively a little wider and the spines

(which number only eight proximally) relatively longer, all but the two uppermost being longer than the segment; the spines are also distinctly spatulate in shape. The widest ventral arm plates are 0·8 mm. long and 1·0 mm. wide; the corresponding dorsal arm plates are 0·8 mm. long and 1·3 mm. wide; the longest arm spines (the *two* lowest ones) are both about 1·3 mm. long. In the largest specimen of *O. pilosus* the ventral arm plates are barely wider than long, the length being 0·7 mm. and the width 0·85 mm.; the dorsal arm plates are 0·7 mm. long and 1·0 mm. wide and the lowest arm spine is c. 0·95 mm. long, the next spine being appreciably shorter, so that only the lowest spine is distinctly longer than the segment.

Mortensen showed how variable his specimens were with regard to the form and proportions of the arm plates (though this was to some extent probably correlated with size) and of the oral shields. Gislén distinguished *O. novaezelandiae* by the large size and distinctness of the disc scaling and the supposedly larger number of arm spines than in *O. pilosus*. Since the disc scales are also distinct in the type specimen of *O. pilosus* and their distinctness may be due to the state of preservation and since the number of arm spines varies with size, neither character seems reliable. Possibly the relatively longer spines and the similarity between the lowest spine and those immediately above it, as well as the relatively greater width of the dorsal and ventral arm plates, may prove to be sufficiently constant to justify the retention of a New Zealand species.

Another species of *Ophiocentrus*, *O. fragilis* H. L. Clark, 1938, also has its type locality in south-east Australia. It is known only from the holotype which was taken off New South Wales and in which the disc diameter was 5 mm. This was supposed by Dr. Clark to differ from *O. pilosus* by having the disc scales relatively large and obscured only by their spinelets, not by skin, also in having the second from lowest arm spine bihamulate. However, in contradiction to H. L. Clark's key, the second from the lowest (and to a lesser extent the following) spines of *O. pilosus* are distinctly square-tipped and some of them might be described as bihamulate. The slightly oblique flattening of the arm spines causes them to appear slender and tapering when viewed at certain angles. Another feature supposedly characteristic of *O. fragilis* is the transparency and microscopically pitted texture of the dorsal arm plates, but this is common to most species of *Ophiocentrus*, including *O. pilosus*, the plates being delicate especially in smaller specimens. [I suspect that this same transparency of the plates showing a dark mid-radial line may account for the allegedly keeled condition of the plates described by Brock in *O. alboviridis*.] However, *O. fragilis* may be marked off by the enlargement of the uppermost arm spine as well as the lowermost and by the relatively longer radial shields, which were six times as long as wide in the holotype, whereas in *O. pilosus* they are usually about four times as long as wide (even shorter in the type specimen).

Some other characters used in H. L. Clark's key to the Australian species of *Ophiocentrus* are incorrect. Firstly, he distinguished *O. dilatatus* from *pilosus* and *asper* by the widening of its arms beyond the base. In the larger Port Phillip specimens of *O. pilosus* the arm spines, if not the arms themselves, have a wider span some way beyond the base of the arm. The largest specimen has the span of arm and spines (extending at right angles) 3·2 mm. basally but 4·2 mm. at a distance of 30 mm. from the

disc. Also the dorsal arm plates are *not* longer than wide (except on the basal segments) in *Ophiocentrus verticillatus*, as can be seen from Döderlein's photograph of the holotype (1896, *in* Semon, Zool. Forsch. Aust. und Malay, Archip., Ophiuroidea, pl. 15, fig. 7).

Some of the characters used in Gislén's key of 1926 are also misleading. Certain features, such as the number of arm spines and the relative width of the arm plates, are influenced by size. On some other points he is mistaken. The dorsal arm plates are only longer than broad on the *basal* segments in *O. asper*, further out they become broader than long; the separation of the radial shields in *O. vexator* is almost certainly due to poor preservation and the flattening of the disc spinelets is not peculiar to the unique holotype of *O. putnami*, but can also be seen in similarly large specimens of *O. pilosus*.

One other species of *Ophiocentrus* has been recorded from south-east Australia; this is *O. asper* (Koehler), which Koehler himself recorded in 1930 from a single specimen taken off Cape Howe, at the same time giving many East Indian stations, without commenting on the specimen itself or the extension of range from the East Indian area that it provided. As H. L. Clark suggested in 1946, this identification may have been a mistake for *O. pilosus*, from which *O. asper* is not very sharply distinguished.

The entire genus *Ophiocentrus* is badly in need of revision. So little account has been taken of variation and growth changes in most of the characters used to distinguish the species that several of the names adopted must prove to be synonyms. The 'Challenger' specimen from station 212 in the Philippines is certainly conspecific with *Ophiocentrus inequalis* (H. L. Clark), 1915, rather than with *O. pilosus*. The type locality of *O. inequalis* was Hong Kong; the holotype, which I have examined and drawn, is in the Museum of Comparative Zoology. The British Museum collection also includes two specimens from Macclesfield Bank in the South China Sea which can be referred to this species At present the following East Indian species of *Ophiocentrus* are recognized:—*aculeatus* Ljungman, 1867, *putnami* (Lyman), 1871, *alboviridis* (Brock), 1888, *verticillatus* (Döderlein), 1896, *asper* (Koehler), 1905, *dilatatus* (Koehler), 1905, *inequalis* (H. L. Clark), 1915, *vexator* Koehler, 1922, and *koehleri* Gislén, 1926, however I doubt whether all these are valid.

ECHINOIDEA.

KEY TO THE ECHINOIDS OF THE EAST FLINDERSIAN REGION

(derived partly from Mortensen's monograph.)

1. (32) 'Regular' radially symmetrical echinoids with ambitus circular and anus and mouth in the centres of the upper and lower sides.

2. (5) Primary spines few and very large; their surfaces skin-less and roughened; secondary spines much smaller, forming rings around the primaries and rows up the ambulacra; peristome covered with plates.

3. (4) Surface of primary spines usually irregular, with tubercles or thorns, the tips of the spines often flared; apical system rather large, its diameter a third to half the total horizontal diameter; usually some or all ocular plates insert (i.e., contacting the periproct between the genital plates). . . . . *Goniocidaris tubaria* f. *impressa* Koehler, 1926.

4. (3) Surface of primary spines uniformly granular, their tips rounded; apical system smaller, less than a third the horizontal diameter; oculars all widely exsert (separated from the periproct by the contiguous adjacent genital plates). *Phyllacanthus irregularis* Mortensen, 1928.

5. (2) Primary spines numerous, neither conspicuously large and isolated nor markedly different from the secondary spines; peristome covered with skin.

6. (29) Ambulacral plates trigeminate, each compound one with three pairs of pores, the pore-pairs arranged either in arcs of three, a vertical row or irregularly.

7. (8) Primary tubercles distinctly crenulate (i.e. with a ring of small knobs around the boss); conspicuous pits between the angles of the plates; test low and hemispherical. . *Temnopleurus michaelseni* (Döderlein), 1914.

8. (7) Primary tubercles hardly, if at all, crenulate; no angular pits but sometimes small hollows or pores present test usually high and more or less globular.

9. (26) All the ambulacral plates with a primary tubercle.

10. (17) Sutures of the interambulacral plates bordered by more or less bare areas.

11. (12) Ambulacral plates numerous, more than 25 in each series, when the horizontal diameter is only 12·5 mm. (as in the unique type); edges of the plates white. . . *Microcyphus pulchellus* H. L. Clark, 1928.

12. (11) Ambulacral plates fewer, less than twenty at this size; edges of plates not white.

13. (14) Peristome smaller than the apical system; arm spines each with a broad red band. . . . . *Microcyphus annulatus* Mortensen, 1904.

14. (13) Peristome larger than the apical system; spines not banded.

15. (16) Bare interambulacral areas dark. *Microcyphus zigzag* L. Agassiz *in* Agassiz & Désor, 1846.

16. (15) Bare interambulacral areas rose red. *Microcyphus compsus* H. L. Clark, 1912.

17. (10) No bare patches along the interambulacral sutures.

18. (23) Tubercles and their accompanying spines present on the plates of the periproct.

19. (20) Pore arcs very sloping, so that the pores also form three vertical series. *Amblypneustes pachistus* H. L. Clark, 1912.

20. (19) Pore arcs not very oblique, so that vertical series are not obvious.

21. (22) Test globular, not patterned with radiating stripes *Amblypneustes ovum* (Lamarck), 1816.

22. (21) Test low, hemispherical, striped. *Amblypneustes grandis* H. L. Clark, 1912.

23. (18) Plates of the periproct bare.

24. (25) Secondary spines reddish, a dark brownish spot below each primary tubercle. *Amblypneustes formosus* Valenciennes, 1846.

25. (24) Secondary spines greenish or whitish; no brown spots on test *Amblypneustes pallidus* (Lamarck), 1816.

26. (9) A primary tubercle only on every second or third ambulacral plate.

27. (28) Ambulacra distinctly wider than the interambulacra; pore zones comprising two dense vertical marginal series of pore-pairs with irregularly placed pore-pairs between. *Holopneustes porosissimus* L. Agassiz *in* Agassiz & Désor, 1846.

28. (27) Ambulacra not wider than the interambulacra; pore pairs forming three regular vertical series. . . *Holopneustes inflatus* Lütken *in* A. Agassiz, 1872.

29. (6) Ambulacral plates polyporous, with arcs of four or more pairs of pores.

30. (31) Four or five pore-pairs in each arc. *Pachycentrotus australiae* (Michelin *in* A. Agassiz), 1872.

31. (30) Seven or eight (rarely nine) pore pairs in each arc. *Heliocidaris erythrogramma* (Valenciennes), 1846.

32. (1) Irregular echinoids, with some degree of bilateral symmetry, the ambitus more or less oval, the anus always and the mouth sometimes excentric.

33. (46) Mouth more or less central (not shifted anteriorly); peristome circular; test more or less flattened; petaloid areas on the upper side flat or slightly convex, never sunken.

34. (41) Size moderate to large, length usually well over 20 mm.; test more or less discoidal or conical, with a marginal area which is either thin and sharp at the edge or at least lower than the central part if the edge is thicker and more rounded; pore areas of the upper side forming very distinct petals.

35. (40) Petals wide open distally miliary spines of the upper surface simply rugose, not ending in a flared crown.

36. (37) Five genital pores; the pore series of the paired petals incurved distally; test high conical, with a fairly thick margin
Clypeaster australasiae (Gray), 1851.

37. (36) Four genital pores; paired petals wide open distally; test low, discoidal.

38. (39) Test nearly circular; anterior petal nearly twice as long as wide
Ammotrophus cyclius H. L. Clark, 1928.

39. (38) Test distinctly wider than long; anterior petal short, less than half again as long as wide .. .. *Ammotrophus platyterus* H. L. Clark, 1928.

40. (35) Petals tapering and closed distally miliary spines of the upper side smooth but ending in a flared crown .. .. *Peronella peroni* (L. Agassiz), 1841.

41. (34) Size small, length not exceeding 20 mm. and usually less than 10 mm.; test "bun-shaped" with a thick rounded margin and the centre hardly, if at all, higher; petals not well-developed, but indistinct.

42. (43) Test low flattened, length over four times the height; internal radiating partitions present .. .. *Echinocyamus platytatus* H. L. Clark, 1914.

43. (42) Test higher, ovate, less than three times as long as high; no internal partitions.

44. (45) Test ovoid, length less than twice the height *Fibularia ovulum* Lamarck, 1816*.

45. (44) Test flatter, between two and three times as long as high
Fibularia plateia H. L. Clark, 1928.

46. (33) Mouth more or less anterior, never central, though still on the under side of the test; peristome crescentic or semicircular; test ovoid, never very flattened; petals usually more or less sunken, at least the paired ones.

47. (56) A peripetalous fasciole present (i.e a distinct belt of crowded, fine, ciliated spinelets running around the whole petaloid area on the upper side of the test).

48. (53) A latero-anal fasciole (leading back from the peripetalous one on each side and running below the anus) present.

49. (50) Four genital pores .. .. .. *Protenaster australis* (Gray), 1851.

50. (49) Two genital pores.

51. (52) A distinct hollow below the anus on the posterior side of the test
Moira lethe Mortensen, 1930†.

52 (51) No pronounced hollow posteriorly. *Moira stygia* Lütken in A. Agassiz, 1872†.

53. (48) No latero-anal fasciole, only a closed sub-anal fasciole in addition to but quite unconnected with the peripetalous one.

54. (55) Paired petals sunken; peripetalous fasciole indented more or less between the petals .. .. .. *Brissus meridionalis* Mortensen, 1950**.

55. (54) Paired petals not at all sunken but flush with the rest of the test; peripetalous fasciole oval, not indented between the petals
Eupatagus valenciennesi L. Agassiz *in* Agassiz & Désor, 1847.

56. (47) No peripetalous fasciole present but only an inner one, looping around the anterior petal and the apical system only
Echinocardium cordatum (Pennant), 1777.

* Mortensen (1948) has shown that *Echinocyamus craniolaris* Leske, 1778, which name was used for this species by H. L. Clark, is a synonym of *E. pusillus* (O. F. Müller), 1776; the proper name for this Indo-Pacific species is therefore *Fibularia ovulum* Lamarck.

† Mortensen (1951) points out that the specimens recorded as *M. stygia* by H. L. Clark are really referable to *M. lethe* but he has himself seen a specimen from Port Elliot, South Australia, which is more like, if not identical with, *M. stygia*

** Mortensen (1951) doubts the occurrence in the south of Australia of *Brissus latecarinatus* to which species H. L. Clark referred a number of Australian specimens. Re-examination of a specimen in the British Museum from Adelaide and two others from the vicinity of Fremantle, Western Australia, all formerly named *latecarinatus*, showed that these have the test vertical posterily and should be referred to *meridionalis*.

HOLOTHURIOIDEA.

Owing to the incomplete descriptions made by Joshua (1914) and Joshua and Creed (1915), there has been uncertainty about the identities and affinities of some of the holothurian species that are found in Victorian and South Australian waters. A recent paper by Hickman (1962) on Tasmanian holothurians helps to relieve the situation, since he gives descriptions, figures and photographs of a number of the species.

The following key was prepared before seeing Hickman's paper. His key does include most of the species found in Port Phillip but also introduces several new species (*Psolidium ravum*, *Psolidiella adhaerens* and *Paracaudina luticola* as well as a new genus and species *Neoamphicyclus lividus*), all from Tasmania. However, it excludes some of the South Australian species which I had given a place in my key in case their ranges should prove to extend further east. Because of this exclusion and for the sake of completeness I think it is worth while to retain my key to supplement Professor Hickman's.

The only novelty to the Australian fauna list, introduced here is the Cucumariid genus *Stereoderma* which is represented by some diminutive specimens from Port Phillip.

KEY TO THE HOLOTHURIANS OF THE EAST FLINDERSIAN REGION.

1. (28) Tube feet present, either scattered or arranged in rows along the radii.

2. (7) Tentacles relatively small and peltate (i.e. with the stalk ending abruptly in numerous branches lying in a single plane making an oval- or shield-shape); size often very large, length exceeding 100 mm.; tube feet always irregular in arrangement.

3. (6) Deposits in the body wall not including buttons, but only tables, possibly also C-shaped spicules and small rosettes.

4. (5) Tables regular with large, smooth-edged discs and regular spires (or legs); no C-shaped spicules . . . . . *Stichopus mollis* (Hutton), 1872.

5. (4) Tables irregular, edges of discs rough or spinous and spires uneven; C-shaped spicules present . . . . . *Stichopus ludwigi* Erwe, 1913.

6. (3) Deposits also include buttons with three or more pairs of holes *Holothuria hartmeyeri* Erwe, 1913.

7. (2) Tentacles relatively large and bush-like with irregular branching, capable of being wholly retracted within the body wall together with the thin-walled introvert; mostly small species much less than 100 mm. long, though with a few exceptions; tube feet often limited to the radii.

8. (17) Tentacles 20 or 25, at least ten of them smaller than the others.

9. (14) Tentacles 20, five pairs of large ones alternating with five pairs of small; few, if any, spicules in the body wall, only some tables in the introvert.

10. (11) Calcareous ring with a very long cylindrical part made up of a mosaic of small plates and longer than or equalling in length the slender posterior prolongations . . *Neothyonidium dearmatum* (Dendy & Hindle), 1907.

11. (10) Calcareous ring short with few pieces and no long cylindrical portion, the posterior prolongations short and tapering.

12. (13) Tube feet similarly developed and evenly distributed all over the body wall *Lipotrapeza vestiens* (Joshua), 1914.

13. (12) Tube feet larger and more concentrated on the under side *Lipotrapeza ventripes* (Joshua & Creed), 1915.

14. (9) Tentacles 25.

15. (16) Three-legged tables present in the body wall
Cucumella mutans (Joshua), 1914.

16. (15) Few if any tables in the body wall, though some do occur in the introvert, but these have only two legs in the spire
Amphicyclus mortenseni Heding & Panning, 1954*.

17. (8) Tentacles ten, no more than two of them smaller than the others.

18. (19) Body with a well-developed ventral sole
Psolidium sp., see Joshua, 1914 and Hickman, 1962.

19. (18) No well-defined sole.

20. (23) Body wall almost rigid (at least in preserved specimens) with masses of knobbed perforated plates of varying sizes.

21. (22) Body quadrangular in cross-section; the smaller perforated plates fairly regular in shape; deposits also include baskets
Pentacta australis (Ludwig), 1875†

22. (21) Body not obviously quadrangular: perforated plates of varying sizes, the smaller ones more or less irregular in shape; no baskets .. *Stereoderma* sp.

23. (20) Body wall pliable; deposits comparitively rare, consisting of cruciform plates, rosettes, rods or tables, not knobbed buttons.

24. (27) Deposits cruciform plates, very small rosettes and sometimes also rods.

25. (26) Tube feet more or less concentrated along the radii; no vertical thorns near the corners of the cruciform plates; rods usually present also.
Staurothyone inconspicua (Bell), 1887.

26. (25) Tube feet not concentrated along the radii; thorns present near the corners of the cruciform plates, no rods. *Staurothyone vercoi* (Joshua & Creed), 1915.

27. (24) No cruciform plates in the body wall, only tables with a two-legged spire.
Thyone nigra (Joshua & Creed), 1915.

28. (1) No tube feet present.

29. (30) Size often very large, length often over 100 mm., body tapering at the ends; body wall thick and opaque, with simple curved rods deep in it and usually perforated plates with knobs nearer the surface.
Paracaudina australis (Semper), 1868.

30. (29) Size usually small, (except *Chiridota gigas*), body worm-like; body wall thin and sometimes semi-transparent, with anchors and anchor plates or else wheels and S-shaped bodies.

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* Joshua and Creed (1915) recorded as *Pseudocucumis bicolumnatus* Dendy and Hindle (otherwise known from New Zealand) a specimen belonging to the South Australian Museum collected by Verco. Heding and Panning refer *bicolumnatus* to the synonymy of *Amphicyclus thomsoni* (Hutton), another New Zealand species, although the type specimen of *bicolumnatus* differed in having numerous two-legged tables in the body wall and was described as probably having 20 (rather than 25) tentacles. Accordingly Pawson (1962) has erected a new genus *Neocucumella* for type species *Pseudocucumis bicolumnatus*, which he considers to be valid and distinct from *Amphicyclus thomsoni*. It is possible that "*Cucumaria*" *striata* Joshua and Creed, from the Great Australian Bight, may also run down to this part of the key. It has tables in the body wall and so cannot be included in the Cucumariinae but might be referred either to the Thyoninae or to *Havelockia* (with synonym *Pentathyone* H. L. Clark) in the Sclerodactylinae (both sub-families of the Cucumariidae), or else to the Phyllophoridae should it prove to have more than ten tentacles. Membership of the Thyoninae is unlikely since Joshua and Creed noted that the calcareous ring is "of the usual generic configuration" (for *Cucumaria*, though sensu lato) and so presumably not like that of *Thyone* with its mosaic of plates and long posterior prolongations. The tables of "*Cucumaria*" *striata* have very tall, two-legged spires, something like those of *Mensamaria intercedens* from Malaysia and southern China.

†Cherbonnier (1952) has shown that *australis* is synonymous with the long-forgotten *Holothuria pentagona* Quoy & Gaimard, 1833. However, a proposition has been made to the International Commission on Zoological Nomenclature that the name *pentagona*, among some others of Quoy and Gaimard, should be placed on the Official List of Rejected Names, to avoid further upset in the accustomed nomenclature. Another species which might run down here is the one that H. L. Clark (1946, p. 389) called *Cucumaria squamatoides* nom. nov. This name is a *nomen nudum* since it was based by H. L. Clark on a specimen from Encounter Bay, South Australia, which he had never seen, which had never been described or figured and about which Joshua and Creed, who named it *Cucumaria squamata* Ludwig, only said (1915, p. 17) that it is "quite in accord with Ludwig's description, both as to pedicel distribution and spiculation." The type locality of *C. squamata* was Kerguelen in the Southern Ocean and H. L. Clark quotes Deichmann (MS), who says that "one can be almost positive" that the name *squamata* was incorrect. I quite agree with this supposition judging from the geographical distribution of other echinoderms found at Kerguelen, but there is still insufficient foundation to satisfy article 13 of the International Code on Zoological Nomenclature, since *squamatoides* is a replacement name not for the Kerguelen species *squamata* but only for the specimen presumed to be incorrectly so-named by Joshua and Creed. Until this specimen has been properly described, adequately figured and compared with related species it cannot be given a new name. *Cucumaria squamata* has large smooth perforated plates and baskets in the body wall and so presumably has this Australian specimen.

31. (34) Deposits anchors with anchor plates; tentacles normally twelve in number, pinnate in form.

32. (33) Anchor plates pear-shaped, with rounded lateral angles
Leptosynapta dolabrifera (Stimpson), 1855.

33. (32) Anchor plates kite-shaped, the sides diverging evenly from the narrow end (i.e., that with the bridge for articulation with the anchor) out to distinct lateral angles. .. .. *Leptosynapta ictinodes* (H. L. Clark), 1924.

34. (31) Deposits wheels (sometimes localized in papillae) and sometimes also S-shaped bodies; tentacles ten or twelve in number, peltato-digitate in form, without a long median rachis.

35. (36) Twelve tentacles; no S-shaped bodies; size up to 500 mm. in life (much contracted when preserved). .. *Chiridota gigas* (Dendy & Hindle), 1907.

36. (35) Ten tentacles; S-shaped bodies present.

37. (38) Teeth on the inside edge of the rim of the wheels arranged in groups interrupted mid-way between the spokes; tentacles with 8–10 digits.
Trochodota allani (Joshua), 1912.

38. (37) Teeth evenly spaced around the inside edge of the rim of the wheels; tentacles with four digits. . . . . *Trochodota roebucki* (Joshua), 1914.

Stereoderma.

This genus was established by Ayres, 1851, (Proc. Boston Soc. Nat. Hist., 4) for the species *Anaperus unisemita* Stimpson, 1851, from the Grand Banks, Newfoundland. That species (according to Deichmann, 1930, Bull. Mus. comp. Zool Harvard, 71, p. 171) has the tube feet limited to the radii only on the mid-ventral radius, which is bordered on each side by smooth areas; laterally and dorsally the feet are uniformly scattered. The calcareous ring has no posterior prolongations. The deposits in the body wall are four-holed buttons of varying size with their surfaces either smooth or more or less knobbed, often more knobbly in one part than another. There is no end plate in the tube feet, but buttons and rods are present.

Stereoderma sp.

Text fig. 9.

MATERIAL.—Port Phillip Survey: South Channel Fort, area 62 (37), 2 specimens.

REMARKS.—The larger specimen is only 9 mm. long. It has a fairly hard body wall in which the larger, multi-layered perforated plates are visible under a low magnification. In addition to these, there are many more or less irregular smaller plates, mostly with knobs between the perforations, usually elongated and with one end smoother than the other, what Panning, 1951, (Zool. Anz., 146, p. 75) calls fir-cone plates. There are no baskets such as occur in *Pentacta australis*. The tube feet appear to be limited to the radii, forming a zig-zag row in each radius, the bare interradial areas being narrower, at least in the preserved specimen. There are end plates in the feet, besides boomerang-shaped rods with perforations particularly at the ends and at the angle in the middle. The calcareous ring has no posterior prolongations but is narrow and undulating. The colour is pale except for the eight large and two small tentacles which are brownish. The body is probably pentagonal in cross section, in comparison with the quadrangular form of *P. australis*. Another difference from *australis* and one which gives the generic distinction, is the absence of baskets in the body wall; besides this the plates include larger and more irregular though not so markedly knobbed ones.

The species which seems to be closest geographically and morphologically to this form from Port Phillip is *Stereoderma leoninoides* (Mortensen), 1925, from the Auckland Islands south of New Zealand. According to Mortensen *S. leoninoides* has the knobbed plates all much the same size, not so variable as here. Without a proper comparison I do not propose to create a new species on the basis of these two small specimens.

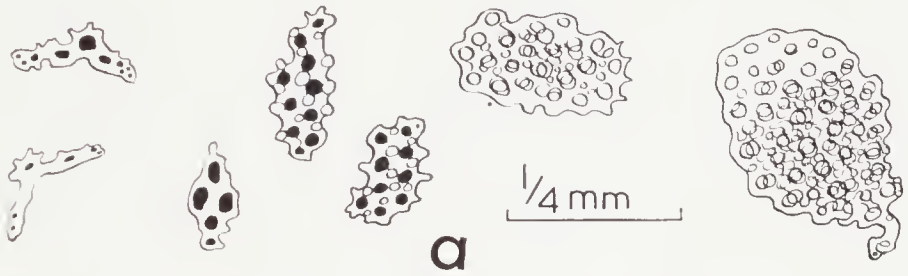

FIG. 9. a *Stereoderma* sp., Port Phillip, various spicules. (In the five smaller ones the holes are shown black but the thickness of the larger plates made this impracticable).

Pentacta australis (Ludwig).

Holothuria pentagona Quoy and Gaimard, 1833, p. 135.

Colochirus australis Ludwig, 1875, pp. 88–89, pl. 6, fig. 15.

Colochirus doliolum: Ludwig, 1887, pp. 1229–1231. [Non *Actinia doliolum* Pallas, 1766, which is a valid species of *Pentacta* from South Africa]. *C. doliolum*: Cotton and Godfrey, 1942, p. 230.

Pentacta australis: H. L. Clark, 1938, p. 445, 1946, p. 392.

Pentacta pentagona: Cherbonnier, 1952, pp. 33–35, figs. 12, 13, pl. 3, fig. 7.

NOMENCLATURE.—As the above synonymy shows, the proper name for this species is really *P. pentagona*, since Cherbonnier has declared that Quoy and Gaimard's type specimen of *pentagona* is conspecific with P. *australis* (Ludwig). However, since it is most undesirable that well-known names should be displaced by others which, since the publication recently of the International Code of Zoological Nomenclature, could be declared *nomina oblita* (not having being used for the last fifty years), a proposition is being made to the International Commission for the formal rejection of the name *Holothuria pentagona* Quoy and Gaimard (among some others of the same authors) and for the placing of *Colochirus australis* (Ludwig) on the Official List of Specific Names.

Thyone nigra Joshua and Creed.

Text fig. 10b, c.

Thyone nigra Joshua and Creed, 1915, pp. 20–21, pl. 3, figs. 3, 4; H. L. Clark, 1946, p. 401.

MATERIAL.—Port Phillip Survey: Areas 26 (300–1), 11 specimens; 27 (41), 1 specimen; (302), 1 specimen.

This seems to be only the second record of the species. The type was presumably from St. Vincent Gulf, South Australia. The tables of these specimens (fig. 10c) are irregular in shape, some of them being transitional

to the rods in the tube feet; the spires are low with only two legs. The calcareous ring is more complex than is shown in Joshua and Creed's figure, the main part being made up of a mosaic of mostly hexagonal plates though the posterior prolongations do have uniserial plates. In most of the specimens the whole ring is about 12 mm. long, approximately half this being made up by the posterior prolongations; this compares with a body length (contracted in preservation) of about 30 mm. The introvert together with the calcareous ring has become detached from the body in most cases. Normally the tentacles number ten, the two ventral ones being very reduced in size. In one specimen there are only six large tentacles and in another a dorsal tentacle is abnormally small like the ventral ones. The colour in spirit is dark purple shading to almost black on the tentacles and paling somewhat in the middle, more convex, part of the body. On some specimens a double row of tube feet can be distinguished along each radius among the other scattered feet all the feet being paler and more brownish in colour.

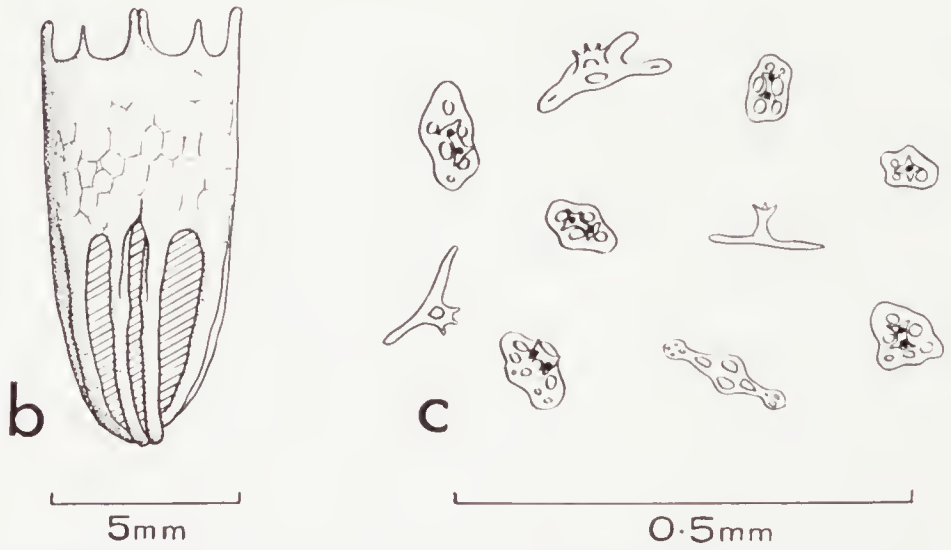

Fig. 10. b–c *Thyone nigra*, Corio Bay, Port Phillip, calcareous ring and spicules.

Cucumella mutans (Joshua)

Cucumaria mutan Joshua, 1914, p. 4, pl. 1, figs. 1a–d; Joshua and Creed, 1915, p. 18.

Cucumella mutans: Heding and Panning, 1954, pp. 67–68, fig. 17; Hickman, 1962, pp. 55–56, figs. 38–45, pl. 1, fig. 4.

MATERIAL.—Port Phillip Survey: Areas: 7 (123); 11 (125); 13 (92); 24 (Mordialloc Pier), 1 specimen; 26 (300–1), 1 specimen; 27 (41), 1 specimen; 28 (285), 1 specimen; 36 (75, 77); 42 (38)', 2 specimens; 55 (39, 148); 59 (25), 3 specimens; 63 (164), 2 specimens; various specimens not examined by A.M.C.

REMARKS.—Hickman has already pointed out that this species has 25 not 20 tentacles, as surmised by Heding and Panning, nor ten as given by Joshua. The long overdue description and figures which he provides

fully justify Heding and Panning's resurrection of *mutans* from the synonymy of *Mensamaria thomsoni* (or *Amphicyclus mortenseni*), where it was relegated by H. L. Clark, 1946. The difference in the number of tentacles may justify a generic distinction of this species from *Cucumella triplex*, consistent with the practise of Heding and Panning in dealing with the other genera of the family Phyllophoridae, but until adult specimens of the latter are forthcoming to show the definite number of tentacles, such a move is premature.

Port Phillip is the type locality of the species.

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PLATE I.

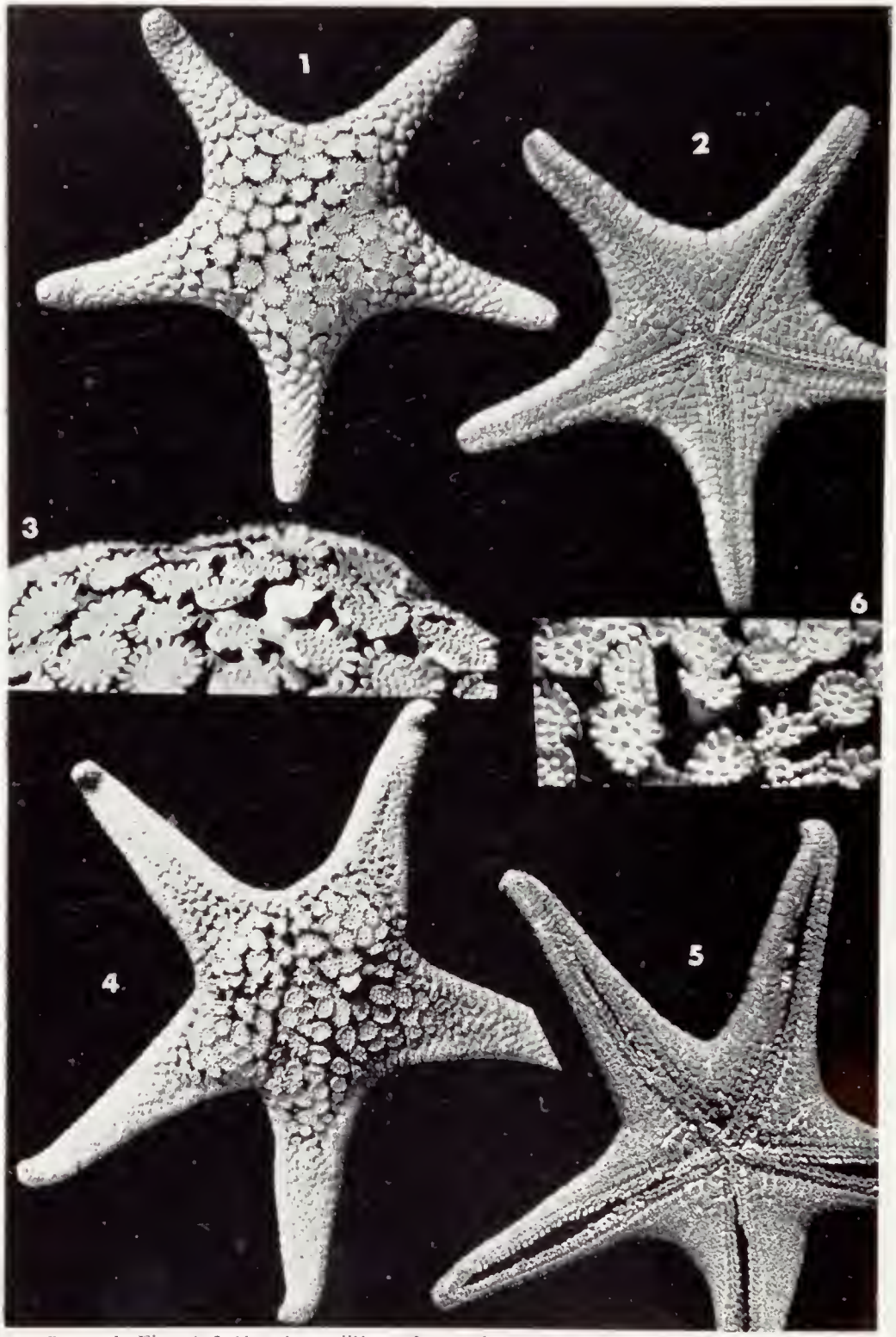

PLATE I. Figs. 1–3 *Nectria ocellifera* (Lamarck), Western Australian Museum specimen No. 362 (locality unknown), fig. 1 dorsal and fig. 2 ventral views, both x 2/3; fig. 3 detail of tabula viewed obliquely, x 2; figs. 4–6 *Nectria* cf. *ocellata*, Western Australian Museum specimen No. 19.59, Dunsborough, Western Australia, fig. 4 dorsal and fig. 5 ventral views, x 2/3, fig. 6 detail of tabula viewed obliquely, x 2.

PLATE II.

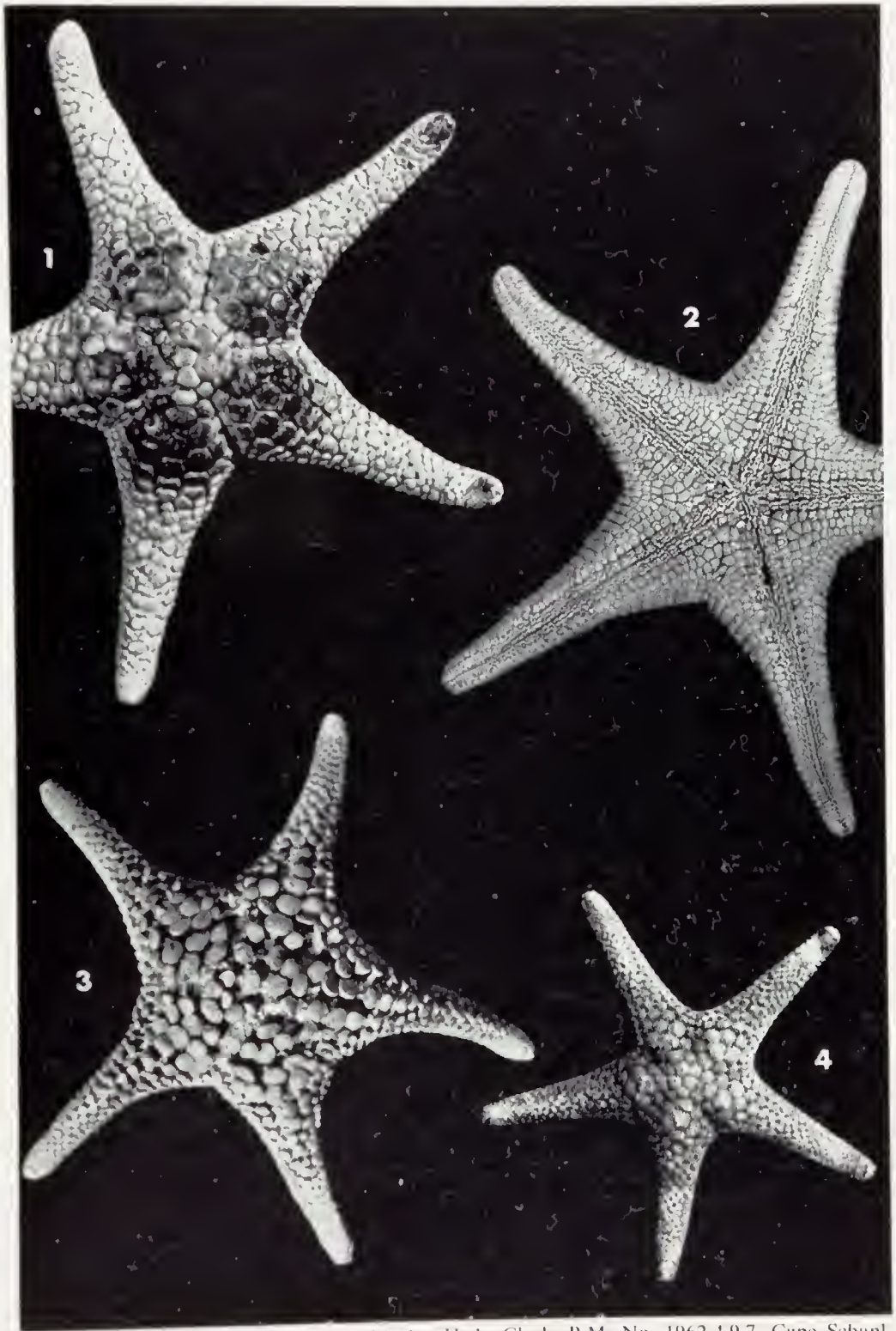

PLATE II. Figs. 1, 2 *Nectria multispina* H. L. Clark, B.M. No. 1962.4.9.7, Cape Schank, Victoria, fig. 1 dorsal and fig. 2 ventral views, x 2/3 ; fig. 3 *N. ocellata* Perrier, B.M. No. 1958.7.30.20, Tasmania, dorsal view, x 2/3 ; fig. 4 *N. ocellata* intermediate with *multispina*, B.M. No. 62.1.8.10, Tasmania, dorsal view, x 2/3.

PLATE III

PLATE III. Fig. 1 *Austrofromia polypora* (H. L. Clark), B.M. No. 85.11.19.69, Port Phillip Heads, dorsal view, x 2·3; figs. 2, 3 *Nectria macrobrachia* H. L. Clark, B.M. No. 1958.7.30.19, Port Phillip, fig. 2 dorsal view, x 2·3, fig. 3 a denuded arm and part of the disc in dorsal view, x 2; figs. 4–6 *Nepanthia hadracantha* sp. nov., holotype, National Museum of Victoria, No. H14, fig. 4 dorsal and fig. 5 ventral views, x 2·3, fig. 6 detail of part of disc and two arm bases (one denuded), x 2.

PLATE IV.

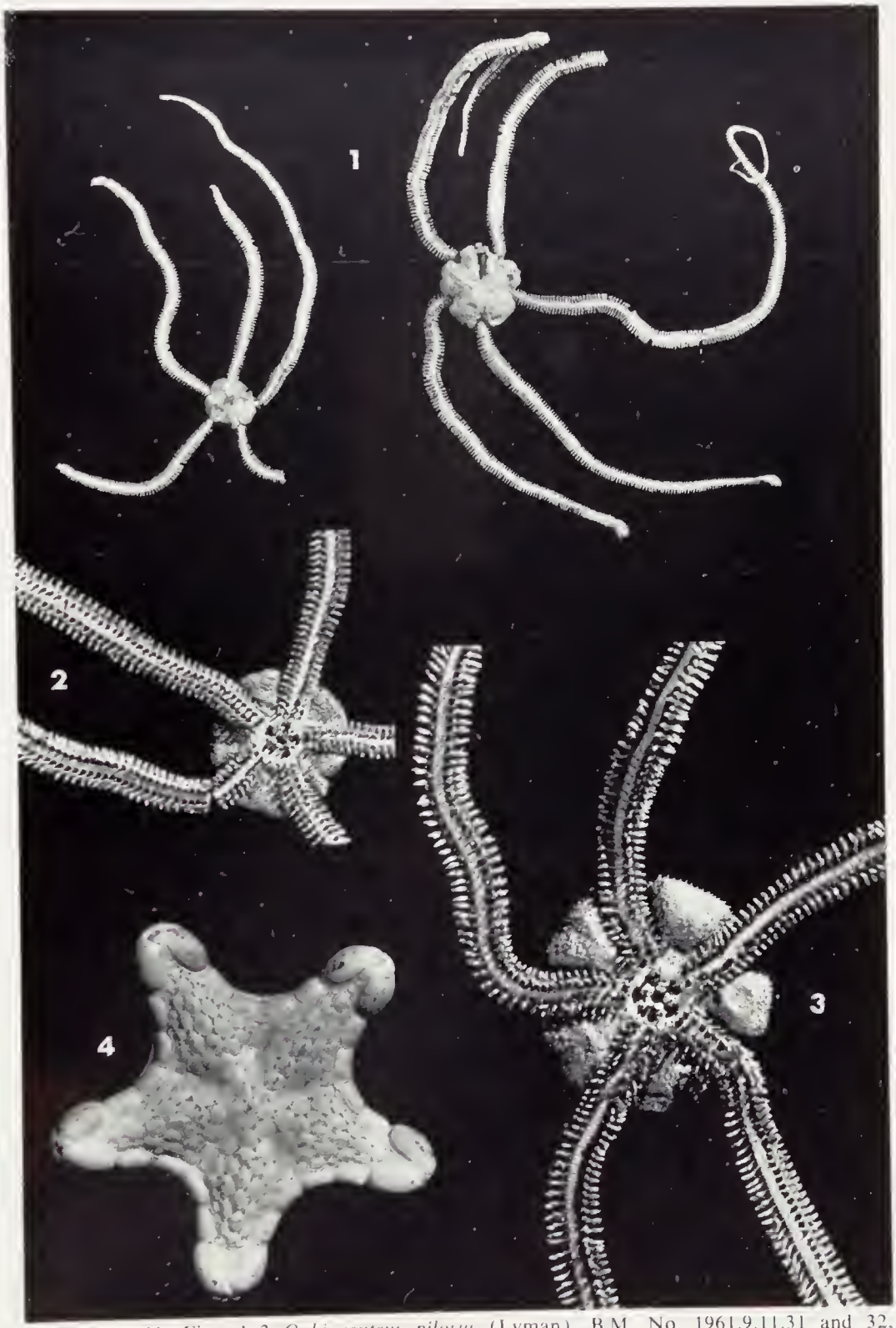

PLATE IV. Figs. 1–3 *Ophiocentrus pilosus* (Lyman), B.M. No. 1961.9.11.31 and 32, Corio Bay, Port Phillip, fig. 1 dorsal view, x 2/3, fig. 2 smaller and fig. 3 larger specimens in ventral view, both x 2; fig. 4 *Pentagonaster duebeni* Gray, B.M. No. 1962.4.9.8, Cape Schank, Victoria, dorsal view, x 2/3.