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REVIEW OF THE RECENT SCLERACTINIA (STONY CORALS) OF SOUTH AUSTRALIA, VICTORIA AND TASMANIA

S. D. CAIRNS & S. A. PARKER

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CAIRNS, S. D. & PARKER, S. A. 1992. Review of the Recent Scleractinia (stony corals) of South Australia, Victoria and Tasmania. *Rec. S. Aust. Mus., Monogr. Ser.* No. 3: 1-82.

Forty-eight species of Recent scleractinian corals from South Australia, Victoria and Tasmania (in 33 genera) are treated, of which 47 are illustrated. Two genera and six species are described as new: *Fungiacyathus dennanti* sp. nov., *Paraconotrochus zeidleri* gen. et sp. nov., *Trematotrochus alternans* sp. nov., *Platytrochus laevigatus* sp. nov., *P. parisepta* sp. nov., *Australocyathus* gen. nov. and *Flabellum hoffmeisteri* sp. nov. An apparently undescribed species of *Stephanocyathus* Seguenza, 1864 is left unnamed pending the collection of more material. A further 11 previously described species are added to the known fauna of the three States, of which six (*) are new records for Australia: **Caryophyllia sarsiae* Zibrowius, 1974, **Conotrochus* sp. *cf. C. funicolumna* (Alcock, 1902), *Stephanocyathus platypus* (Moseley, 1876), **Deltocyathus magnificus* Moseley, 1876, *Solenosmilia variabilis* Duncan, 1873, *Peponocyathus australiensis* (Duncan, 1870), **Guynia annulata* Duncan, 1872, *Stenocyathus vermiformis* (Pourtalès, 1868, **Placotrochides scaphula* Alcock, 1902, *Notophyllia recta* Dennant, 1906 and **Enallopsammia rostrata* Pourtalès, 1878. *Dendrophyllia atrata* Dennant, 1906 is transferred to *Astrangia* Milne Edwards & Haime, 1848, *Deltocyathus vincentinus* Dennant, 1904 is transferred to *Australocyathus* gen. nov., and *Monomyces radiatus* (Dennant, 1904) is synonymized with *Rhizotrochus tuberculatus* (Tenison-Woods, 1879).

A brief zoogeographic analysis is presented. Of the 48 species, 30 are apparently endemic to Australia, with marked regional endemism in the south-eastern part of the continent. The remaining 18 are cosmopolitan (7 spp.), shared with the Indo-Pacific (9 spp.), shared with the Subantarctic (1 sp.) or shared with New Zealand (1 sp.).

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INTRODUCTION

Knowledge of the Recent scleractinian fauna of South Australia, Victoria and Tasmania (below referred to simply as the region) begins with the description of *Scolymia australis* (Milne Edwards & Haime, 1849a) from Port Lincoln, South Australia. In the 1870s and 1880s, six species were added to the region's list (Tenison-Woods 1878, 1879, 1880; Moseley 1881). However, no studies concentrating on the region's fauna were conducted until Dennant's (1902a,b, 1904, 1906) reports on Sir Joseph Verco's dredgings from South Australia, which (nomenclature modernized) increased the list from seven to twenty-three species. Howchin (1909) reviewed previous records, noting in passing Dennant's untimely death in 1907.

Thomson & Rennet (1931) reported specimens of *Flabellum australe* Moseley, 1881 obtained by the Australian Antarctic Expedition at Maria I., Tasmania. Hoffmeister (1933), reporting collections made off southern and eastern Australia by the Commonwealth vessel 'Endeavour' in 1909-1914, described *Culicia australiensis* sp. nov. (already recorded by Dennant 1904: 9, as *C. rubeola* (Quoy & Gaimard, 1833)), *Flabellum tuthilli* sp. nov., and *F. japonicum* (*non* Moseley, 1881; = *F. hoffmeisteri* sp. nov. of the present paper), adding in all seven species to the regional list. Further 'Endeavour' material was reported by Boschma (1952), who published details of a series of *Notophyllia* Dennant, 1899 in the Zoological Museum, Copenhagen, obtained off Victoria and New South Wales by T. Mortensen during the latter's trips on the 'Endeavour' in 1914-1916.

Another naturalist to use the 'Endeavour' was Verco. In March and April 1912, on what Cotton (in Verco 1935: 173) referred to as his last collecting trip, Verco accompanied the 'Endeavour' to an area of the Great Australian Bight west of Eucla, Western Australia (Verco 1912: 206), there obtaining material of *Culicia australiensis* Hoffmeister, 1933, *Trematotrochus alternans* Cairns & Parker sp. nov., *Platytrochus hastatus* Dennant, 1902 and *Australocyathus vincentinus* (Dennant, 1904) (records herein published for the first time).

Totton (1952) discussed material of three species obtained in South Australia by Adelaide zoologist S. J. Edmonds, all previously recorded.

Wells (1958), discussing the scleractinians of the British, Australian and New Zealand Antarctic Research Expedition (BANZARE), listed six species from Station 115, off north-eastern Tasmania, of which *Anthemiphyllia dentata* (Alcock, 1902) was new for

the region. In the same paper, Wells mentioned specimens of *Letepsammia formosissima* (Moseley, 1881) together with material of eight other genera (including *Holcotrochus* Dennant, 1902), in the Australian Museum, collected at 185 m, 40 Nm (73 km) south of Cape Wiles, South Australia. If, as seems likely, these formed part of the 'Endeavour' collection, then they must have been overlooked or ignored by Hoffmeister (1933). Regardless, they cannot at present be found in the Australian Museum (P. Berents, pers. comm.).

Wells (1959) recorded a sample of 20 *Holcotrochus scriptus* Dennant, 1902 in the Australian Museum, collector unknown, from Murray Island in the eastern Torres Straits, many miles from its previously known range in South Australia. By quoting the depth range of *H. scriptus* in South Australia as 185 m, Wells (1959) implicitly identified the *Holcotrochus* from 40 miles south of Cape Wiles as *H. scriptus*.

Squires (1961) presented an uncritical list of 41 species from the 'South Australian Shelf' (apparently from Western Australia to New South Wales). Several species are absent from this list, including the common *Scolymia australis*. Subsequently, Squires (1966) identified four species of scleractinians among the collections of the Port Phillip Bay Survey (Victoria), including *Culicia hoffmeisteri* sp. nov. (previously recorded from the region as *C. rubeola* by Tenison-Woods 1878: 324-325 and as *C. tenella* Dana, 1848 by Hoffmeister 1933: 11, see below).

Eguchi (1973) listed specimens of *Platytrochus compressus* (Tenison-Woods, 1878) (= *P. laevigatus* sp. nov. of present paper) and *Culicia hoffmeisteri* Squires, 1966 collected in South Australia by J. Watson.

Veron & Pichon (1980) and Shepherd & Veron (1982) brought the region's list up to 33 species with the addition of *Coscinaraea mcneilli* Wells, 1962 and *C. marshae* Wells, 1962. Shepherd & Veron reviewed the shallow-water scleractinians of southern Australia, listing 20 species, of which their *Astrangia woodsi* (*non* Wells, 1955) and *Dendrophyllia atrata* Dennant are synonyms of the species referred to below as *Astrangia atrata* (Dennant, 1906).

Cairns (1982), in a review of Antarctic and Subantarctic scleractinians, summarised and mapped Australian records of *Caryophyllia planilamellata* Dennant, 1906 (as *C. profunda* Moseley, 1881), *Aulocyathus recidivus* (Dennant, 1906), *Stephanocyathus platypus* (Moseley, 1876), *Desmophyllum cristagalli* Milne Edwards & Haime, 1848 and *Solenosmilia variabilis* Duncan, 1873.

Increasingly since the early 1970s, further material has been obtained in the region by observers on Government research and naval vessels and on numerous fishing vessels (trawlers) (see Appendix 3). Collecting by scuba-diving has also been productive, chiefly of the shallow-water species such as *Coscinaraea* spp., *Plesiastrea versipora* (Lamarck, 1816), *Scolymia australis* and *Culicia* spp. An examination of this new material, in conjunction with a re-examination of many of the previously-reported specimens, has greatly added to our knowledge of the scleractinian fauna of south-eastern Australia. Of the 33 species recorded up to this point, three are here redescribed as new: *Fungiacyathus dennanti* sp. nov. (*Bathyactis symmetrica* of Dennant, 1906), *Platytrochus laevigatus* sp. nov. (*P. compressus* of Dennant, 1904 and of Eguchi, 1973) and *Flabellum hoffmeisteri* sp. nov. (*F. japonicum* of Hoffmeister, 1933). In addition, three other new species are described (*Paraconotrochus zeidleri* sp. nov., *Trematotrochus alternans* sp. nov., *Platytrochus parisepta* sp. nov.), while a fourth (*Stephanocyathus* sp.) is held in abeyance pending the collecting of further specimens. Finally, a further 11 species are added to the region's fauna, of which six (*) are new records for Australia:

**Caryophyllia sarsiae* Zibrowius, 1974, **Conotrochus* sp. *cf. C. funicolumna* Alcock, 1902, *Stephanocyathus platypus*, **Deltocyathus magnificus* Moseley, 1876, *Solenosmilia variabilis*, *Peponocyathus australiensis* (Duncan, 1870)[1], **Guynia annulata* Duncan, 1872, *Stenocyathus vermiformis* (Pourtalès, 1868), **Placotrochides scaphula* Alcock, 1902, *Notophyllia recta* Dennant, 1906[2], **Enallopsammia rostrata* (Pourtalès, 1878). This brings the regional total to 48, a figure expected to increase as collecting continues. A checklist of the species treated is given in Appendix 1, and a key provided in the section on Systematics.

It will be noted from the main account that five species of turbinoliids (*Trematotrochus verconis* Dennant, 1904, *Holcotrochus crenulatus* Dennant, 1904, *Platytrochus parisepta* sp. nov., *Australocyathus vincentinus* and *Idiotrochus emarciatus* (Dennant, 1906)) are known only from the Verco Collection (made 1890-1912), and that several others are still known principally from that collection. This situation probably stems from a combination of turbinoliid ecology and Sir Joseph Verco's methods of collecting. Most turbinoliids (including the five mentioned) are tiny, unattached solitary species inhabiting the interstices of coarse sand, gravel and shellgrit. Being small and interstitial, they are rarely collected. Sir Joseph used dredges – a conical iron bucket dredge and a very fine-meshed net dredge – with which he would scrape up sand and shellgrit from the seabed (see Verco 1935, especially pp. 18-22 and 172; and Cotton 1961: 318, figs 349, 350 for illustrations of Verco's actual dredges). That Verco obtained so many turbinoliids is a tribute to his meticulous collecting methods (and also to his persistence in the face of

[1] Previously recorded from the Miocene of Victoria

[2] Not *N. recta* of Dennant, 1906, off Cape Jaffa = *N. etheridgi* Hoffmeister, 1933

seasickness). There seems little doubt that re-employment of these methods would result in further collections of the turbinoliids Sir Joseph once found so plentiful.

Many of Verco's dredgings (all dry) are kept in their original glass jars in the Marine Invertebrate Section of the South Australian Museum. Although most of the zoological material (*e.g.* bryozoans, molluscs and scleractinians) has long since been extracted, the samples still occasionally reward scrutiny, as when in March 1988 SAP found a further 53 specimens of *Dunocyathus parasiticus* Tenison-Woods, 1878 (now SAM H611) in the dredging from 190 m, 64 km south-west of the Neptunes, January 1905.

Materials and Methods

Museum abbreviations used are:

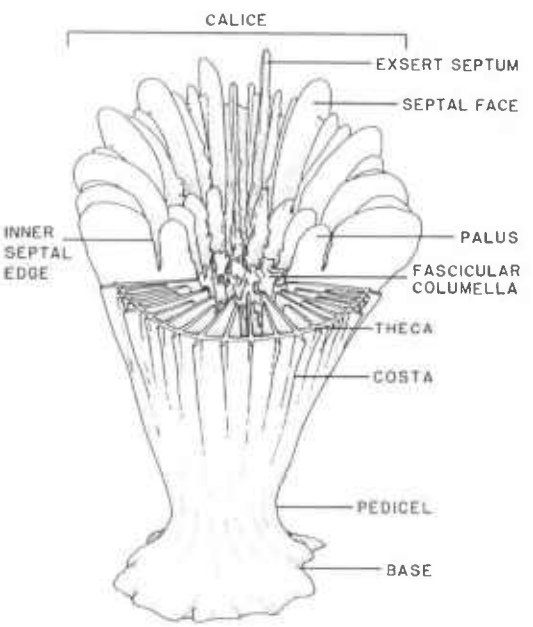
AM	Australian Museum, Sydney (coral catalogue numbers prefaced with G or E)
BMNH	British Museum (Natural History), London (now the Natural History Museum)
NMV	National Museum of Victoria, Melbourne (now the Museum of Victoria), (coral catalogue numbers prefaced with F, or P if a fossil)
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden
SAM	South Australian Museum, Adelaide (coral catalogue numbers prefaced with H)
TM	Tasmanian Museum, Hobart (coral catalogue numbers prefaced with K)
USNM	United States National Museum (now the National Museum of Natural History), Washington, D.C.
WAM	Western Australian Museum, Perth

Most of the specimens in this review are hitherto unreported, and come mainly from three Australian museums, SAM, NMV and TM. Much of the previously reported material has also been examined, including specimens referred to by: Moseley (1881) BMNH; Tenison-Woods (1878, 1879) Macleay Museum; Dennant (1902 a,b) NMV; Dennant (1904) AM; Dennant (1906) SAM, AM, RMNH, NMV; Hoffmeister (1933) AM, USNM; Wells (1958) SAM; Wells (1962) USNM, WAM; Squires (1966) NMV, USNM; and Cairns (1982) USNM. In all, 2,654 specimens were examined from 557 lots, collected at 309 localities (including the 104 vessel stations listed in Appendix 3).

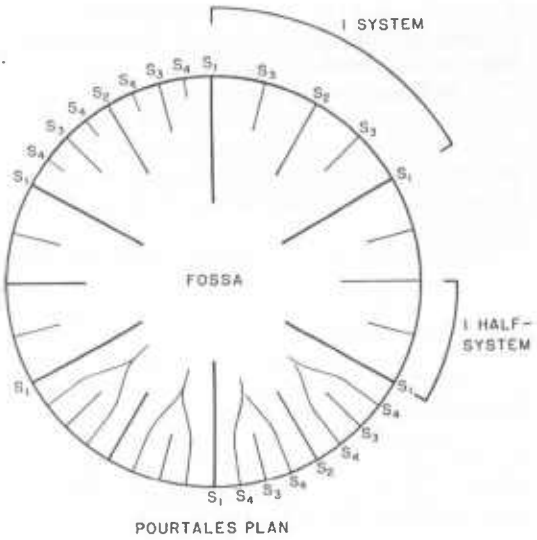
Species-synonymies are complete for Australian records; however, if a species ranges beyond Australia, one or more references summarising the extralimital distribution are included in the synonymy. Efforts have been made to verify most of the historical records by personal observations (SDC); where specimens have not been available for study and the published account is unclear, the synonymy and corresponding distributional records are queried. Representatives of 47 of the 48 species reported from southern Australia were examined and are illustrated; only *Paracyathus vittatus* was not seen and the unique type is presumed lost. Of previously described species, type-material of 20 nominal taxa (representing 19 species) was examined.

Descriptions are provided for most species; however, in six cases in which no additional specimens were collected, or when the Australian specimens available were poorly preserved, or when the species was very common and recently described, diagnoses only are provided, including emendations or additions to the previously published descriptions.

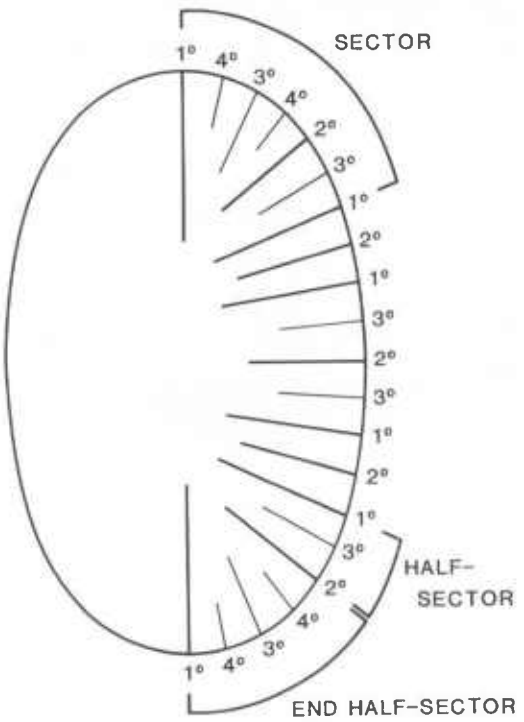
Conventional scleractinian terminology is used in describing the corallum (see Wells 1956; Cairns 1981, 1989a; Text-fig. 1); however, several terms are introduced here. The terms 'system' and 'half-system' have previously been used to designate one-sixth or one-twelfth of a calice, respectively (Text-fig. 2), but when the symmetry of a calice is not hexameral, these terms become vague. We propose the terms 'sector'and 'half-sector' to replace these terms in coralla having other than hexameral symmetry (Text-fig 3). Thus, a corallum having 10 primary septa would have 10 sectors delimited by the primaries and 20 half-sectors, further delineated by the secondary septa. The four sectors (or systems) adjacent to the two principal septa are



TEXT-FIGURE 1. Cutaway drawing of a species of *Caryophyllia* illustrating the basic morphological features of an attached solitary scleractinian.



TEXT-FIGURE 2. Composite diagram of a calice illustrating various septal insertion patterns: upper right system with three cycles of septa, upper left system with four cycles, and lower two systems both with four cycles arranged in a Pourtalès Plan. Numbers refer to the cycle to which the septa belong.



TEXT-FIGURE 3. Diagram of half of the septal insertion pattern of *Platytrochus parisepta*, a coral having incomplete decameral symmetry.

termed the 'end sectors' (or 'end-system'). In regard to the description of septa, the terms 'wide' and 'narrow' pertain to the dimensions of the septal face as measured from the theca to the inner (fossa) edge. Terms 'thick' and 'thin' pertain to the distance between the two faces of the same septum.

The following morphological abbreviations are used in the text: C_n, P_n, S_n, SC_n – costae, pali, septa, or septocostae (respectively) of the cycle designated by the subscript.

LCD	Lesser calicular diameter
GCD	Greater calicular diameter
GCD:H	Ratio of greater calicular diameter to height of corallum
GCD:LCD	Ratio of greater calicular diameter to lesser calicular diameter
LEL:H	Ratio of lateral edge length to height of corallum

Under Material Examined, all specimens are Recent unless otherwise stated. Specimens are listed under their nearest State (*e.g.* South Australia, Victoria), or, where this seemed inappropriate, under a separate heading (*e.g.* Eastern Bass Strait, Cascade Plateau, South Tasmanian Rise). The number of individuals (or colonies if the species is colonial) appears in parentheses after the catalogue number of the sample, followed by reference to previous citation if any. The abbreviations for collectors are explained in Appendix 2. For vessel stations listed in Appendix 3, only the station number and depth is cited in the main text, except in the case of type-specimens of new species, for which the full details of locality and date are given. If the species is widespread, bathymetric ranges are given for the southern Australian records distinct from the known depth-range elsewhere.

The scanning electron photomicrographs were taken by the senior author on a Cambridge Stereo Scan 100. In some cases stereo pairs are presented, in order to give a better appreciation of the depth of the fossa and relative exsertness of septal cycles. Some specimens were dyed with red food colouring to improve their contrast for conventional photography.

Systematics

Key To The Recent Scleractinia Known From South Australia, Victoria, And Tasmania

1 – Corallum colonial 2
– Corallum solitary 10

2 – Corallum branching; deep-water habitat (200-2 200 m) 3
– Corallum not branching (reptoid, encrusting, or cerioid); shallow-water habitat (0-100 m) 4

3 – Corallum uniplanar, robust; calices occur on only one side of corallum; calices often rostrate ..... *Enallopsammia rostrata*
– Corallum bushy, lightweight; calices oriented in all directions; calices not rostrate ..... *Solenosmilia variabilis*

4 – Budding intratentacular: adjacent corallite centres linked by septa 5
– Budding extratentacular: adjacent corallites discrete, their centres not linked 7

5 – Corallites relatively large (2-3 cm in diameter); usually no more than 10 corallites per corallum .. *Scolymia australis*
– Corallites relatively small (2-7 mm in diameter); usually hundreds of corallites per corallum 6

6 – Corallum chaliciform in shape; well-developed collines separate rows of corallites ..... *Coscinaraea marshae*
– Corallum usually encrusting or laterally attached; calices absent ..... *Coscinaraea mcneilli*

7 – Corallites closely spaced (cerioid), intercalicular coenosteum sparse; corallum massive (up to 3 m) ..... *Plesiastrea versipora*
– Corallites usually not closely spaced (reptoid to phaceloid); coralla relatively small (rarely over 4 cm) 8

8 – Corallum brown to black; theca costate ..... *Astrangia atrata*
– Corallum white; epithecate 9

9 – Each corallite with 36-48 closely-spaced septa arranged in three size-classes ..... *Culicia australiensis*
– Each corallite with 20-24 well-spaced septa arranged in two size-classes ..... *Culicia hoffmeisteri*

10 – Corallum attached to substrate 11
– Corallum free of substrate (but may be attached to fragment of parent corallum) 21

11 – Columella absent or extremely rudimentary ... 12
– Columella present: fascicular, labyrinthiform, spongy, or papillose 13

12 – Pedicel small in diameter (about 1/10 GCD), base reinforced by 6-8 rootlets; epithecate ..... *Rhizotrochus tuberculatus*
– Pedicel massive (about half GCD), lacking rootlets; costate ..... *Desmophyllum cristagalli*

13 – Upper theca porous (synapticulothecate); septa arranged in Pourtalès Plan; columella spongy .. 14
– Theca not porous (epithecate or septothecate); septa arranged normally; columella fascicular, labyrinthiform, or papillose 15

14 – Inner edges of S_3 laciniate; corallum rarely larger than 13 mm GCD ..... *Balanophyllia dentata*
– Inner edges of S_3 smooth; corallum larger, up to 28 mm GCD ..... *Balanophyllia bairdiana*

15 – Pali present 16
– Pali absent 19

16 – Calices with 24 septa; only six pali (P_2) present; corallum cylindrical .... *Stenocyathus vermiformis*
– Calices with 48 or more septa; 12-24 pali present; corallum conical (ceratoid) 17

17 – Pali in two crowns before all but last cycle (P_{1-3}) ..... *Paracyathus vittatus*
– Pali in one crown before penultimate cycle of septa (S_3 or secondary septal cycle) 18

18 – Calices with 12-14 pali and 48-56 septa; columella small (2-6 discrete elements) ..... *Caryophyllia sarsiae*
– Calices with 18-24 pali (usually 20) and 72-96 septa (usually 80); columella robust, composed of numerous fused elements ..... *Caryophyllia planilamellata*

19 – Calices large (up to 39 mm in diameter) and discoidal; inner edges of septa highly dentate ..... *Scolymia australis*
– Calices smaller (< 17 mm in GCD) and conical (ceratoid); inner edges of septa smooth 20

20 – Columella fascicular; theca thin ..... *Crispatotrochus inornatus*
– Columella labyrinthiform; theca thick ..... *Conotrochus* sp. *cf. C. funicolumna*

21 – Theca porous (synapticulothecate) 22
– Theca not porous (epithecate, septothecate, or pitted) 24

22 – Corallum discoidal; septa and costae alternate in position, joined by synapticulae ..... *Letepsammia formosissima*
– Corallum cuneiform, with a straight-edged base caused by transverse division; costae not present 23

23 – Corallum small (less than 6 mm GCD); 26-28 septa per calice, the secondary septa almost as large as the primary ..... *Notophyllia recta*
– Corallum larger (up to 12.5 mm GCD); 48 septa, the secondaries much smaller than the primaries .... *Notophyllia etheridgi*

24 – Septa alternate in position with costae 25
– Septa correspond in position to costae 26

25 – Corallum tympanoid, calice circular; costae granular, intercostal furrows deep and wide; no thecal spines ..... *Dunocyathus parasiticus*
– Corallum compressed, calice elliptical; costae smooth, intercostal furrows shallow and thin; one basal pair of thecal edge spines ..... *Idiotrochus emarciatus*

26 – Intercostal furrows deep and narrow (narrower than costae); corallum small (< 1 cm GCD) ..... Turbinoliidae, 27
– Intercostal furrows shallow and broad (wider than costae) or absent; corallum variable in size 35

27 – Corallum compressed-cuneiform 28
– Corallum not compressed: bowl-shaped or tympanoid 34

28 – Intercostal furrows regularly pitted, but not perforate 29
– Intercostal furrows solid, not pitted or perforate 30

29 – Lateral sectors of calice with two very different size-classes of septa (primary and secondary) alternating in position; GCD:LCD 1.8-2.0 ..... *Trematotrochus alternans*
– Lateral sectors of calice with three size-classes of septa (S_{1-3}); GCD:LCD 1.45-1.80 ..... *Trematotrochus verconis*

30 – Calices with 10 septa; costae granular; columella rudimentary 31
– Calices with 40 or more septa; costae smooth; columella papillose 32

31 – Corallum with deep, broad thecal edge sulci; costae degenerate toward base; 20 costae ..... *Holcotrochus crenulatus*
– Corallum lacking edge sulci; costae continuous to base; 10 costae and intercostal ridges ..... *Holcotrochus scriptus*

32 – Pedicel tapering to a noncostate, smooth cone; calices with 40 septa; GCD:LCD 1.5-1.7 33
– Pedicel not a smooth cone; calices with 72 septa; GCD:LCD > 2.0 ..... *Platytrochus laevigatus*

33 – Two costal trifurcations per thecal face; gradation in septal width of S_{1-3} ..... *Platytrochus hastatus*
– No costal trifurcations; S_{1-3} virtually equal in width ..... *Platytrochus parisepta*

34 – Corallum tympanoid, with a flat base ..... *Australocyathus vincentinus*
– Corallum bowl-shaped, with a convex base ..... *Peponocyathus australiensis*

35 – Corallum discoidal (flat base) or bowl-shaped (flat to convex base) 36
– Corallum flabellate (laterally compressed), conical (ceratoid), or cylindrical 42

36 – Corallum discoidal, with a relatively high GCD:H ratio (about 4) 37
– Corallum bowl-shaped, with a lower GCD:H ratio (less than 2) 40

37 – Corallum extremely fragile (usually fragmented) and small (< 1 cm calicular diameter); 48 septa in an intact corallum ..... *Fungiacyathus dennanti*
– Corallum robust and larger (2 cm or more in diameter); 96 septa 38

38 – All septa directed straight toward epicentre; septal edges bear tall, slender teeth for entire length (no pali) ..... *Anthemiphyllia dentata*
– Higher cycle septa (S_{3-5}) fuse to next lower cycle septa; septal edges lobate or spinose; paliform lobes present 39

39 – Adjacent septa linked by transverse synapticulae; costae rounded and granular ..... *Fungiacyathus paliferus*
– Synapticulae absent; costae thin, serrate ridges ..... *Deltocyathus magnificus*

40 – Corallum stabilized by six long C_t spines ..... *Stephanocyathus (A.) spiniger*
– Basal spines lacking 41

41 – Columella and paliform lobes lacking or rudimentary; corallum large, up to 82 mm in diameter ..... *Stephanocyathus (S.) platypus*
– Columella robust, discrete paliform lobes before all but last cycle of septa; corallum less than 30 mm in calicular diameter ..... *Stephanocyathus (S.)* sp.

42 – Corallum cylindrical and extremely small (calicular diameter < 1.5 mm); 16 septa in two cycles ..... *Guynia annulata*
– Corallum laterally compressed or conical (ceratoid or trochoid), GCD well over 2 mm; 28 or more septa 43

43 – Corallum conical, calice circular to slightly elliptical (GCD:LCD < 1.3); columella robust (fascicular, labyrinthiform, or papillose) 44
– Corallum laterally compressed, calice highly elliptical to elongate (GCD:LCD >1.3); columella rudimentary or absent (composed of fusion of inner edges of larger septa) 46

44 – Corallum invariably attached to sector of parent corallum ..... *Aulocyathus recidivus*
– Corallum free, not attached to parent corallum 45

45 – Pedicel usually attenuate and bent; columella fascicular; palar crown well defined, composed of 18-24 broad pali ..... *Caryophyllia planilamellata*
– Pedicel short and stout; columella labyrinthiform; pali (P_3) poorly defined, intimately associated with columella ..... *Paraconotrochus zeidleri*

46 – Corallum small (< 5 mm GCD); thecal edges parallel; transverse division present producing a straight-edged basal scar ..... *Placotrochides scaphula*
– Corallum larger (well over 10 mm GCD); thecal edge angle >40°; transverse division lacking, base originating in a small, unattached pedicel 47

47 – Edges of corallum rounded (not crested); edge angle 40°-50° ..... *Flabellum (F.) transversale*
– Edges of corallum acute, usually crested for all or part of length; basal edge angle >70° 48

48 – Corallum large (up to 73 mm in GCD) and highly compressed; GCD:LCD 2.2-3.0, thecal face angle 29°-39°; septa hexamerally symmetrical in up to six cycles (192 septa); calicular margin smooth ..... *Flabellum (F.) australe*
– Corallum smaller (up to 58 mm in GCD) and less compressed; GCD:LCD 1.3-1.8, thecal face angle 49°-61°; septa octamerally arranged (16 primary septa) in four cycles; calicular margin finely serrate 49

49 – Sixteen primary costae dark brown; thecal edges crested for most of length ..... *Flabellum (U.) hoffmeisteri*
– Theca entirely white, no costal striping; thecal edges crested only on lower half of corallum ..... *Flabellum (U.) tuthilli*

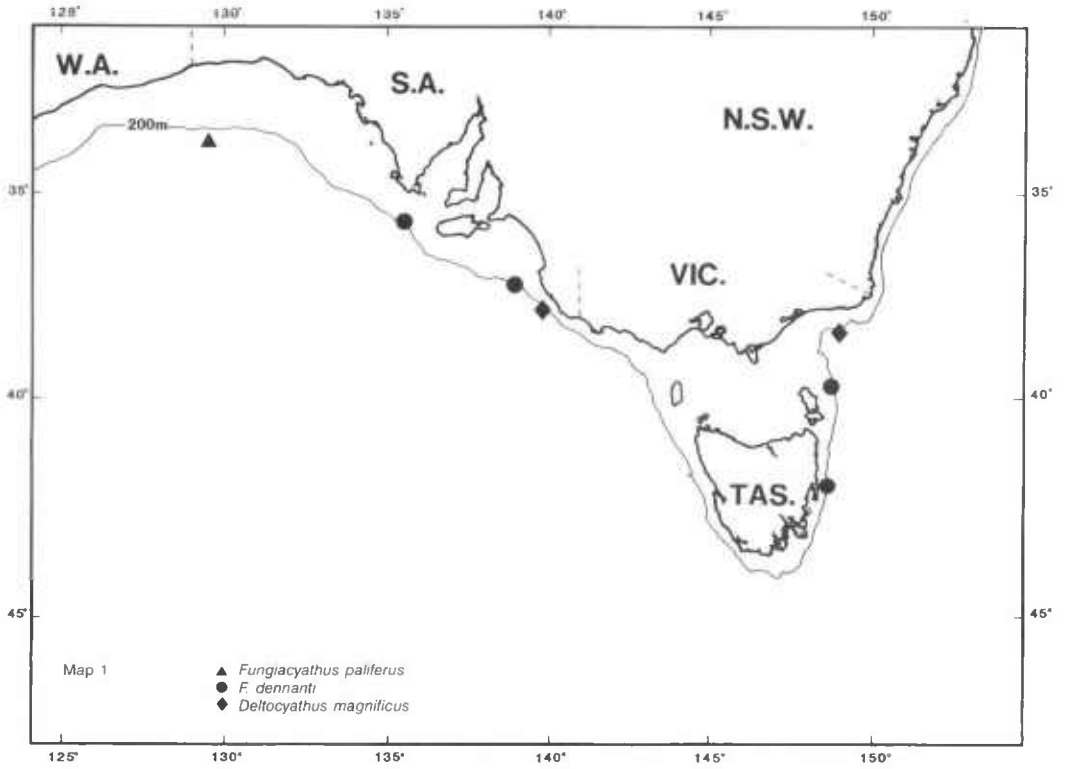
Taxonomic Section

Order Scleractinia Bourne, 1900
Suborder Fungiina Verrill, 1865
Superfamily Fungiicae Dana, 1846
Family FUNGIACYATHIDAE Chevalier, 1987

Fungiacyathus Sars, 1872

1. *Fungiacyathus (Fungiacyathus) paliferus* (Alcock, 1902)
(Figs 1a, b, Map 1)

Bathyactis palifera Alcock, 1902: 38, pl. 5, figs 34, 34a; Hoffmeister, 1933: 14, pl. 4, fig. 6.
Fungiacyathus paliferus: Cairns, 1989a: 9, 10, pl. 2c-i, 3a-e (synonymy).



Diagnosis

Coralla up to 22.1 mm in diameter (Hoffmeister 1933) and 5.8 mm in height. Corallum base solid and flat to slightly concave. Costae rounded, granular, and unequal in thickness and height, according to the formula: $C_{1-2} > C_3 > C_4 > C_5$. Septa hexamerally arranged in five complete cycles (96 septa). S_1 of larger specimens composed of 14-17 trabecular spines; innermost four or five spines individually projecting above septal edge, outermost spines united in an exsert lobe. Innermost five or six trabecular spines of S_2 also individually project above septal edge, the third and fourth spines sometimes fusing to form a paliform lobe. S_3 also composed of two or three inner trabecular spines, a low medial paliform lobe and a low peripheral septal lobe. S_4 composed of 5-15 trabecular spines, S_5 a lesser number of spines. Septa planar (not corrugated), the higher cycle septa joined to one another within systems in typical fungiacyathid fashion; septal canopies absent. Eight or nine synapticular plates per S_1, the highest being the fourth or fifth from columella. Columella rudimentary.

Discussion

Fungiacyathus paliferus is distinguished from the three other Recent species in the nominate subgenus (see Cairns 1989a) and most other species in subgenus *F. (Bathyactis)*, by having rounded, granular costae, as opposed to the more common condition of thin, serrate ridges.

The specimen reported by Hoffmeister (1933) from the Great Australian Bight, the only specimen ever reported from Australia, is also the largest recorded thus far. It was examined at the Australian Museum in 1988 (SDC) but was unavailable for photography in 1989. Therefore, specimens from Indonesia and Japan have been used to illustrate this species.

Material Examined

South Australia: Great Australian Bight 129°28′E, 250-450 fms (=457-823 m), 'Endeavour', AM E3737(1) (*B. palifera* of Hoffmeister, 1933).

Other: specimens listed by Cairns (1989a).

Distribution

Australia: Great Australian Bight, one record only, 129°28′E; between 457 m and 823 m. Japan, Philippines, Indonesia, Réunion; 75-522 m (see Cairns 1989a).

2. *Fungiacyathus (Bathyactis) dennanti* sp. nov. (Figs 1d, e, g, Map 1)

Bathyactis symmetrica: Dennant, 1906: 161; Howchin, 1909: 247.

Description

Corallum discoidal; however, almost all specimens are broken in half, resulting in semi-circular fragments consisting of two septal systems flanked on either side by half-systems. Only one complete specimen is known (holotype), which is 9.2 mm in calicular diameter and in the process of asexually fragmenting into six or seven daughter sectors (Fig. 1d, e). Another specimen (NMV F57178) has a relatively intact corallum, consisting of a circular calice 4.5 mm in diameter that has regenerated from a parent sector 3.2 mm in calicular radius (about 6.5-7.0 mm in original diameter). Corallum base flat to slightly concave, covered by equal, rounded, granular costae, the granules about 50 μm in diameter.

Septa hexamerally arranged in four cycles; however, because of the fragmentary nature of most coralla, usually only 24 of the expected 48 septa are present in any specimen. S_1 independent, composed of four or five inner trabecular spines that extend well above septal edge as incurved, flattened spines. Peripheral to these spines is a tall septal lobe composed of three or four trabecular spines, which suddenly decreases in height peripherally and continues as a low spinose septum for remaining 0.3-0.4 mm. S_{1-2} extend to epicentre of calice, the S_2 composed of approximately eight trabecular spines, the innermost three or four extending well above septal edges as large spines, the outermost four or five spines either forming a small septal lobe or remaining independent like the inner spines. The third spine from epicentre is usually the most prominent spine of the S_2 and corresponds to the area of fusion with adjacent S_3. Pairs of S_3 fuse with S_2 at a distance of about one-third calicular radius from epicentre, each S_3 consisting of about four tall septal spines and a lower, peripheral shoulder. Pairs of S_4 fuse to S_3 at a distance of about two-thirds calicular radius from epicentre, each S_4 consisting of four or five small trabecular spines. Lateral edges of trabecular spines, especially those of S_{1-2}, consist of dentate ridges up to 0.12 mm tall, the ridges degenerating into discontinuous, tall granules closer to base. Approximately two synapticular plates per S_1. Columella nonextant, the calicular epicentre lying on the fracture plane.

Discussion

Cairns (1989a) listed the 17 species in the subgenus *Fungiacyathus (Bathyactis)*, two of which, like *F. dennanti*, are fissiparous: *F. fissilis* Cairns, 1984 (Hawaii) and *F. crispus* (Pourtalès, 1871) (western Atlantic). *F. dennanti* differs from *F. fissilis* in having a smaller corallum, fewer trabecular spines per septum, differently shaped septal lobes, and granular (*vs* ridged) costae. *F. crispus* differs by its larger size and complete lack of septal lobes.

Another species of an equally small diameter originally thought to belong to this subgenus is *F. beaumariensis* Dennant, 1904, described from the Miocene of Victoria. However, examination of the figured syntype (Fig. 1c) of this species (NMV P27131) shows it to be a turbinoliid, the outer concentric 'synapticular ring' alluded to by Dennant being the thecal wall.

Etymology

Named in honour of John Dennant, author of several important descriptive accounts of the Tertiary and Recent coral fauna of Australia and New Zealand.

Material Examined (types)

Holotype

Eastern Bass Strait: 'Kimbla' Stn 79-K-1-34, 39°38.7′S, 148°49.4′E, Flinders Canyon, 770 m, 27.iii.1979, NMV F56882(1).

Paratypes

South Australia: 35 Nm (=64 km) SW of Neptune Is, 104 fms (=190 m), JV, SAM H357 (32 fragments)/USNM 85676 (9 fragments).

Tasmania: 'Franklin' Stn Slope 46, 42°0.2′S, 148°37.7′E, 720 m, NMV F57178(1).

Distribution

Australia: south of Eyre Peninsula and off south-eastern South Australia, eastern Bass Strait and off eastern Tasmania; 190-238, 720-770 m.

Family MICRABACIIDAE Vaughan, 1905

Letepsammia Yabe & Eguchi, 1932

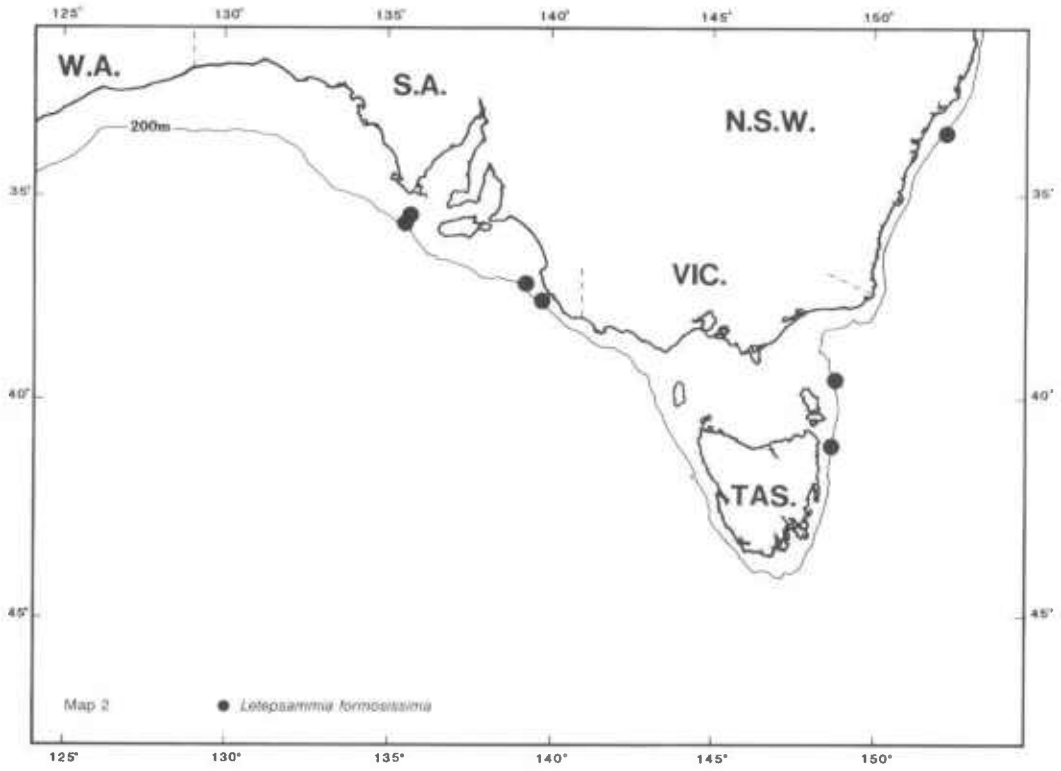
3. *Letepsammia formosissima* (Moseley, 1876)

(Figs 1f, h, Map 2)

Stephanophyllia formosissima Moseley, 1876: 561, 562; Moseley, 1881: 201-204, pl. 4, fig. 11, pl. 13, figs 6, 7, pl. 16, figs 8, 9; Wells, 1958: 263, pl. 1, figs 1, 2.
Leptopenus discus: Dennant, 1906: 162; Howchin, 1909: 248.
Letepsammia formosissima: Cairns, 1989a: 15-18, pl. 6j, 7g-i, 8a-d, text-fig. 1 (synonymy).

Diagnosis

Corallum discoidal and very fragile, up to 38 mm in diameter; however, all South Australian specimens examined are less than 15 mm in diameter and broken into fragments consisting of one-sixth to one-third of a corallum. Base flat and porous; costae thin, granular ridges, the intercostal spaces bridged by transverse synapticulae. Costae alternate in position with septa. Larger specimens bear a peripheral marginal shelf. Septa arranged in typical micrabaciid fashion: septa of first two cycles straight and nonbifurcate; the 12 S_3 lead to multiple bifurcations in a complex but consistent



pattern (Cairns 1989a: text-fig. 1). A complete corallum has 120 septa. S_1 isolated from adjacent septa, producing the six-rayed, stellate septal pattern characteristic of this and most other micrabaciid genera. Septa highly porous, and, along with the porous base, produce a fragile, low density corallum. Columella a large, elongate, spongy mass, joined to inner edges of S_{1-3}.

Discussion

Because the only specimens of *L. formosissima* known from Australia are small or fragmentary, our diagnosis and illustrations are based on more complete specimens from other localities (Cairns 1989a).

Dennant's (1906) tentative identification of *L. discus* from South Australia and Port Jackson was first queried by Wells (1958), who suggested that these specimens might instead be *L. formosissima*. Cairns (1989a) agreed with this suggestion, based on Dennant's description and the shallow depth range of these specimens, although neither Wells nor Cairns had at that time seen Dennant's specimens. In 1988, the senior author examined two fragments of Dennant's *Leptopenus discus* from Cape Jaffa (90 fms) deposited at the Australian Museum and found them to be specimens of *Letepsammia formosissima*.

Material Examined

South Australia: Off Cape Jaffa, 90 fms (=165 m), AM G12054 (2 fragments), (*Leptopenus discus* of Dennant, 1906).

Eastern Bass Strait: 'Kimbla' Stn K7/73-47, NMV F56895(1); 'Sprightly' Stn 73-2051, 399 m, AM uncat. (1).

Other: specimens listed by Cairns (1989a: 17-18), including syntypes of *L. formosissima*.

Distribution

Australia: 73 km south of Cape Wiles, 64 km south-west of Neptune Is, off Cape Jaffa, off Beachport, South Australia; eastern Bass Strait; Tasmania; off Port Jackson, New South Wales; 128-457 m. Off southern Japan, Philippines, New Zealand; 97-470 m (Cairns 1989a).

The specimen reported by Wells (1958) from south of Cape Wiles belongs to the AM but at present cannot be found there; the specimen reported by the same author (1958) from BANZARE Station 115 off Tasmania belongs to the SAM but is similarly untraceable.

Superfamily Agariciicae Gray, 1847

Family SIDERASTREIDAE Vaughan & Wells, 1943

Coscinaraea Milne Edwards & Haime, 1848

4. *Coscinaraea marshae* Wells, 1962
(Figs 1i, j)

Coscinaraea marshae Wells, 1962: 240, 241, pl. 17, figs 1-4, pl. 18, figs 1-3 (in part: not WAM 59-59, 101-58, 102-58, = *C. mcneilli*); Shepherd & Veron, 1982: 172-174, fig. 4.53; Veron, 1986: 283, 4 figs; Veron & Marsh, 1988: 75.

Description

Colonics chaliciform, up to 24 cm in diameter and 2 cm thick, centrally attached by a thick pedicel. Costae on underside of calicular surface thin ridges, each about 0.08 mm wide and ornamented with a unilinear row of coarse granules. Intercostal grooves quite wide (0.25 mm) and deep. Wall synapticulothecate and imperforate; no epitheca. Living colonies yellow-brown or brown.

Corallites formed by circumoral budding, producing short to moderately long series (valleys) of corallites often concentrically arranged around a larger, founder corallite. Collines well developed, up to 5 mm tall and 6-9 mm apart, with rounded upper edges. Calices 4-7 mm in diameter, but rarely isolated, usually joined in long series, their centres linked by lamellae or trabeculae. Approximately 30 septa per calice, only half of these reaching columella; 25-30 septa per cm along colline. Septocostae thin, about 0.18-0.20 mm wide, separated by broader (about 0.25 mm), deep, intercostal furrows. Septocostal edges beaded (Fig 1i). Fossa moderately deep. Columella robust, composed of 15-25 granulated papillae, the columella often continuous for some distance in linked calices. Vesicular dissepiments common, spaced 0.5-1.0 mm apart.

Discussion

According to Veron (1986) there are eight valid species of *Coscinaraea*, six of which are known from Australia: *C. exesa* (Dana, 1846); *C. columna* (Dana, 1846); *C. mcneilli* Wells, 1962; *C. marshae* Wells, 1962; *C. wellsi* Veron & Pichon, 1980 and *C. crassa* Veron & Pichon, 1980. Only *C. mcneilli* and *C. marshae* are known from the temperate waters of southern Australia. *C. marshae* is distinguished from *C. mcneilli* by its exclusively chaliciform shape, well-developed collines, and much thinner costae and septocostae (equal to or less than width of intercostal grooves).

Material Examined

Western Australia: Rottnest I., USNM 68363 (two paratypes of *C. marshae*); King George Sound, WAM 4-87(1), WAM 368-77(1) (Veron & Marsh 1988: 75). **South Australia:** Pearson I., 15 m, SAS 30.iii.1982, SAM H358 (1).

Distribution

Restricted to the continental shelf of south-western and southern Australia, from the Wallabi Group, Houtman Abrolhos Is, Western Australia (Veron & Marsh 1988: 75) south and east to Pearson I., eastern Great Australian Bight, South Australia; 1-20 m.

5. *Coscinaraea mcneilli* Wells, 1962
(Figs 2b, c)

Coscinaraea mcneilli Wells, 1962: 239, 240, pl. 16, figs 1-3; Veron & Pichon, 1980: 94, 98, figs 158-162; Shepherd & Veron, 1982: 172, figs 4.52c, d; Veron, 1986: 282, 3 figs; Veron & Marsh, 1988: 75.
Coscinaraea marshae Wells, 1962: 241 (in part: WAM 59-59, 101-58, 102-58).

Description

Colonies form broad, thamnasteroid plates up to 60 cm wide and 5 cm thick, attached basally (encrusting or chaliciform) or laterally (bracket growth form). Colony edges with free margins; well-developed costae occur at edges of underside of corallum. Costae equal in width (about 0.3 mm), rounded, and covered by small, pointed granules arranged randomly. Intercostal grooves shallow and narrow (about 0.05 mm wide). Wall synapticulothecate and imperforate; no epitheca. Living colonies dark grey, brown, or green (Veron 1986).

Corallites formed by circumoral budding, but collines and valleys not well developed; collines often lacking. Calices 2-5 mm in diameter; centres 4-8 mm apart. Ten to forty septa per calice, only 10-16 of which reach the columella; 20-26 septa per cm over colline. All septocostae of approximately equal width, widest on the colline (0.30-0.38 mm) and narrowest near columella (about 0.15 mm). Septocostae separated by narrow (0.10 mm), quite deep furrows. Septocostal edges distinctively beaded. Fossa shallow. Columella composed of 1-5 granulated papillae. Vesicular dissepiments abundant and many layered, spaced 0.2-0.4 mm apart.

Discussion

Comparisons with *C. marshae* are made in the account of that species.

Material Examined

Western Australia: Rottnest I., USNM 68365 (two paratypes of *C. mcneilli*); Geographe Bay, USNM 68364 (two paratypes of *C. marshae, ex* WAM 59-59, reported as WAM 52-59 in Veron & Marsh 1988: 75); off Fremantle, USNM 82549 (*ex* WAM 132-73); Geographe Bay, USNM 82548 (*ex* WAM 276-73); King George Sound, WAM 3-87; Frederick I., Recherche Archipelago, WAM 132-85, WAM 127-85 (Veron & Marsh 1988: 75).

South Australia: Franklin Is, 12-15 m, WZ *et al.* 23.ii.1983, SAM H359(1), 360(3); Goat I., Nuyts Archipelago, 12-15′(=3.7-4.6 m), WZ, KGH 10.iii.1987, SAM H361(1); St Francis I., 3-5 m, WZ 25.i.1982, SAM H362 (1); Flinders I., SAS, TM K862 (7 fragments); off Boston I., 3-8 m, WZ, KGH 17.ii.1988, SAM H363(1); Marum I., 20′ (=6.1 m), WZ 10.i.1984, SAM H364(1) and 15-35′ (=4.6-10.7 m), WZ, KGH 20.i.1986, SAM H365(1); reef NW of Hareby I., 15-20′ (=4.6-6.1 m), WZ, KGH 28.i.1986, SAM H366(1); Kirkby I., 10-45′ (=3-13.7 m), WZ, KGH 28.i.1986, SAM H367(1); Reevesby I., 8-20′ (=2.4-6.1 m), WZ, KGH 24, 25, 30.i.1986, SAM H368-370(3); Edithburgh, 1-5 m, WZ, KGH 19.xi.1986, SAM H371(2); 3 km W of Glenelg, 20 m, anon., xi.1972, SAM H372(1); *ca* 3 Nm (=5.5 km) off Glenelg, 35′ (=10.7 m), KGH ix.1982, SAM H374(1); Aldinga Reef, 60′ (=18 m), SAS 6.iii.1966, SAM H375(1).

Distribution

Continental shelf of south-western and southern Australia, from the Houtman Abrolhos, Western Australia (Veron & Marsh 1988: 75) south and east to Gulf St Vincent, South Australia; also New South Wales; 0-33 m.

Suborder Faviina Vaughan & Wells, 1943
Superfamily Faviicae Gregory, 1900
Family FAVIIDAE Gregory, 1900

Plesiastrea Milne Edwards & Haime, 1848

6. *Plesiastrea versipora* (Lamarck, 1816)
(Figs 2e, f)

Astraea versipora Lamarck, 1816: 64.
Astrea galaxea Quoy & Gaimard, 1833: 216, pl. 17, figs 10-14.
Plesiastrea versipora: Milne Edwards & Haime, 1857: 490, 491, pl. D7, fig. 5; Wijsman-Best, 1977: 93, 94, pl. 4, figs 1-4; Veron, Pichon, & Wijsman-Best, 1977: 149-153, figs 284-294 (synonymy and discussion); Shepherd & Veron, 1982: 172, figs 4.52a, b, pl. 19.4; Veron, 1986: 510, 511, 4 figs; Veron & Marsh, 1988: 111, 112.
Plesiastrea urvillei Milne Edwards & Haime, 1849b: 117, pl. 9, fig. 2; Tenison-Woods, 1878: 323; Howchin, 1909: 242-243, 247, 249-251, text-figs 1, 2; Totton, 1952: 976, pl. 36, figs 5, 6; Squires, 1966: 170, pl. 1, figs 6, 7.
Plesiastrea quatrefagiana Milne Edwards & Haime, 1849b: 119.
Plesiastrea peroni Milne Edwards & Haime, 1857: 492, pl. D7, fig. 3; Tenison-Woods, 1878: 324; Howchin, 1909: 247.
Plesiastrea proximans Dennant, 1904: 9, pl. 2, figs 3a, b; Howchin, 1909: 247.
Orbicella gravieri Vaughan, 1918: 86.

Description

Coralla extremely variable in most characters. Colonies subcerioid to plocoid and encrusting, up to 3.1 m in diameter (Howchin, 1909). Living colonies pale yellow, cream, brown, or brightly coloured.

Corallites circular, slightly elliptical, or irregular in shape, relatively closely spaced, and 2.0-5.5 mm in diameter. Corallites originate by extratentacular budding. Number of septa per calice varies depending on calicular diameter; however, the range includes 24-54 septa. In small calices, septa may be hexamerally arranged in three complete cycles ($S_1 > S_2 > S_3$, 24 septa), whereas larger calices have a greater number of primary, secondary, and tertiary septa, the last cycle of septa rarely complete (*e.g.*, septal formulae of 12:12:24 or 14:14:20-28). Primary septa extend to columella, each invariably bordered by a palus. Secondary septa one-half to two-thirds width of primaries and usually lack pali. Tertiary septa small to rudimentary and unevenly developed within a calice. All septa equally exsert and have finely dentate inner edges. Septocostae variable in expression: usually SC_1 are present, sometimes a costa corresponds to each septum, but often the coenosteum is noncostate and simply vesicular. Columella rudimentary, composed of several weak trabeculae. Exothecal dissepiments spaced about 1 mm apart; endothecal dissepiments spaced about 0.75 mm apart.

Discussion

Plesiastrea versipora is an extremely variable species with a broad geographic range, which undoubtedly accounts for its long list of junior synonyms. Veron *et al.* (1977) listed three ecomorphs of the species, of which only ecomorph *urvillei* occurs in the temperate latitudes off southern Australia. This form is characterized by having large, encrusting coralla, closely spaced corallites, thin septa and pali, little exothecal ornamentation, and brightly coloured tissue.

Material Examined

Western Australia: Duke of Orleans Bay, WAM 276-89 (1); King George Sound, WAM 277-89 (1).
South Australia: Pearson I., WZ 24.xi.1976, SAM H376 (1); Whittlebee Point, WZ 1.iii.1975, SAM H383 (1); St Francis I., 3-5 m, WZ 23-26.i.1982, SAM H377 (1), 378 (1), 667 (1); Franklin Is, 7-15 m, WZ, KGH, PA 21-25.ii.1983, SAM H379-382 (14), H668 (1), 13 and 15.iv.1983, SAM H669, 670 (2); Dog I., Nuyts Archipelago, in rockpool, WZ, AG 28.i.1982, SAM H671 (1); Port Blanche, 6-20′ (=1.8-6.1 m), WZ, KGH 9.iii.1987, SAM H384 (5); Langton I., 5-12′ (=1.5-3.7 m), WZ, KGH 25.i.1986, SAM H385 (10); Winceby I., 30′ (=9.2 m), WZ 12.i.1984, SAM H386 (1), and 15′ (=4.6 m), WZ *et al.* 26.i.1986, SAM H387 (1); N of Partney Shoal, 10-25′ (=3-7.6 m), WZ, KGH 22.i.1986, SAM H388 (4); Marum I., 20′ (=6.1 m) WZ 9.i.1984, SAM H389 (5), 15′ (=4.6 m), WZ

10.i.1984, SAM H390(1), 15-35′ (=4.6-10.7 m), WZ, KGH 20.i.1986, SAM H391 (5), 10-20′ (=3-6.1 m), WZ, KGH 23.i.1986, SAM H392 (4); reef E of Blythe I., 5-20′ (=1.5-6.1 m), WZ, KGH 29.i.1986, SAM H393 (2); Rccvcsby I., 15′ (=4.6 m), NH 27.ix.1982, SAM H394 (1), 10′ (=3 m), WZ 18.i.1984, SAM H395 (2), 10-20′ (=3-6.1 m), WZ, KGH 24.i.1986, SAM H396 (1); Wardang I., 4 fms (=7.3 m), KS 12.iii.1938, SAM H672 (1); Corny Point, WZ 14.x.1974, SAM H397 (1); Marion Bay, 2 m, WZ 21.i.1980, SAM H400 (3); Coobowie Bay, 3-4 m, WZ, KGH 17.xi.1986, SAM H399 (5); Stansbury jetty, 1-3 m, WZ, KGH 18.xi.1986, SAM H398 (2); Gulf St Vincent, RS 1960-65, SAM H401 (3), another, no data, SAM H403 (1); Glenelg, anon., SAM H402 (1); Sellick's Beach, 1 fm (=1.8 m), HH 13.ii.1937, SAM H673 (1); Second Valley, 8-12′ (=2.4-3.7 m), WZ, KGH 31.vii.1985, SAM H674 (1).
Victoria: Mornington, USNM 83004 (1) (Squires 1966: pl. 1, figs 1-7); Beaumaris, USNM 353570 (2); Altona Bay, USNM 353571 (1); Port Phillip Bay, USNM 353569 (2).
Tasmania: Badger I., Furneaux Group, viii.1969, TM K860 (2); Weymouth, v.1963, TM K859 (1); Capc Portland, 28.xii.1969, TM K861 (1); Kelso, 1.i.1979, TM K858 (3); Green's Beach, 5.iii.1985, TM K964 (2).

Distribution

Australia: around the entire coastline (Veron 1986: 510); 0-30 m. Tropical Indo-West Pacific from the Red Sea to the Marshall Is and Fiji; 0-30 m. The material examined from Tasmania may be subfossil.

Family RHIZANGIIDAE d'Orbigny, 1851

Culicia Dana, 1846

7. *Culicia australiensis* Hoffmeistcr, 1933
(Figs 2a, d, g)

Cylicia rubeola: Dennant, 1904: 9.
Culicia australiensis Hoffmeister, 1933: 12, pl. 3, figs 3, 4; Wells, 1958: 263, pl. 1, figs 3, 4; Squires, 1960: 200, fig. 8.
?*Culicia* sp. *cf. C. quinaria:* Wells, 1958: 263, 264, pl. 1, figs 5-7.
Culicia sp. Veron, 1986: 600, black and white fig.

Description

Colonies reptoid (encrusting), corallites asexually budding from a common basal coenosteum in proximity to other corallites, or linked by a very thin, fragile stolon which results in more widely spaced corallites. Colonies small, largest contiguous cluster of corallites 3.0 × 2.2 cm, consisting of 18 corallites (SAM H420). Corallites cylindrical, with a circular to slightly irregularly-shaped calice up to 6 mm in diamcter; corallites up to 11 mm tall. Corallites epithecate.

Septa hexamerally arranged in four complete cycles. S_{1-2} consist of a broad (up to 0.75 mm wide), sometimes slightly exsert septal lobe, having straight, entire, vertical inner edges, the lower inner edges bearing two tall (about 0.35 mm), slender (0.20 mm) paliform lobes (Fig. 2a). S_3 about half width of S_{1-2} and lobate for entire length, bearing 2-3 large lobes apically and 2-3 progressively narrower and taller lobes adjacent to columella. S_4 quite narrow, but bear 4-8 tall, slender lobes (Fig. 2d); inner edges of S_4 do not reach columella. Septa closely spaced (about 0.11 mm apart), the thickness of an S_{1-2} being about 0.16 mm. In large coralla, all septa are nonexsert, the theca extending upward in a fragile, nonseptate lip encircling the calice. Septal faces covered by coarse granules about 60 μm in diameter. Fossa deep, containing a papillose columella of 10-15 elements, the innermost lobes of the S_{1-3} grading imperceptibly into columella.

Discussion

Although found in the same geographic region and having the same calicular dimensions, *C. australiensis* is easily distinguished from *C. hoffmeisteri* Squires, 1966 in having the septa more numerous (36-48 *vs* 20-24), more closely spaced, in three size-classes and with different dentition.

Wells (1958) tentatively identified four specimens from Tasmania as *C. quinaria* Tenison-Woods, 1878; however, an examination of nine of the 15 syntypes (Fig. 2h) of *C. quinaria* (deposited at the Maclcay Museum, University of Sydney) shows them to be different. In contrast to the species description of Tenison-Woods (1878), all nine syntypes had hexamerally arranged septa in three cycles (24 septa), occasionally with one pair of S_4 (up to 26 septa). The Tasmanian specimens have 32-48 septa and more closely resemble the septal arrangement and shape of *C. australiensis*, and are therefore tentatively identified as this species. *C. quinaria*, known only from off Port Jackson (Fig. 2h), differs from *C. australiensis* in having the septa fewer (24 *vs* 36-48), more widely spaced, less dissected and more delicate.

Material Examined (all single colonies)
Western Australia: BANZARE Stn 76, E of Albany, 62 m, SAM H405 (Wells 1958); Esperance, 17-19 fms (=31-35 m), WAM 1853; Guton I., Recherche Archipelago, 15 m, WAM 131-85; 'Soela' Stn 21 (1981), 78 m, SAM H406; 'Comet' Stn 2, 180 m, SAM H737; 40 Nm (=72 km) W of Eucla, 72 fms (=132 m), JV iii.1912, SAM H407.
South Australia: St Francis I., 15-20 fms (=27-37 m), JV, SAM H408; W of St Francis I., 35 fms (=64 m), JV, SAM H409; near E. Franklin I., 6 m, PA, NH 25.ii.1983, SAM H410; near Boston I., 10-25′ (=3-7.6 m), WZ, KGH 17.ii.1988, SAM H411; Kirkby I., 20-30′ (=6.1-9.2 m), KGH, NH 31.i.1986, SAM H412, and 10-45′ (=3-13.7 m), WZ, KGH 28.i.1986, SAM

H413b; Royston Head, 15 fms (=27 m), JV, SAM H414; off Cape Borda, 55 fms (=101 m), JV, SAM H415; Investigator Strait, 14 fms (=26 m), SAM H417, 20 fms (=37 m), SAM H418 and no depth, SAM H419, all JV; Gulf St Vincent, JV, SAM H416; Cape Jervis, 23 fms (=42 m), EH, SAM H420; between Gulf St Vincent and Backstairs Passage, 17-22 fms (=31-40 m), JV, SAM H421; Backstairs Passage, 17-22 fms (=31-40 m), SAM H422/USNM 85675 and 'deep water', SAM H432, both JV; off Cape Jervis, 30 m, SAS 13.v.1980, SAM H424/USNM 85674; Cape Jaffa, 130 fms (=238 m), JV, SAM H425.

Eastern Bass Strait: 'Silver Gull' Stn 1, 63 m, NMV F56965.

Tasmania: BANZARE Stn 115, 128 m, SAM H426, 427 (Wells 1958, tentatively as *C. quinaria*).

Distribution

Southern Australia, from just east of Albany, Western Australia, to eastern Bass Strait and eastern Tasmania; 3-238 m.

8. *Culicia hoffmeisteri* Squires, 1966
(Figs 3a-d)

Cylicia rubeola: Tenison-Woods, 1878: 324, 325; Howchin, 1909: 247.
Culicia tenella: Hoffmeister, 1933: 11, pl. 3, figs 1, 2; Totton, 1952: 975, 976, pl. 36, figs 7, 8; Shepherd & Veron, 1982: 174-176 (part: fig. 4.54e).
Culicia hoffmeisteri Squires, 1966: 171, 172, pl. 1, fig. 3; Eguchi, 1973: 86, pl. 1, figs 6, 7.

Description

Colonies reptoid, corallites united basally by thin, broad (about 4 mm) stolons separated by as much as 4-5 mm from adjacent corallites; however, sometimes corallites are directly adjacent, with laterally fused theca and no apparent stolon. Largest colony examined 7 × 3 cm in size, consisting of approximately 100 closely adjacent corallites. Corallites cylindrical, with a circular to slightly irregularly-shaped calice up to 6.0 mm in diameter; corallites rarely taller than 5 mm. Corallites usually epithecate, showing fine, horizontal growth bands, but some specimens that are asexual clones of those that have epitheca have, instead, a noncostate granular theca. Theca about 0.10 mm thick and sometimes completely encrusted by calcareous algae.

Septa hexamerally arranged in three complete cycles; however, 20-22 septa per corallite is not uncommon, and larger corallites often have a variable number of very rudimentary S_4. S_1 composed of three or four very coarse lobes, the largest lobe constituting as much as half of a septum (0.23-0.33 mm wide). In other specimens, however, inner edges of S_1 are less lobate, sometimes dissected by narrow clefts that delineate lobes. S_2 usually same size as S_1 and therefore often indistinguishable, or slightly smaller, having smaller and finer septal lobes. S_3 about half width of S_{1-2} and bear 3-8 (usually three or four) small (0.10-0.11 mm wide and 60 μm tall), horizontally projecting teeth and usually a massive paliform lobe up to 0.6 mm tall, 0.45 mm wide basally, and 0.20-0.30 mm wide apically. These P_3 sometimes fuse with inner edge of adjacent S_2. S_{1-2} about 0.1 mm thick; S_3 about 80 μm thick; all septa widely and evenly spaced about 0.25 mm apart. Inner edges of S_{1-2} reach columella; inner edges of S_3 reach columella via their paliform lobes. If an S_3 does not bear a P_3, its inner edge extends only about half distance to columella. Septa nonexsert, the upper edges of all septa very narrow or nonextant on upper, inner rim of theca, this theca extending up to 0.8 mm as a delicate nonseptate lip encircling the calice. All septal faces, including septal teeth and paliform lobes, covered with coarse granules about 60 μm in diameter. Fossa deep and spacious, containing a papillose columella consisting of 10-15 cylindrical, granular elements loosely interconnected among themselves and to the P_3. P_3 larger and higher than columellar elements and triangular in shape.

Discussion

Approximately 12 species are known in the genus *Culicia*, at least five of which are known from off Australia: *C. tenella* Dana, 1846; *C. verreauxi* Milne Edwards & Haime, 1850; *C. quinaria* Tenison-Woods, 1878; *C. australiensis* Hoffmeister, 1933; and *C. hoffmeisteri* Squires, 1966. Whereas most reports of living *C. rubeola* (Quoy & Gaimard, 1833) from Australia were probably based on Dennant (1904) (which was actually *C. australiensis*), *C. rubeola:* Tenison-Woods, 1878 from the Port River, Adelaide, was almost certainly *C. hoffmeisteri*, the only *Culicia* known to occur in that district. Tate (1890) reported *C. rubeola* from Pleistocene deposits at Dry Creek on the Adelaide Plain, South Australia; in the absence of his material (so far not traced), no ascription to species is possible.

Among the Australian species, *C. hoffmeisteri* appears to be most similar to *C. tenella*. The type of *C. tenella* (USNM 184) is small and poorly preserved, but topotypic specimens believed to be the same species (USNM 78553) have 24 widely spaced septa in two size-classes, as in *C. hoffmeisteri*, but lack P_3, and their lower septal dentition and columella are composed of laciniate trabeculae.

Material Examined (all single colonies except where indicated)

Western Australia: Emu Point, Albany, WAM 403-86 (2).

South Australia: Pearson I., rockpools, WZ 24.xi.1976, SAM H428; Franklin Is., WZ, PA *et al.* 24.ii.1983, SAM H429; Donington Reef, 3 m, anon.

28.ii.1978, SAM H430; Spencer Gulf, between Mount Young and Wallaroo, 10 fms (=18 m), SAFD 8.iii.1938, SAM H431; Kirkby I., 10-45′ (=3-13.7 m), WZ, KGH 28.i.1986, SAM H413a; Investigator Strait, 14 fms (= 26 m), JV, SAM H432; American River, Kangaroo I., 10-20′ (=3-6.1 m), KGH 1.ii.1989, SAM H727; Outer Harbour, Adelaide, RB 9.v.1965, SAM H433/USNM 85679; Port Adelaide Creek, SAM H434; off Port Stanvac, 95′ (=29 m), SS 26.iii.1966, SAM H435; Rapid Bay, JW 2.xi.1977, SAM H437; off Cape Jervis, 90′ (=27.5 m), RS 17.i.1980, SAM H436; West I., Encounter Bay, SS 12.ii.1966, SAM H438. **Victoria:** Portsea Hole, 25 m, SS, SAM H439; Pope's Eye, Port Phillip, USNM 83003 (paratype of *C. hoffmeisteri*) and USNM 53416 (topotype); Beaumaris, Port Phillip, 7 m, USNM 353573; Interlock, 29.xi.1958, NMV F56827.
Eastern Bass Strait: no locality, 30 m, anon., SAM H440.
Fossil: **South Australia:** Hindmarsh Bore, 450-487′ (=137-148 m), in core, Adelaide, Pliocene, USNM 67957 (*ex* NZGS 1083).

Distribution

Continental shelf of southern and south-eastern Australia from Franklin Is and Pearson I., eastern Great Australian Bight, to Victoria and eastern Bass Strait; no records from Tasmania; 0-29 m. Pliocene: Adelaide, South Australia.

Astrangia Milne Edwards & Haime, 1848

9. *Astrangia atrata* (Dennant, 1906), comb. nov.
(Figs 3e-g)

Dendrophyllia atrata Dennant, 1906: 163-165, pl. 6, figs 5a, b; Howchin, 1909: 248; Shepherd & Veron, 1982: 178, fig. 4.54g.
Tubastrea atrata: Squires, 1961: 19.
?Astrangia woodsi: Shepherd & Veron, 1982: 176, fig. 4.54c; Veron, 1986: 601, 2 figs.

Description

Colonies plocoid to reptoid, corallites united basally by a thick, encrusting common coenosteum. Occasionally small corallites project perpendicular to thecal edges of larger corallites, perhaps as the result of independent settlement. Largest colony examined (SAM H445) 2.8 × 2.3 cm in diameter, consisting of 19 corallites. Corallites cylindrical, with a circular to slightly irregularly-shaped calice up to 7.5 mm in diameter; corallites up to 12 mm tall. Costae equal, low, and rounded, sometimes becoming carinate near calicular edge. Intercostal striae narrow and shallow. Costae coarsely granular. According to Dennant (1906), an epitheca envelopes the thecal base, but specimens are usually too encrusted with attached organisms for this structure to be visible. Theca light brown; corallum within calice brown to black.

Septa hexamerally arranged in four complete cycles (48 septa). S_{1-2} have slightly exsert upper septal lobes followed by 7-12 (number depends on size of calice) tall, slender, ornately spinose septal teeth (Fig. 3g) that gradually decrease in size toward the columella and eventually merge into columella. S_3 about three-quarters width of S_{1-2} with an equal number (but smaller in size) of septal teeth. S_4 about half width of S_3, composed of 6-7 septal teeth. S_{1-2} independent, septa of both cycles reaching the columella. S_3 also reach columella but their inner edges tend to curve toward, but do not fuse with, the S_2 within their respective systems. Likewise, pairs of S_4 curve toward, but do not fuse with, the respective S_3 in their half-systems. This arrangement of septa tends to isolate the six S_1 and confer an easily recognized hexameral symmetry upon each calice. Septal faces covered by tall (0.13-0.16 mm) pointed spines, often taller than thickness of septa they adorn, thereby giving a crowded appearance to calice. Fossa deep and regularly concave, bordered by upper edges of septal teeth and columella. Columella papillose, composed of 10-15 slender elements, indistinguishable from lower S_{1-3} septal teeth.

Discussion

Only one other species of *Astrangia* is known from Australia, *A. woodsi* Wells, 1955, described from off Brisbane. *A. woodsi* differs in having smaller corallites (2-4 mm in calicular diameter), correspondingly fewer septa (36 or fewer), and a white corallum.

Material Examined

South Australia: Inside D'Entrecasteaux Reef, 15-30 m, on ascidian, SS iii.1980, SAM H720(1); Cape Jervis, 90′ (=27.5 m), RS 17.i.1980, SAM H466(1); Backstairs Passage, 22 fms (=40 m), JV, USNM 85673(1) (*ex* SAM H443); ?S.Aust. (no data), SAM H444(1).
Victoria: Horn Point, Wilson's Promontory, 25.i.1971, NMV F56968 (2).
Eastern Bass Strait: no locality, 30 m, SAM H445(1).
New South Wales: Port Hacking, 9 m, USNM 82177(1); off Sydney, 9 m, USNM 80412(1).

The Verco colony from Backstairs Passage might be considered a syntype of *Dendrophyllia atrata* Dennant, except that before the present study it was unidentified, an indication that Verco had not sent it to Dennant with the other original material.

Distribution

Continental shelf of southern and south-eastern Australia from eastern Great Australian Bight (D'Entrecasteaux Reef) to off Sydney, New South Wales; no records from Tasmania; 9-40 m.

Family MUSSIDAE Ortmann, 1890

Scolymia Haime, 1852

10. *Scolymia australis* (Milne Edwards & Haime, 1849)
(Figs 4a-d)

Caryophyllia australis Milne Edwards & Haime, 1849a: 239, pl. 8, fig. 2.
Isophyllia australis: Milne Edwards & Haime, 1857: 375 (in part: not specimen from Barbados).
?*Scolymia vitiensis* Brüggemann, 1877: 304, 305.
Homophyllia australis: Brüggemann, 1877: 311, 312; Dennant, 1904: 8, pl. 2, fig. 2; Howchin, 1909: 246, 247; Wells, 1964: 378, 379 (synonymy); Squires, 1966: 171, pl. 1, figs 4, 5.
Culicia magna Tenison-Woods, 1878: 325, pl. 4, figs 3a-c; Totton, 1952: 975, pl. 36, figs 9-11.
Scolymia australis: Veron & Pichon, 1980: 250-252, figs 425, 775; Shepherd & Veron, 1982: 174, fig. 4.54h, pl. 19.5; Veron, 1986: 402, 403, 5 colour figs; Veron & Marsh, 1988: 91.

Description

Corallum solitary (see Discussion for exceptions), bowl-shaped to turbinate, and firmly attached by a broad pedicel, which is sometimes up to 90% of calicular diameter in width. Solitary coralla up to 39 mm in diameter; calices circular to irregular in outline, one (Squires 1966: pl. 1, figs 4, 5) with periodically invaginated calicular edges. A thin epitheca, usually encrusted with organisms, covers lower theca. Above level of epitheca, costae variable in thickness (depending on costal cycle), rounded, and finely granular. Costae separated by deep intercostal furrows, each about 0.2 mm wide. Polyps brilliant green, cream, red, blue, or combinations of these (Veron & Pichon 1980).

Septa hexamerally arranged in five cycles (96 septa), large specimens having an incomplete sixth and even seventh cycle. S_{1-2} equal in size, thick (about 0.5 mm), and reach the columella, conferring an easily recognized symmetry upon each calice. Each S_{1-2} bears 7-17 (number depends on calicular diameter) coarse, vertical teeth, which occur along entire septal edge. S_3 bear 8-16 septal teeth, which are slightly smaller in height and width than those on S_{1-2}; S_3 reach columella, but only as rudimentary septa deep within fossa. S_4 and S_5 bear 5-15 septal teeth, and 2-6 septal teeth, respectively, the teeth of each successive cycle shorter and narrower, those of the inner S_4 and S_5 laciniate. S_4 extend about three-quarters distance to columella; S_5 much smaller, extending about one-third distance to columella. All septa slightly exsert at calicular edge. All septal faces, as well as septal teeth, bear small, pointed granules. Fossa variable in depth depending on corallum shape, but usually shallow. Columella trabecular, circular to elliptical, and 3-5 mm in diameter.

Discussion

Although most of the specimens reported herein are solitary coralla, about 10% are colonial, having 2-6 calicular centres per corallum (Fig. 4a, b). These colonies are up to 56 mm wide and their centres are linked by robust lamellae. Veron & Pichon (1980) strongly implied that the widespread *S. vitiensis* was a junior synonym of *S. australis*, but, nonetheless, they and Veron (1986) retained them as separate species. Based on the variation of *S. australis* found in the South Australian specimens and that of *S. vitiensis* as illustrated by Veron & Pichon (1980), we advocate synonymizing the two.

Material Examined

Western Australia: Flinders Bay, Augusta, WAM 357-79(1); Point d'Entrecasteaux, WAM 34-43(1); King George Sound, WAM 2-87(1); Cheyne Beach, WAM 246-85(1); Hopetoun, WAM 418-86(1); Duke of Orleans Bay, WAM 247-85(1) (see Veron & Marsh 1988: 91); Quaranup, Albany dist., WAM 193-88(3). **South Australia:** St Francis I., 'beach', JV, SAM H449(1), 3-5 m, WZ 25.i.1982, SAM H450(8), in rockpool, WZ 26.i.1982, SAM H451(26), 10 m, WZ, AG 29.i.1982, SAM H452(7); Franklin Is, 2-5′ (=0.6-1.5 m), WZ, PA 25.ii.1983, SAM H453(1), in shallows and rockpools, WZ, PA 26.ii.1983, SAM H454(6); Port Blanche, Streaky Bay, 6-20′ (=1.8-6.1 m), WZ, KGH 9.iii.1988, SAM H455(6); Sheringa, 3 m, MK 3.i.1979, SAM H456(1); Coffin Bay, 1-6′ (=0.3-1.8 m), WZ, KGH 6.iii.1987, SAM H457(8); Donington Reef, 3 m, anon. 28.ii.1978, SAM H458(2); Tumby Bay jetty, 1-5 m, WZ, KGH 21.i.1988, SAM H459(8); Reevesby I., 10′ (=3 m), WZ 13.i.1984, SAM H460(7), rockpools, MC 20.i.1985, SAM H461(2), intertidal, ES 20.i.1986, SAM H462(1), 10-20′ (=3-6.1 m), WZ, KGH 24.i.1986, SAM H463(3), 10-15′ (3-4.6 m), WZ, KGH 25.i.1986, SAM H464(8); Turfey's Rocks, 5-10′ (=1.5-3 m), WZ, KGH 27.i.1986, SAM H465(1); Roxby I., 20′ (=6.1 m), NH 9.i.1984, SAM H466(1), ?depth, NH 25.ix.1982, SAM H467(2); Langton I., 5-12′ (=1.5-3.7 m), WZ, KGH 25.i.1986, SAM H468(24)/USNM 85710(3); N of Partney Shoal, 10-25′ (=3-7.6 m), WZ, KGH 22.i.1986, SAM H469(1); Smith Rocks, intertidal, ES 28.i.1986, SAM H470(3); reef E of Blythe I., 5-20′ (=1.5-6.1 m), WZ, KGH 29.i.1986, SAM H471(11)/USNM 85709(4); Marum I., 15-20′ (=4.6-6.1 m), WZ 8-13.i.1984, SAM H472-476(27), 10-35′ (=3-10.7 m), WZ, KGH 20,23.i.1986, SAM H477(2), 478(4); E of Lusby Rocks, 10-15′ (=3-4.6 m), WZ, KGH 24.i.1986, SAM H479(4); Lusby I., 20′ (=6.1 m), WZ 11.i.1984, SAM H480(1); Winceby I., 30′(=9.2 m), WZ 12.i.1984, SAM H481(1); Kirkby I., 10-45′ (=3-13.7 m), WZ, KGH 28.i.1986, SAM

H482(5), 10-35′ (=3-10.7 m), NH, KGH 31.i.1986, SAM H483(2); Wedge I., RS 29.xii.1963, SAM H484(1); Point Turton jetty, 6-15′ (=1.8-4.6 m), WZ, KGH 25.xi.1985, SAM H485(3); Gleeson's Landing, reef, WZ, IK 8.xi.1976, SAM H486(5); Chinaman's Hat Rock, 8 m, BH, WAM 553-81(1); Edithburgh, 20′ (=6.1 m), KGH 11.ii.1984, SAM H487(4), 10-25′ (=3-7.6 m), KGH, WZ 24.xi.1985, SAM H488(3), 1-5 m, KGH, WZ 19.xi.1986, SAM H489(1); Stansbury, 1-3 m, KGH, WZ 18.xi.1986, SAM H490(5); Nepean Bay, Kangaroo I., FM 7-9.v.1938, SAM H491(2); off Cape D'Estaing, Kangaroo I., 35-55′ (=10.7-16.8 m), KGH 30.i.1989, SAM H492(5); Outer Harbour, Adelaide, 15′ (=4.6 m), FW 30.i.1958, SAM H493(1); West Beach, Adelaide, 1.5 m, SS ii.1966, SAM H494(1); Kingston Park, Adelaide, cast up on shore, RS 6.ix.1961, SAM H495(1); Port Noarlunga, 10′(=3 m), FW 10.i.1959, SAM H496(1); Port Willunga, intertidal, IT 13.iii.1979, SAM H497(1); Second Valley, 8-12′ (=2.4-3.7 m), WZ, KGH 31.vii.1985, SAM H498(3).

Victoria: Mornington, Port Phillip Bay, NMV F57157(3)/USNM 83002(1) (*ex* Port Phillip Bay Survey, *vide* Squires 1966: 171).

Distribution

S. australis s.s.: Australia: southern and eastern coastal waters, from Rottnest I., Western Australia (Veron & Marsh 1988: 91) to Port Phillip Bay, Victoria, also Elizabeth and Middleton Reefs, Queensland and Lord Howe I. (Veron 1986: 402); 0-16.8 m; ?*S. vitiensis:* Indo-Pacific, including Great Barrier Reef (Veron 1986: 400).

Family ANTHEMIPHYLLIIDAE Vaughan, 1907

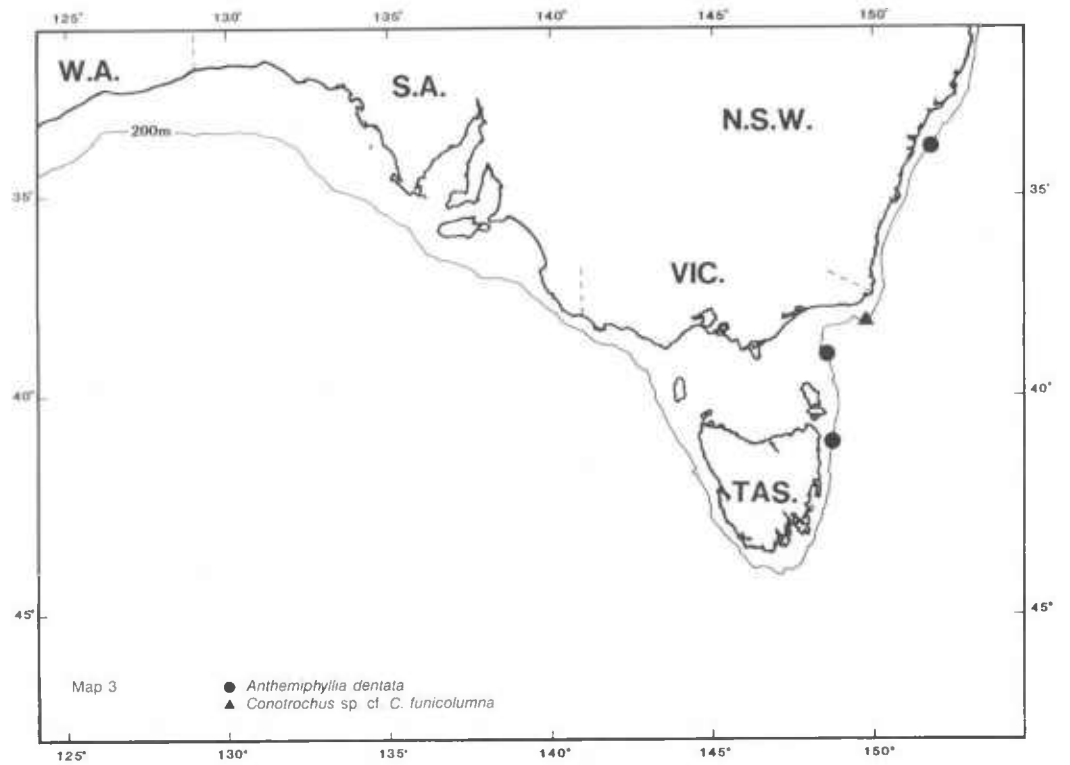
Anthemiphyllia Pourtalès, 1878

11. *Anthemiphyllia dentata* (Alcock, 1902) (Figs 4c, f, Map 3)

?*Discotrochus investigatoris* Alcock, 1893: 142, pl. 5, figs 5, 5a.

Discotrochus dentatus Alcock, 1902: 27, pl. 4, fig. 26; Faustino, 1927: 63, pl. 7, figs 1, 2; Yabe & Eguchi, 1937: 143-145, pl. 20, figs 15a-c; Gardiner & Waugh, 1938: 194.

Anthemiphyllia dentata: Yabe & Eguchi, 1942b: 128, 129; Wells, 1958: 264, pl. 1, figs 8-11; Eguchi, 1968:



C29-30, pl. C6, figs 12-21; Veron, 1986: 604, fig.; Best & Hoeksema, 1987: 398, 399, figs 9a-c.
Not *Anthemiphyllia dentata:* Cairns, 1984: 11, pl. 1, figs F, G (undescribed species).

Description

Corallum discoidal (patellate), with a flat to slightly convex (bowl-shaped) base. Scar of attachment 1.8-2.0 mm in diameter; however, only very small specimens are still attached. Largest specimen known 27.5 mm in calicular diameter (Yabe & Eguchi 1937). Costae approximately equal in width (up to 0.5 mm wide in large specimens) and rounded, bearing small, pointed granules scattered on all sides. Intercostal grooves increase in both width and depth with distance from epicentre, up to 0.25 mm wide in large specimens; however, in small specimens, and even the innermost 6-8 mm of larger specimens, intercostal grooves are very shallow and sometimes bisected by low ridges, which attenuate with distance from epicentre.

Septa hexamerally arranged in five cycles, the fifth cycle complete only in largest of specimens. Specimens 16-24 mm in calicular diameter have a variable and gradually increasing number of S_5 pairs. Most coralla very uneven in S_5 development, the same specimen having half-systems with no S_5, some with one pair of S_5, and some half-systems with a full two pairs of S_5. S_1 independent, extending to columella and conferring an easily recognized hexameral symmetry upon calice. S_2 also extend to columella but are loosely joined by innermost septal spines of adjacent S_3 near columella. Likewise, S_3 usually joined by innermost septal spines of adjacent S_4 several mm from columella. S_5 rudimentary and do not attain the columella. All septa low in profile and equally exsert at calicular edge. All septa bear tall, robust septal spines, often blunt-tipped, which very gradually increase in height and thickness with distance from epicentre. Outermost S_1 septal spines up to 1.2 mm tall and 0.55 mm in diameter; however, spines of higher cycle septa approximately same height but progressively less thick, resulting in tall but slender spines on innermost S_{3-5}. Lateral edges of septal spines granular; septal faces also sparsely granular. Innermost septal spines flattened in a plane perpendicular to septum; middle septal spines roughly cylindrical; outermost spines massive and flattened in the plane of septum. Septal spines always independent, separated from one another by approximately their own diameter, never fused into septal lobes. Number of septal spines per septum a function of calicular diameter, a large specimen (*e.g.*, calicular diameter above 24 mm) having 16-20 spines per S_{1-3}, 14-15 per S_4, and 9-10 per S_5; smaller specimens have correspondingly fewer spines. Fossa relatively shallow, containing a papillose columella, which is simply a circular field of the innermost S_{1-2} septal spines.

Discussion

There are three described Recent species of *Anthemiphyllia: A. patera* Pourtalès, 1878 (western Atlantic, 500-700 m); *A. pacifica* Vaughan, 1907 (Hawaiian Islands, 205-296 m); and *A. dentata* (Alcock, 1902). *A. patera* is easily distinguished by its smaller size, porcellaneous, noncostate base, four cycles of septa, and massive columella (Cairns 1979).

Both Yabe & Eguchi (1942b) and Wells (1958) considered *A. pacifica* to be the juvenile stage of *A. dentata,* but Cairns (1984) argued for its distinction. To reiterate, *A. pacifica* has a smaller adult size than *A. dentata,* only four cycles of septa, and a more turbinate (instead of patellate) corallum.

The specimen identified as *A. dentata* by Cairns (1984) from the Hawaiian Islands is now considered to represent an undescribed species. It differs from typical *A. dentata* in corallum shape (deep bowl-shaped), in lacking a scar of attachment, and in having peripheral septal lobes on S_{1-3}.

Discotrochus investigatoris Alcock, 1893, is undoubtedly a juvenile *A. dentata* and would have nomenclatural priority; however, the type of this species has not been examined to confirm this synonymy.

Material Examined

Western Australia: 'Comet' Stn 1, 240 m, SAM H722(1).
Eastern Bass Strait: 'Kimbla' Stn K7/73-37, 256 m, NMV F57153(1).
Tasmania: BANZARE Stn 115, 128 m, SAM H500(2), 501(1) (Wells 1958).
New South Wales: off Cronulla, NSW, USNM 83010(1); 'Nimbus' Stn 12, USNM 78611(1).
Queensland: 'Nimbus' Stn 55, 270-272 m, USNM 78609(2).

Distribution

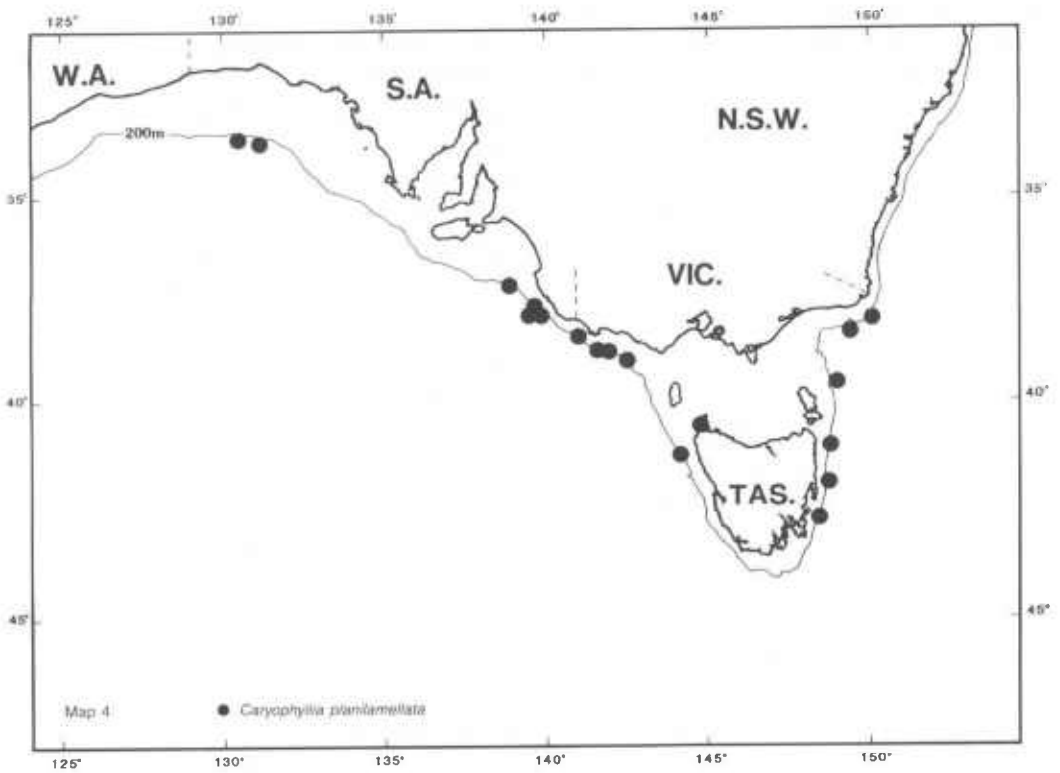
Outer continental shelf and upper slope of southern and eastern Australia: Great Australian Bight (Western Australia), off north-eastern Tasmania, eastern Bass Strait, off New South Wales and off southern Queensland; 128-272 m. Off western India, Maldives, Japan, Sulu Sea, Indonesia; 75-522 m. Pleistocene: Ryukyu Is.

Suborder Caryophylliina Vaughan & Wells, 1943
Superfamily Caryophylliicae Dana, 1846

Family CARYOPHYLLIIDAE Dana, 1846

Caryophyllia Lamarck, 1801

12. *Caryophyllia planilamellata* Dennant, 1906
(Figs 4g-i, Map 4)



Caryophyllia planilamellata Dennant, 1906: 157, 158, pl. 6, figs 4a, b; Howchin, 1909: 246.
Caryophyllia cyathus: Hoffmeister, 1933: 14, pl. 4, figs 4, 5.
Caryophyllia clavus: Wells, 1958: 265, pl. 1, figs 12, 13; ?Shepherd & Veron, 1982: 176, 177 (in part: not fig. 4.55b).
Not *Caryophyllia profunda:* Zibrowius, 1974b: 754; Cairns, 1982: 17.

Description

Corallum ceratoid and cornute, gradually tapering toward pedicel in a curved or bent fashion. Pedicel slender (1.5-4.5 mm in diameter) and usually detached from substrate but occasionally remaining attached. Largest specimen (Dennant 1906) 26 x 23 mm in calicular diameter and 47 mm tall. Calice slightly elliptical, GCD:LCD ranging from 1.05-1.14. Theca porcellaneous, composed of equal (about 0.5 mm wide), flat costae that bear very low, rounded granules; intercostal striae narrow and shallow.

Septa arranged in three size-classes, the total number dependent on calicular diameter. Most adult coralla have 80 septa (20:20:40), but arrangements of 18:18:36 (72), 22:22:44 (88), and even 24:24:48 (96) septa are also found, although the last is rare. Primary septa moderately exsert, with straight, vertical inner edges that extend only about 0.7 distance to columella. Secondary septa less exsert and about three-quarters width of primaries, each bearing a wide palus of approximately equal width (2.5-3.0 mm) to the secondary septum. Pali (18-24) rounded apically, each separated from its secondary septum by a deep (3.0-3.5 mm), narrow (about 0.25 mm) notch. Inner edges of secondary septa straight to slightly sinuous. Tertiary septa only slightly less exsert but approximately half width of secondaries, becoming rudimentary lower in fossa; inner edges of tertiary septa straight. Septal faces smooth and flat, bearing few, low granules. All septa thin; interseptal spaces 2-3 times septal width. Fossa relatively shallow. Pali form a distinct, elliptical crown within calice, their lower, inner edges fused to columella. Columella robust and fascicular, composed of 7-20 broad, twisted laths arranged in a tightly fused, elongate mass or individualized. Apices of columellar elements extend to lower level of notch separating pali from septa.

Discussion

Both Zibrowius (1974b) and Cairns (1982) incorrectly attributed *C. planilamellata* and *C. clavus sensu* Wells (1958) to *C. profunda*. *C. profunda* differs in having a straight corallum with a massive pedicel, four size-classes of septa ($S_{1-2} > S_3 > S_4 > S_5$) with highly exsert S_{1-2}, relatively narrow pali, and a deeper fossa. It is known from circum-Subantarctic localities and New Zealand at 35-1 116 m (Cairns 1982).

Wells (1958) was correct in equating *C. planilamellata* and *C. cyathus sensu* Hoffmeister (1933) with his *C. clavus* from Tasmania; however, *C. clavus* Scacchi, 1835 is a junior synonym of *C. smithii* Stokes & Broderip, 1828, a species endemic to the eastern Atlantic (Zibrowius 1980), and *C. cyathus* (Ellis & Solander, 1786) is also endemic to the eastern Atlantic. The earliest available name for the South Australian and Tasmanian species is thus *C. planilamellata*.

Material Examined

South Australia: 131°E (SE of Eucla), 200 fms (=366 m), 'Endeavour', AM G13396 (=E3740) (1); 130°24′E (SE of Eucla), 130-180 fms (=238-329 m), 'Endeavour', AM G12288 (=E3741) (3)/USNM 80427(1) (all *C. cyathus* of Hoffmeister 1933); off Cape Jaffa, 130 fms (=238 m), JV 25.xii.1905, SAM H504(43), 300 fms (=549 m), JV 25.xii.1905, SAM H505(47)/USNM 85678(3); off Beachport, 100 fms (=183 m), SAM H506(1), 110 fms (=201 m), SAM 507(7), 150 fms (=275 m), SAM H508(6), 200 fms (=366 m), SAM H509(56), all JV; 'Silent Victory' Stn 0, 4 000′ (=1 220 m), SAM H510(5); 'Halcyon' Stn 2, 705 m, NMV F56825(1) and 677-714 m, NMV F56823(1); 'Silent Victory' Stn 1, 300-412 m, SAM H513(1); 'Silent Victory' Stn 2, 330-570 m, SAM H512(2).

Victoria: W of Cape Nelson, 165-201 m, 28.vii.1969, NMV F56819(3); off Cape Nelson, 220-293 m, v.1969, NMV F56807(11); 'Vema' Stn 18-105, 369 m, USNM 82176(1); SE of Portland, 220-293 m, 9.vi.1969, NMV F56817(3); S of Warrnambool, 220-310 m, 14.v.1969, NMV F56816(4); 'Soela' Stn 34, 446 m, SAM H514(1); 'Soela' Stn 27, 452 m, SAM H511(1).

Eastern Bass Strait: 'Kimbla' Stn K7/73-46, 201 m, NMV F56894(1).

Tasmania: between Woolnorth Point and King I., 183 m, AM, 1.iii.1979, TM K1119(1); 'Soela' Stn 51, 520 m, SAM H517(6)/USNM 85680(2); BANZARE Stn 115, 128 m, SAM H515(1), H516(26) (*C. clavus* of Wells 1958); Cape Lodi, ? depth, v.1954, NMV F56814(1); 'Soela' Stn 3-84-77, 506 m, NMV F56787(2)/USNM85719(1).

Distribution

Southern and south-eastern Australia, mainly continental slope, from western South Australia (130°24′E) to eastern Victoria, eastern Bass Strait and Tasmania; 128-714 m, 1 220 m.

13. *Caryophyllia sarsiae* Zibrowius, 1974
(Figs 5b, c, e, f, Map 5)

Caryophyllia sarsiae Zibrowius, 1974a: 779-782, pl. 3, figs a-f; Zibrowius, 1980: 62, 63, pl. 24A-J (synonymy).
Caryophyllia sp. Zibrowius, 1974b: 755, 756, pl. 1, fig. 11, pl. 2, fig. 1.
Caryophyllia profunda: Cairns, 1982: 17-19 (in part: 'Eltanin' 1403).

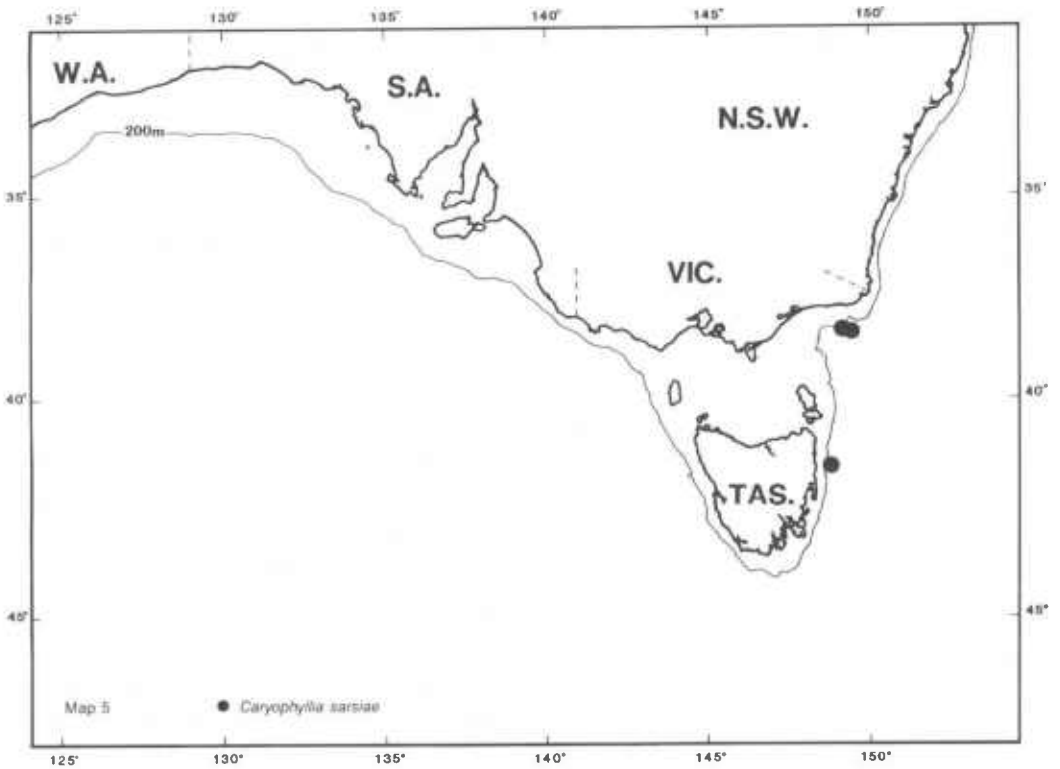
Description

Corallum ceratoid and straight, firmly attached by robust, stereome-reinforced pedicel approximately half calicular diameter in width. Pedicel and lower portion of corallum sometimes irregularly bent. Largest Australian specimen ('Soela' Stn 16 [1987], TM K1120) 19.3 x 17.3 mm in calicular diameter and 58 mm tall. Calice elliptical to irregular in outline. Theca porcellaneous, composed of equal (about 0.75 mm wide), flat costae that bear very low rounded granules; intercostal striae absent. Porcellaneous, light brown theca usually extends only several mm from calice (edge zone), below which the theca is either encrusted or chalky white in color.

Among the 10 specimens examined, four have septa hexamerally arranged in four cycles (48 septa, 12 pali), and six have septa heptamerally arranged in four cycles (56 septa, 14 pali). S_{1-2} (or 14 primaries) highly exsert (up to 3 mm) and thick (up to 1 mm thick), with straight inner edges that almost attain the columella, overlapping with the P_3 in distance toward the columella. S_3 (or secondaries) much less exsert (about 1 mm), about three-quarters width of S_{1-2}, and have thickened, slightly sinuous inner edges. S_4 (or tertiaries) equally exsert as S_3 but only about 0.8 width and have straight inner edges. Septal faces appear smooth, bearing only very small, pointed granules. A distinct crown of 12-14 broad (1.5 mm wide) P_3 occur in fossa, each palus separated from its corresponding S_3 by a deep, narrow notch. Pali usually same thickness as septa but in some specimens 2-3 times as thick. Fossa moderately deep, containing the palar crown, which encircles a fascicular columella composed of 2-6 twisted laths, in some specimens greatly thickened.

Discussion

Zibrowius (1974a, 1980) noted some variation in the number of pali (and corresponding number of septa and symmetry) in this species, ranging from 10-13; however, in over 200 specimens he did not report a specimen with 14 pali. Nonetheless, the hexameral South Australian specimens (those with 12 pali and 48 septa) are extremely similar to typical eastern Atlantic *C. sarsiae*, and the heptameral specimens (those with 14 pali and 56 septa) are clearly the same species as the hexameral.



Material Examined

Eastern Bass Strait: 'Franklin' Stn Slope 33, 930 m, NMV F57172(5)/USNM 85731(1); 'Franklin' Stn Slope 40, 400 m, NMV F57165(1).

Tasmania: 'Soela' Stn 16 [1987], 1 090-1 150 m, TM K1120(3).

Other: various reference specimens in USNM from eastern Atlantic, Bermuda and New Zealand.

Distribution

Australia: continental slope, eastern Bass Strait and off eastern Tasmania; 400 m, 930-1 150 m. North-eastern Atlantic (Zibrowius 1980), off Bermuda, South Africa, St Paul I., New Zealand; 520-2 200 m.

This species has not previously been reported from Australia.

Crispatotrochus Tenison-Woods, 1878

14. *Crispatotrochus inornatus* Tenison-Woods, 1878 (Figs 5a, d, g, h)

Crispatotrochus inornatus Tenison-Woods, 1878: 309, 310, pl. 6, figs 2a-c; Cairns, 1979: pl. 12, fig. 5 (lectotype of *C. cornu* designated).

Cyathoceras cornu Moseley, 1881: 156, 157 (in part: 'Challenger' 163); Hoffmeister, 1933: 9, 10, pl. 12, figs 5, 6.

Description of Holotype

Corallum ceratoid: 9.1 x 7.5 mm in calicular diameter, 12.1 mm tall, and firmly attached through a thick pedicel 5.0 mm in diameter. Costae broad, equal, and flat, covered by low granules and separated by very thin, shallow intercostal striae. Septa hexamerally arranged in four complete cycles according to formula: $S_{1\text{-}2} > S_3 > S_4$. $S_{1\text{-}2}$ moderately exsert and have straight inner edges that almost attain the columella. S_3 half as exsert as $S_{1\text{-}2}$ and have slightly sinuous inner edges that extend almost as far toward columella. S_4 equally exsert as S_3 but only half the width, their inner edges poorly formed, often dentate to laciniate. Septal granules sparse, but most apparent as rows of triangular granules on S_3 septal face undulations. Columella deeply recessed, composed of 28-32 narrow, twisted laths, all interconnected laterally and basally.

Discussion

Only four specimens of *C. inornatus* (the type-species of *Crispatotrochus*) are known: the holotype, Hoffmeister's (1933) *C. cornu*, the paralectotype of *C.*

cornu Moseley, 1881, and a small specimen from 'Soela' Station 30. Hoffmeister's specimen from Bass Strait is much larger than the holotype (16.4 x 12.7 mm in calicular diameter) and differs in having 50 septa, ridged costae near the calice, and a relatively smaller, less finely composed columella. The paralectotype of *C. cornu* ('Challenger' Stn 163), slightly larger than the holotype of *C. inornatus*, has three pairs of S_5 (54 septa) and a much smaller columella. Nonetheless, these differences are considered to fall within the range of variation of the species.

Cairns (1991) resurrected the genus *Crispatotrochus* and recognized 12 species, noting *C. inornatus* to be most similar to *C. galapagensis* Cairns, 1991.

Material Examined

Eastern Bass Strait: no locality, 'Endeavour', AM E4657(1) (*C. cornu* of Hoffmeister 1933).
Victoria: 'Soela' Stn 30, 190 m, WZ, SAM H519(1).
New South Wales: paralectotype of *C. cornu*, HMS 'Challenger' Stn 163, BMNH 1880.11.25.60 (see below); holotype of *C. inornatus*, Macleay Museum, off Port Stephens, 80 fms (=146 m).

Distribution

South-eastern Australia: outer continental shelf and (?upper) slope from eastern Bass Strait to Port Stephens, New South Wales; 146-220 m (??4 023 m).

The specimen reported by Moseley (1881) from 'Challenger' 163, off Twofold Bay, New South Wales, 120 fms is contradictory in data. According to the 'Challenger' cruise narrative (Tizard *et al.* 1885), 'Challenger' 163 was off Twofold Bay but at 2 200 fathoms (=4 023 m), whereas 'Challenger' 163D was at 120 fathoms but off Sydney Harbour. Either way, the specimen is from south-eastern New South Wales. The depth of 120 fathoms (=220 m) seems the more likely.

Paraconotrochus gen. nov.

Diagnosis

Corallum solitary, turbinate, and free. Thick septotheca weakly costate. Paliform lobes (often obscure) present on third septal cycle. Columella papillose to labyrinthiform.

Discussion

Paraconotrochus is most similar to *Conotrochus* Seguenza, 1864, as defined by its type-species *C. typus* Seguenza, 1864, and two Recent species: *C. brunneus* (Moseley, 1881) and *C. funicolumna* (Alcock, 1902). Points of similarity include their similar columella, weakly costate theca, and thick septotheca. *Paraconotrochus* differs primarily in having paliform lobes. It also differs in having a free, turbinate corallum (*vs* an attached, ceratoid corallum) and in lacking the distinctive thecal rim (or septal notch) characteristic of all species of *Conotrochus*.

Paraconotrochus is also similar to *Caryophyllia*, especially those specimens of *Paraconotrochus* in which paliform lobes (P_3) are well developed; however, it is distinguished by having a papillose to labyrinthiform columella (*vs* fascicular) and poorly differentiated paliform lobes, which are often lacking.

Two other species are tentatively placed in this genus: *Gardineria antarctica* Gardiner, 1929 and *Duncania capensis* Gardiner, 1904, a grouping previously implied by Cairns (1989a).

Etymology

Named after its resemblance and surmised evolutionary proximity to *Conotrochus* Seguenza, 1864. Gender: masculine.

Type-Species

Paraconotrochus zeidleri, here designated.

Distribution of genus

Off Tasmania, New South Wales, South Africa, circum-Antarctic; 87-728 m.

15. *Paraconotrochus zeidleri* sp. nov.
(Figs 5i, 6a, b)

Cyathoceras sp. Veron, 1986: 606, fig.

Description

Corallum turbinate, expanding rapidly from a small pedicel (1.2-2.3 mm in diameter) to a broad, elliptical calice (GCD:LCD = 1.15-1.28). Largest specimen 26.1 x 21.0 mm in calicular diameter and 21.4 mm tall, the height usually being equivalent to LCD. Corallum usually free of substrate, even at a small size, revealing the pedicel scar. Theca quite thick and nonepithecate. Costae not well differentiated: equal, about 0.3 mm wide, and rounded to ridged. Intercostal furrows shallow, also about 0.3 mm wide. Costae a porcellaneous white and covered with coarse, low granules.

Septa hexamerally arranged in five cycles; however, end half-systems often have additional pairs of S_6, whereas lateral half-systems often lack pairs of S_5. $S_{1\text{-}2}$ equal in size, moderately exsert (up to 2.5 mm above calicular edge), and have straight, vertical inner edges that extend to the columella. S_3 less exsert and only about 0.8 width of $S_{1\text{-}2}$, usually internally bordered by a broad, flat paliform lobe, which merges with adjacent columella. Each P_3 separated from its S_3 by a deep notch of variable width. In some coralla (*e.g.*, holotype), P_3 are well developed, each separated by a narrow notch from its S_3, but in other specimens, P_3 are difficult to distinguish from the columella. S_4 about 0.8 width of S_3, their lower, inner edges often

fused to their adjacent S_3 or P_3. S_5 rudimentary, only about 0.2 width of S_4. Inner edges of all septa straight; septal and palar faces covered with low, pointed granules. Upper, outer edges of all septa exsert to some degree, but not forming a thecal rim or notch around calicular perimeter. Fossa relatively shallow, containing a massive, elongate columella of variable structure, ranging from papillose to labyrinthiform. Paliform lobes sometimes extend as labyrinthiform plates of the columella. Height of paliform lobes and columellar elements similar.

Discussion

Paraconotrochus zeidleri differs from *P. antarcticus* (Gardiner, 1929), comb. nov. in lacking P_{1-2} and in having exsert septa (see Cairns 1982).

Etymology

Named after the collector, Wolfgang Zeidler, Marine Invertebrate Section, South Australian Museum.

Material Examined

Holotype

Tasmania: 'Soela' Stn 51, 41°15′S, 144°08′E, 25 Nm (=46.5 km) W of Richardson Point, 520 m, coll. W. Zeidler 20.x.1984, SAM H520.

Paratypes

Tasmania: SAM H521 (1, figured), SAM H522(45)/USNM 85677(5), as for holotype; 'Socla' Stn 45, 41°14′S, 144°07′E, 25.5 Nm (=46.5 ks) W of Richardson Point, 520 m, coll. W. Zeidler 19.x.1984, SAM H524(4).

New South Wales: 'Kapala' Stn K76-24-01, 33°42′S, 151°52′E, 457 m, 20.xii.1976, AM G15271(11); 'Kapala' Stn K75-09-03, 29°52'S, 153°43'E, 502 m, 10.xi.1975, AM G15262(4).

Other material

New South Wales: 'Kapala' Stn K75-09-08, 29°26′S, 153°49′E, 250 fms (=457 m), 12.x.1975, AM G15044(2) (*Cyathoceras* sp. of Veron 1986: 606, fig.).

Distribution

Known from five stations on the Australian continental slope, two off western Tasmania and three off New South Wales; 457-520 m.

Conotrochus Seguenza, 1864

16. ***Conotrochus*** sp. *cf.* ***C. funicolumna*** (Alcock, 1902)
(Fig 6c, f, Map 3)

Ceratotrochus (Conotrochus) funicolumna Alcock, 1902: 11, 12, pl. 1, figs 6, 6a.
Conotrochus funicolumna: Cairns, 1984: 14, pl. 2, figs I, J.

Description (based on single worn specimen examined)

Corallum ceratoid: 16.7 x 14.5 mm in calicular diameter, 26.6 mm tall, and 2.2 mm in pedicel diameter. Wall thick, covered with epitheca. Septa 62, hexamerally arranged in five cycles, the fifth incomplete: every system has one pair of S_5 and one system has both pairs of S_5. S_{1-2} appear to be equal in size, their thickened, lower, inner edges fusing to the columella. S_3 only slightly narrower, also fusing with columella. S_4 rudimentary, unless flanked by a pair of S_5, in which case they are almost as large as an S_3, their lower, inner edges fused to inner edges of the adjacent S_3 near the columella. S_5 rudimentary, equivalent in size to S_4 in underdeveloped half-systems. Inner edges of all septa straight and vertical. Septal faces bear sparse, low granules. Pali and paliform lobes absent. Columella massive, labyrinthiform.

Discussion

The specimen described above compares well to specimens identified as *C. funicolumna* by Cairns (1984) from the Hawaiian Islands. A definitive identification is not made, however, because of the poor condition of the specimen, its large size and correspondingly high number of septa (upper extreme for this species), and its elliptical calice (normally circular).

C. funicolumna has not been previously reported from Australia. The related *C. brunneus* (Moseley, 1881) is known from southern Western Australia (specimens in SAM); it has also been reported from eastern and south-eastern Australia by Veron (1986: 607 and *in litt.*), though so far we have been unable to trace the material upon which this report was based. *C. funicolumna* differs from *C. brunneus* in having a larger corallum (11-16 mm in calicular diameter *vs* 6-8 mm) with more septa ($\geq$48 *vs* $<$48), in lacking stereome within the corallum and in lacking pigmentation.

Material Examined

Victoria: 'Soela' Stn 33, 442 m, SAM H525(1).

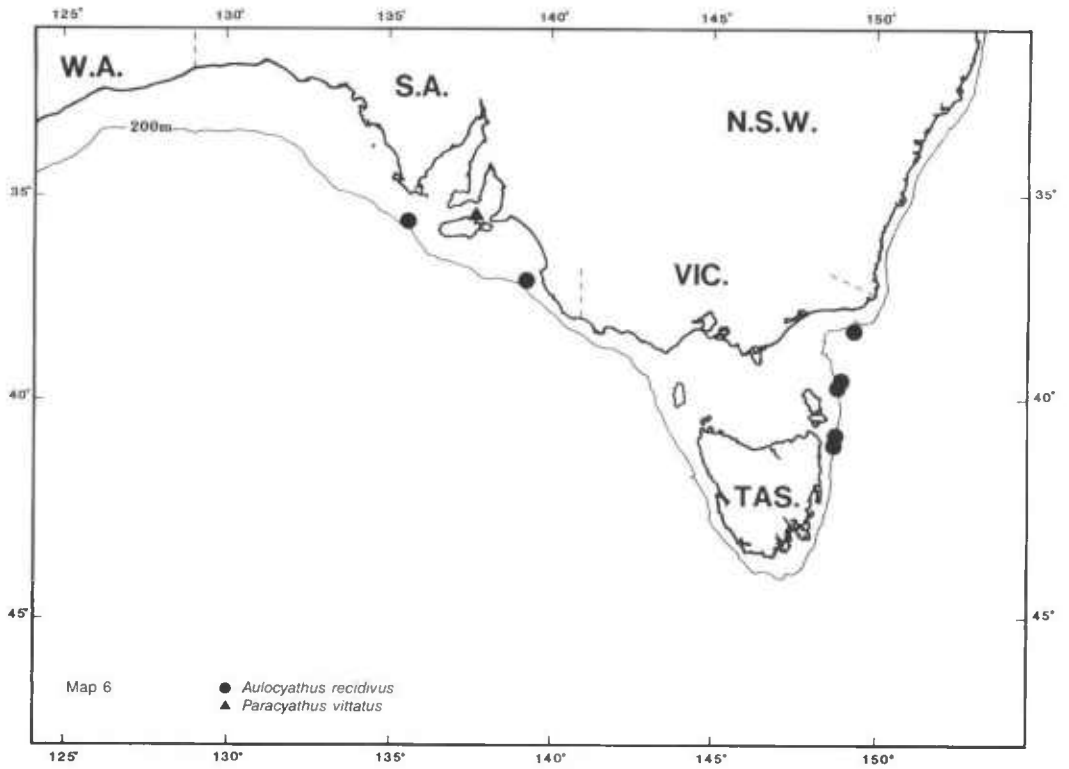
Distribution

Australia: off Cape Everard, Victoria; 442 m. Sulu Sea, off Japan, Hawaiian Islands; 165-600 m.

Aulocyathus Marenzeller, 1904

17. ***Aulocyathus recidivus*** (Dennant, 1906)
(Figs 6d, e, g, h, Map 6)

Ceratotrochus recidivus Dennant, 1906: 159, 160, pl. 6, figs 1a, b, 2a-c; Howchin, 1909: 246.
Ceratotrochus (Conotrochus) typus: Wells, 1958: 265, 266, pl. 1, figs 14, 15.



Paracyathus conceptus: Squires & Keyes, 1967: 23, part: pl. 2, figs 7, 8.
Aulocyathus recidivus: Cairns, 1982: 25-26, pl. 7, figs 7-9, pl. 8, fig. 1; Veron, 1986: 607.

Description

Corallum ceratoid, straight to slightly curved, and invariably attached to internal surface of a fragment of a parent corallum from which it asexually originated through longitudinal parricidal budding. Largest specimen examined (BANZARE Stn 115) 11.5 mm in calicular diameter and 25.1 mm tall; however, most southern Australian specimens are 6.0-7.5 mm in calicular diameter. Calices usually circular, rarely slightly elliptical. Calicular perimeter minutely and regularly serrate, a thecal apex corresponding to each septum. Theca smooth and glistening, having weakly developed costae, if at all, and bearing very low, coarse granules.

Septa hexamerally arranged in 4-5 cycles, the last cycle incomplete (up to 66 septa); however, hexameral symmetry usually difficult to determine because of similar sizes of S_{1-3} and unequal development of fifth cycle septa. Specimens 6-7 mm in calicular diameter usually have heptameral symmetry in four cycles, the fourth cycle incomplete (*e.g.*, 7:7:14:14-16, 32-42 septa), pairs of quaternary septa developed irregularly within calice. The largest specimen of 11.5 mm calicular diameter has 66 septa: five half-systems having no S_5, five having one pair of S_5, and two half-systems having both pairs of S_5. S_{1-2} equal in width in larger coralla and have straight, vertical inner edges that attain the columella. S_3 about three-quarters width of S_{1-2} and S_4 much smaller, about one-third width of S_3, unless flanked by a pair of S_5, in which case the flanked S_4 is three-quarters to full width of an S_3. S_5, when present, equivalent in size to unaccelerated S_4. Septal faces covered by low granules. In smaller specimens with heptameral symmetry (*e.g.*, syntypes; NMV F57169), there is a gradual decrease in septal width with increasing cycle number, the seven primary septa easily distinguished as the widest septa. All septa nonexsert, their upper, outer (thecal) edges forming a small notch where they join theca. Fossa deep. Columella large, papillose.

Discussion

Among the Australian scleractinians, *A. recidivus* is most similar to *Conotrochus funicolumna*. Both species have weakly developed costae, a similar septal notching, and lack pali. Wells (1958), in fact, identified several specimens of *A. recidivus* as *Conotrochus typus*. *A. recidivus* differs from *Conotrochus* in having longitudinal parricidal budding and a thinner theca.

Material Examined
Eastern Bass Strait: 'Kimbla' Stns K7/73-46, 201 m, NMV F56889(1), K7/73-47, 274 m, NMV F56808(1), 79-K-1-33, 293-329 m, NMV F56885(2).
Victoria: 'Franklin' Stn Slope 32, 1 000 m, NMV F57169(5)/USNM 85726(2).
Tasmania: BANZARE Stn 115, 128 m, SAM H526(1), H527(5) (*C. typus* of Wells 1958); 'Sprightly' Stn 73-2051, 399 m, AM G15266(5).

Distribution
Southern and south-eastern Australia: 64 km south-west of Neptune Is and off Cape Jaffa, South Australia, eastern Bass Strait and north-eastern Tasmania; 128-399, 1 000 m. Macquarie Ridge, south-west of New Zealand (Cairns 1982); 366 m.

Paracyathus Milne Edwards & Haime, 1848

18. *Paracyathus vittatus* Dennant, 1906
(Map 6)

Paracyathus vittatus Dennant, 1906: 156, pl. 5, figs 3a, b; Howchin, 1909: 246; Shepherd & Veron, 1982: 176.

Diagnosis
Corallum subcylindrical: 4.0 x 3.5 mm in calicular diameter and 3.5 mm tall, firmly attached by a broad pedicel. Lower 1.0 mm of corallum epithecate, upper 2.5 mm bear granular costae. Septa hexamerally arranged in four cycles according to formula: $S_{1-2} > S_3 > S_4$; however, Dennant's illustrated holotype shows only 46 septa, one end half-system lacking a pair of S_4. All septa exsert, but higher cycle septa progressively less so. Septal faces covered by tall, pointed granules. Pali in two crowns before S_{1-2}, separated from their respective septa by deep, wide notches. Columella fascicular.

Discussion
This species is known only from the holotype, which is not present at the SAM, AM, or RMNH, and is therefore presumed lost. Thus, the preceding diagnosis is based on Dennant's original account. Dennant (1906: 156) stated that pali were present 'before the primary and secondary septa'. By this we assume that he meant pali to have been present in two crowns before the S_{1-2} and S_3, as would be the case in *Paracyathus*.

Many species of *Paracyathus* are found throughout the tropical and temperate regions of the world. Besides *P. vittatus*, three others have been reported from Australia: *P. conceptus* Gardiner & Waugh, 1938 by Wells (1964); *P. porphyreus* Alcock, 1893; and an undescribed species alluded to by Veron (1986). Comparisons of *P. vittatus* with these species are not made here because of the small size (?juvenile) and unavailability of the single known specimen.

Material Examined
None.

Distribution
Known only by the unique holotype (now missing), from off Point Marsden, Kangaroo Island, South Australia; 31 m.

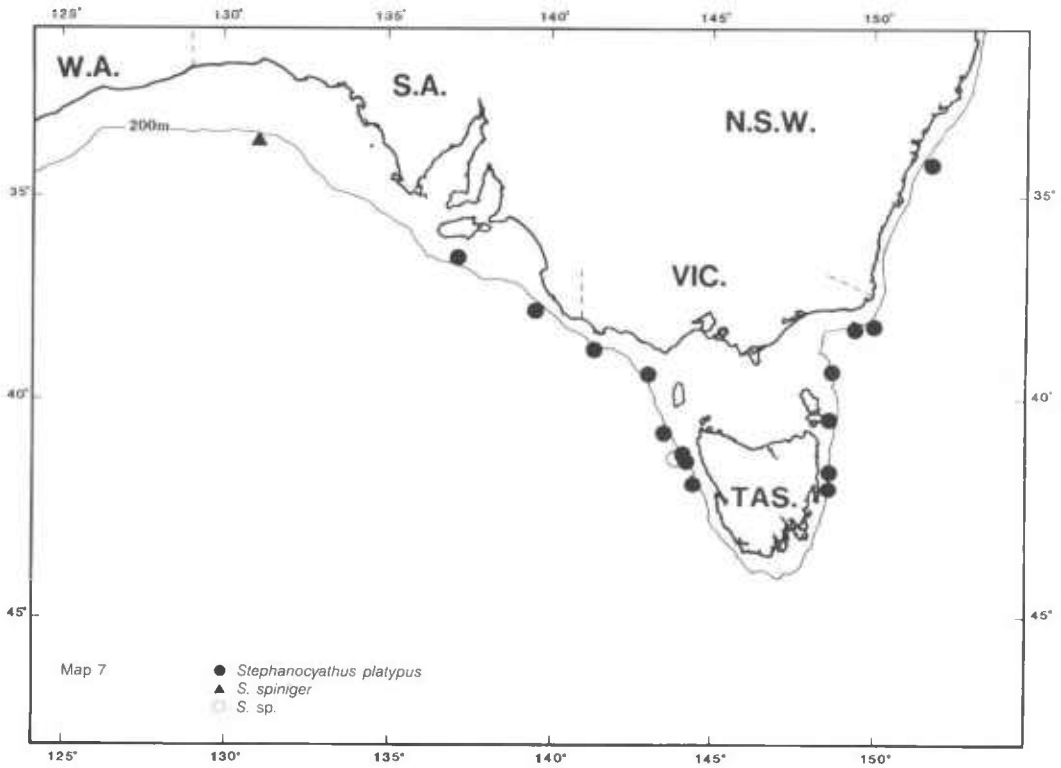
Stephanocyathus Seguenza, 1864

19. *Stephanocyathus (Stephanocyathus) platypus* (Moseley, 1876)
(Figs 7a-c, Map 7)

Ceratotrochus platypus Moseley, 1876: 554.
Stephanotrochus platypus: Moseley, 1881: 154, pl. 3, figs 4a, b.
Stephanocyathus sp. Squires & Ralph, 1965: 262, 263, figs 3, 4; Squires & Keyes, 1967: 24, pl. 2, figs 11, 12.
Stephanocyathus platypus: Cairns, 1982: 24, 25, pl. 7, figs 3-6 (synonymy).

Description
Corallum bowl-shaped and large: coralla up to 82 mm in calicular diameter and 49 mm tall (NMV F56967); however, most specimens examined fall within the 50-60 mm calicular diameter range. Base of young specimens (up to 35-40 mm diameter) flat to slightly convex, whereupon the thecal edges abruptly curve upward at a 60°-70° angle from horizontal. Epicentre of base often shows a small scar of attachment, 2.0-2.5 mm in diameter; in one case an adult specimen remained attached to a small gastropod shell. C_{1-2} ridged from epicentre to calice, prominently near calice. C_{3-6} ridged only on vertical thecal faces above point of thecal inflection. Calice circular; calicular margin highly serrate, having tall apices corresponding to the 12 S_{1-2} and much smaller apices for the S_{3-6}.

Septa hexamerally arranged usually in five cycles, but some specimens have an incomplete sixth cycle. For example, one specimen (in SAM H530) of 55.6 mm calicular diameter has 114 septa: five half-systems with no S_6, five with one pair of S_6, and two with two pairs. Larger specimens, however, may have only 96 septa. S_1 highly exsert (9-16 mm) and relatively narrow, their straight, inner edges following the contour of the underlying theca. S_1 inner edges greatly thickened (up to 1.3 mm) but not lobate, reaching almost to epicentre. S_2 also highly exsert (up to 7 mm) but clearly subordinate to S_1, their inner edges also thickened and falling about 2.5 mm short of the S_1. S_{3-6} much less exsert, rising only 1.5-2.0 mm above calicular edge. S_{3-4} of approximately same size, but each S_4 adjacent to the S_2 within a half-system is usually slightly longer than the S_3, and the other S_4 in the half-system (adjacent to the S_1) is usually slightly shorter than the S_3. Inner edges of S_4



sometimes loosely fused to inner edges of S_3 within same half-system. If pairs of S_6 are developed, the flanked S_5 is accelerated to about three-quarters width of an S_4. Otherwise, S_{5-6} rudimentary, extending only several mm from calicular edge. Septal faces smooth, with only very low, sparse granulation. Paliform lobes absent. Columella rudimentary, composed of a solid fusion of lower inner edges of S_{1-2}.

Discussion

As discussed by Cairns (1982), among the 14 species in the subgenus, *S. platypus* is most similar to *S. moseleyanus* (Sclater, 1886) (north-eastern Atlantic, 600-2 028 m). Aside from the species described below, no other species of this subgenus is known from Australia.

Material Examined

South Australia: 'Saxon Progress' Stn 0, 1 000 m, SAM H676(1); 'Silent Victory' Stn 0, 4 000′ (=1 220 m), SAM H528(3); 'Silent Victory' Stn 4, 1 000-1 060 m, SAM H529(2); 'Silent Victory' Stn 5, 933-1 098 m, SAM H530(8)/USNM 85681(2).

Victoria: 'Zeehan' Stn 1, 310-320 fms (=567-586 m), NMV F56791(1); 'Derwent Venture' Stn 2, 732-1 098 m, NMV F56792(1); 'Franklin' Stn Slope 34, 800 m, NMV F57159(1); 'Kimbla' Stn K7/73-8, 512 m, NMV F56963(6)/USNM 85728(1), F56964(2)/USNM 85733(1); 'Soela' Stn 28, 656 m, SAM H531(1).

Eastern Bass Strait: 'Soela' Stn 19, 660 m, SAM H532(3).

Tasmania: FRV 'Challenger' Stn 1, 860-1 060 m, TM K1129(3); halfway between Woolnorth Point and King I., 183 m, AM 1.iii.1979, TM K1128(2); 'Soela' Stn 51, 520 m, SAM H533(3); off Sandy Cape, 560 m, Evans 7.ix.1984, TM K1133(2); FRV 'Challenger' Stn 4, 963 m, TM K1131(1); 'Derwent Venture' Stn 1, 500-650 fms (=915-1 190 m), NMV F56966(1), F56967(1); 'Franklin' Stns Slope 45, 800 m, NMV F57176(1), Slope 46, 720 m, NMV F57158(1); 'Bluefin' Stn 1, 713 m, TM K1132(1); FRV 'Challenger' Stn 3, 625 fms (=1 144 m), TM K1130 (1).

Distribution

Australia: south-eastern continental slope from south of Kangaroo I., South Australia, eastwards around Tasmania and north to south-east of Sydney, New South Wales; 560-1 219 m (one occurrence on continental shelf, Bass Strait, 183 m). New Zealand waters and seamount east of New Zealand (Cairns 1982); 622-913 m.

20. *Stephanocyathus (Stephanocyathus)* sp.
(Figs 7d-f, Map 7)

Description

Corallum bowl-shaped: 28.8 mm in calicular diameter and 15.4 mm tall. Base of specimen slightly concave, but at a diameter of 16 mm the theca turns upward producing a full, almost hemispherical, corallum. Costae equal (about 1.1 mm wide on lateral surfaces) and rounded, becoming narrowly ridged near calice where the adjacent intercostal furrows become deeper and correspondingly wider. Costae bear coarse granules.

Septa hexamerally arranged in five cycles, the last incomplete (72 septa); every half-system contains one pair of S_5. S_{1-2} equal in size and 3-4 mm exsert. Each S_{1-2} bordered internally by a small paliform lobe about 1.6 mm wide and separated from its septum by a wide notch about 1.2 mm across. P_{1-2} surround columella and are easily distinguished from it by their lamellar shape and elevation above columella. S_3 narrower and less exsert (about 2.5 mm) than S_{1-2} but bear wider (3.6 mm wide) and taller (4.5 mm) paliform lobes, separated by wide (1.8 mm) notches. Apices of crown of 12 P_3 extend above calicular edge, whereas the apices of the P_{1-2} crown terminate 2-3 mm lower in fossa, about 1 mm above columella. S_4 flanked by S_5 are accelerated to a size equivalent to that of an S_3, their inner edges solidly fused to adjacent P_3. Unflanked S_4 and S_5 only 2 mm exsert and extend only several mm down theca. Inner edges of all septa straight; septal and palar faces smooth, covered by very low granules. Fossa shallow. Columella elongate, composed of a dozen fused papillae.

Discussion

Of the approximately 14 species in the nominate subgenus, four are known only as fossils from the European Pliocene and Miocene of Borneo, seven are apparently endemic to the Atlantic Ocean, and three occur in the Indo-West Pacific: *S. platypus* (Moseley, 1876), *S. nitens* (Alcock, 1891), and *S. oldhami* (Alcock, 1894). The species described above is easily distinguished from *S. platypus* by its distinctive paliform lobes, large columella, and equal-sized S_{1-2}. The other two Indo-West Pacific species, both described from the Laccadive Sea, Indian Ocean, have never been illustrated as such; however, their original descriptions distinguish them from the present specimen primarily by virtue of their spinose costae and small paliform lobes.

Among all of the described species in the subgenus, this specimen is remarkably similar to *S. paliferus* Cairns, 1979 (western Atlantic, 229-715 m), in corallum size and shape and the possession of prominent paliform lobes. *S. paliferus* differs in having four discrete cycles of paliform lobes (P_{1-4}) and in having its P_3 fused to its P_2, only its P_1 being independent. The Tasmanian specimen, although believed to represent an undescribed species, is not named herein because only one specimen is available for study.

Material Examined

Tasmania: 'Soela' Stn 51, 520 m, SAM H534(1).

Distribution

Off Richardson Point, north-western Tasmania; 520 m.

21. *Stephanocyathus (Acinocyathus) spiniger* (Marenzeller, 1888)
(Figs 7g-i, Map 7)

Stephanotrochus spiniger Marenzeller, 1888: 20-21.
Stephanotrochus tatei Dennant, 1899a: 117-118, pl. 3, figs 1a-c.
Odontocyathus sexradiis Alcock, 1902: 23, pl. 3, figs 2-2b.
Odontocyathus stella Alcock, 1902: 24, pl. 3, figs 2la, b.
Odontocyathus japonicus Yabe & Eguchi, 1932: 149-152, pl. 14, text-figs 1-3.
Odontocyathus sexradii (sic): Hoffmeister, 1933: 10, pl. 1, figs 6-8.
Odontocyathus spiniger: Yabe & Eguchi, 1942b: 124-125, pl. 10, figs 26-28; Eguchi, 1968: C39-40, pl. C23, figs 1, 2, pl. C20, figs 12-14.
Stephanocyathus (Acinocyathus) spiniger: Wells, 1984: 209, pl. 2, figs 10-13.
Stephanocyathus spiniger: Veron, 1986: 607, fig.

Description (based on single specimen examined)

Corallum bowl-shaped: 29.5 mm in calicular diameter, 21.0 mm tall, and supported basally by six long (up to 13 mm), tapered thecal spines that correspond to the C_1. Thecal spines begin to form at a calicular diameter of 12 mm and are straight, regularly curved, or bent. Corallum base flat and porcellaneous; corallum above thecal spines bears low, equal (about 0.7 mm wide), rounded costae covered with very small, well-spaced granules. Intercostal furrows narrow (0.25 mm) and shallow. Calice circular, calicular margin serrate, forming six prominent apices corresponding to six S_1 and their adjacent S_5, and much smaller apices corresponding to S_{2-5}.

Septa hexamerally arranged in five complete cycles (96 septa). S_1 highly exsert (up to 8 mm) and by far the largest septa. S_1 inner edges straight and vertical, each bordered by a broad (2.0 mm wide) paliform lobe separated from its septum by an even broader (2.5 mm) notch. In most non-Australian specimens, the upper, outer (calicular) edges of the S_1 are pigmented dark brown. S_2 only about 2.5 mm exsert and correspondingly narrow, but also bear equal-sized paliform lobes, together with the P_1 forming a crown

of lobes encircling and penetrating the columella. S_{3-5} progressively less exsert and wide, except for those S_5 directly adjacent to S_1, which are highly exsert. Each S_3 bears a large (2.5 mm) paliform lobe, together forming a crown of 12 lobes recessed slightly from columella. S_4 also bear narrow paliform lobes, forming a crown of 24 lobes recessed even farther from columella; however, inner edges of pairs of S_4 are usually solidly fused to the P_3 within its half-system. Thus, three crowns of paliform lobes are present: 12 P_{1-2} (indistinguishably associated with columella), 12 P_3, and 24 P_4. Septal and palar faces smooth, covered by low, sparse granules. Fossa relatively shallow. Columella papillose and elliptical in shape, composed of several central papillae flanked by the 12 P_{1-2}.

Discussion

When Wells (1984) established the subgenus *Acinocyathus* (type-species *S. spiniger*), he included seven species but implied that some of them might be synonymous, a conclusion reached by earlier authors (*e.g.*, Yabe & Eguchi 1942b; Squires 1958). Examination of Recent specimens from off Japan, the Philippines, and Australia, and Miocene specimens from Victoria convinces the senior author that all Recent specimens pertain to the same species and that even the Victorian Miocene *S. tatei* is also synonymous (Fig. 7h). It is very probable that *S. coloradus* (Smith, 1913) (Miocene to Pliocene, Philippines) and *S. sundaicus* (Gerth, 1923) (Miocene, Borneo) are also junior synonyms, which would make *Acinocyathus* a monotypic subgenus with a range from the Miocene to Recent.

Material Examined

South Australia: 131° E, 200 fms (=366 m), 'Endeavour', USNM 85318(1) (*ex* AM E3730) (*O. sexradii* of Hoffmeister, 1933).

Distribution

Australia: Central Great Australian Bight, 131°E, South Australia, 366 m; Miocene of Victoria. Japan, Philippines, Indonesia; 120-560 m; ? Miocene of Borneo; Pleistocene of Vanuatu; Neogene (*s.l.*) of Japan, Philippines (Wells 1984).

Deltocyathus Milne Edwards & Haime, 1848

22. *Deltocyathus magnificus* Moseley, 1876

(Figs 7j-l, 8a, Map 1)

Deltocyathus magnificus Moseley, 1876: 552-553; Moseley, 1881: 147-148, pl. 4, fig. 10, pl. 13, figs 1,2; Alcock, 1902: 20; Yabe & Eguchi, 1937: 138-140, pl. 20, figs 13, 14; Yabe & Eguchi, 1942b: 126.
Fungiacyathus sp. Veron, 1986: 598, fig.

Description

Corallum discoidal, with a perfectly flat, thin (0.15 mm) base. Larger of two Australian specimens examined 36.5 mm in calicular diameter and 10.8 mm tall (NMV F57164). Base covered by thin, equal, ridged costae, all of which extend 1.35-1.40 mm beyond calicular edge and merge with their corresponding septa. Only C_{1-2} present at epicentre; at calicular edge, costae 0.18-0.20 mm wide and separated by relatively deep, wide (up to 1 mm) intercostal furrows. Costal edges finely serrate to dentate. At a calicular diameter of 10-11 mm, each intercostal furrow of the larger specimen bears a discontinuous medial row of dentiform processes, which do not correspond to calicular septa. These pseudocostae are much lower than the C_{1-5}. Corallum white.

Septa hexamerally arranged in five complete cycles (96 septa). S_1 independent, each bearing a broad paliform lobe internally, which unites it to the columella. S_2 approximately same size as S_1, each also having a broad paliform lobe recessed slightly farther from columella than P_1. S_3 slightly smaller than S_2, each having a tall, broad paliform lobe internally that is loosely fused to the adjacent P_2. S_4 only about one-third to half calicular radius, each bearing a tall, broad paliform lobe, their inner edges loosely fused to the adjacent P_3. S_5 relatively smaller and nonpaliferous, their inner edges loosely joined to adjacent P_4. Thus, only the six S_1 are independent and confer the characteristic stellate pattern to the calice. The higher cycle septa all join to one another through their paliform lobes or inner edges. Four indistinct crowns of paliform lobes are present, all lobes equally broad but the P_{3-4} being the tallest of the lobes. Septal and palar faces covered by tall, pointed granules. Fossa shallow. Columella elongate and spongy, uniting the inner edges of the P_{1-3}.

Discussion

Of the approximately 17 valid Recent species of *Deltocyathus*, only two have five cycles of septa: *D. magnificus* and *D. fragilis* Alcock, 1902 (Indonesia, 794 m). Although the types of *D. fragilis* were not examined, a reference specimen from the Philippines (ALB-5601, USNM 86817) differs in having very small P_3, independent S_2, and an irregular calicular margin.

Material Examined

South Australia: 'Silent Victory' Stn 3, 150-170 m, SAM H540(1).
Victoria: 'Franklin' Stn Slope 27, 1 500 m, NMV F57164(1).
Moluccas: HMS 'Challenger' Stn 192, off Kei Is, 129 fms (=236 m), syntype of *D. magnificus*, BMNH.

Distribution

South-eastern Australia: continental shelf off Beachport, South Australia, 150-170 m, and continental

slope, eastern Victoria and eastern entrance to Bass Strait, 1500 m. Off Japan, Philippines, Indonesia; 88-522 m.

This species has not previously been reported from Australia.

Desmophyllum Ehrenberg, 1834

23. *Desmophyllum cristagalli* Milne Edwards & Haime, 1848
(Figs 8b, c, Map 8)

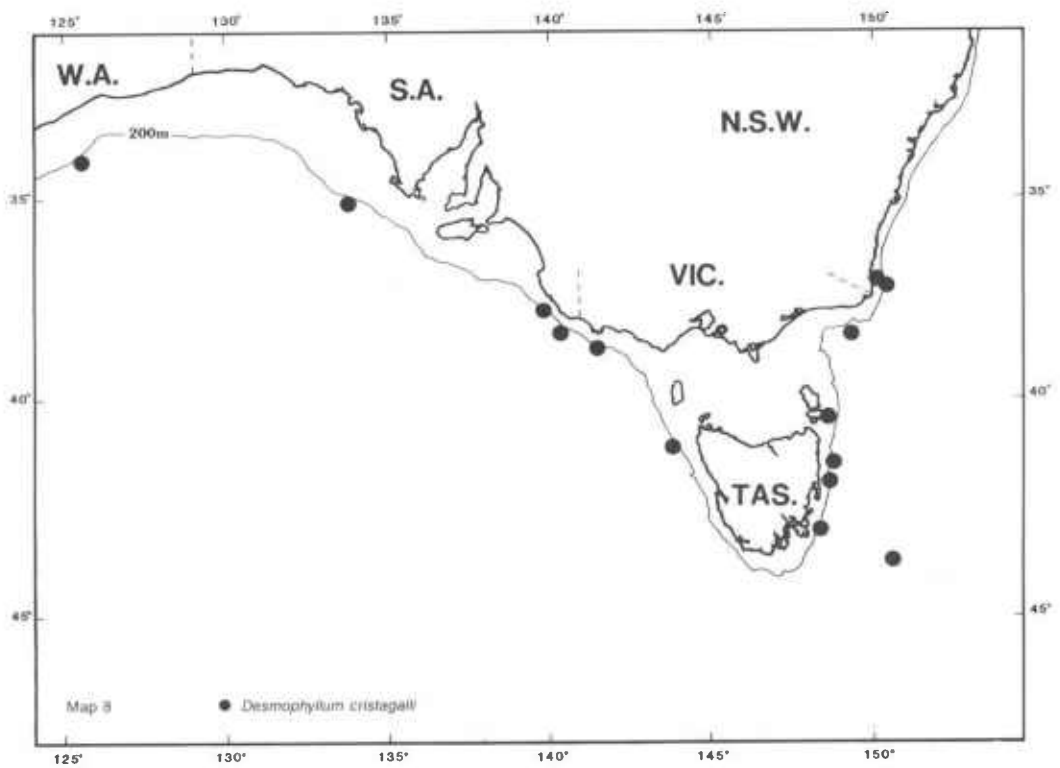
Desmophyllum cristagalli Milne Edwards & Haime, 1848a: 253, pl. 7, figs 10, 10a; Hoffmeister, 1933: 8, 9, pl. 2, figs 1-4; Cairns, 1979: 117-119, pl. 21, figs 7, 8, pl. 22, fig. 8 (synonymy); Zibrowius, 1980: 117-121, pl. 61, figs A-O, pl. 62, figs A-M (synonymy); Cairns, 1982: 29, 30, pl. 8, figs 8-12, pl. 9, figs 1-3; Veron, 1986: 608, fig.

Diagnosis

Corallum quite variable in shape, ranging from long and cylindrical to stocky and ceratoid with a flared upper theca. Coralla firmly attached by a thick pedicel. Independent settlement of planulae either near base of coralla or actually on lower theca of coralla give the false impression of coloniality. Calices circular, elliptical, irregular, or periodically invaginated; calices up to 50 × 80 mm in calicular diameter, but more typically 40-45 mm in GCD. Theca covered with low, fine granules; ridged costae (C_{1-3}) often correspond to first three cycles of septa. Septa hexamerally arranged in 5-6 cycles (96-192 septa), those specimens with invaginated calices often having S_7 (up to 324 septa). S_{1-2} large and quite exsert, with long, straight, vertical inner edges. Higher cycle septa progressively smaller and less exsert, except for those highest cycle septa adjacent to S^{1-2}, which are more highly exsert than expected. Septal faces flat and virtually smooth, covered by numerous, very small granules. Fossa deep; endothecal dissepiments sometimes present in elongate specimens. Columella and pali absent.

Discussion

It is not surprising to find *D. cristagalli* off southern Australia, for it is one of the approximately dozen species of cosmopolitan Scleractinia. All three forms (typical, *ingens*, and *capense*), as defined by Cairns (1982), are found in the region. The species is easily distinguished from other caryophylliids in the region by its lack of pali and columella.



Material Examined

Western Australia: 'Adelaide Pearl' Stn 1, 1 011-1 020 m, associated with *Solenosmilia variabilis*, SAM H536(7).

South Australia: 'Saxon Progress' Stn 2, 916 m, associated with *S. variabilis*, SAM H675(7+); 'Silent Victory' Stn 1, 300-412 m, SAM H537(1); 'Tuna Endeavour' Stn 1, 800-1 100 m, TM K1123(2).

Victoria: 'Sarda' Stn 1, 150-156 m, NMV F56881(2); 'Franklin' Stn Slope 32, 1 000 m, NMV F57170(5).

Eastern Bass Strait: no locality, 'Endeavour', USNM 85319(2) (*ex* AM E4660).

New South Wales: off Eden, 20-40 fms (=37-73 m), 'Endeavour', USNM 85320(1) (*ex* AM E5541); 'Endeavour', no data, USNM 85671(2) (*ex* AM E4651) (Hoffmeister 1933).

Tasmania: 'Derwent Venture' Stn 3, 1 098-1 281 m, NMV F56793(5); FRV 'Challenger' Stn 2, 960 m, TM K1122(3); 'Franklin' Stn Slope 47, 500 m, NMV F57175(1); off St Patrick's Head, *ca* 1 000 m, 12-15.vii.1986, TM K1093(2); 41°34.7′S, 148°44.6′E, ENE of St Patrick's Head, 1 090-1 150 m, 9.v.1987, TM K1092(29).

Cascade Plateau: 'Labrador' Stn 3, 990-1 150 m, associated with *S. variabilis*, SAM H730(27).

Distribution

Australia: southern and south-eastern continental slope (occasionally shelf), from Western Australia (125°31′E) to Tasmania, Bass Strait and southern New South Wales (off Eden), also Cascade Plateau; 37-1 281 m. Cosmopolitan, but not off continental Antarctica; 35-2 460 m (Cairns 1982). ?Pliocene of Italy (Hoffmeister 1933: 9).

Solenosmilia Duncan, 1873

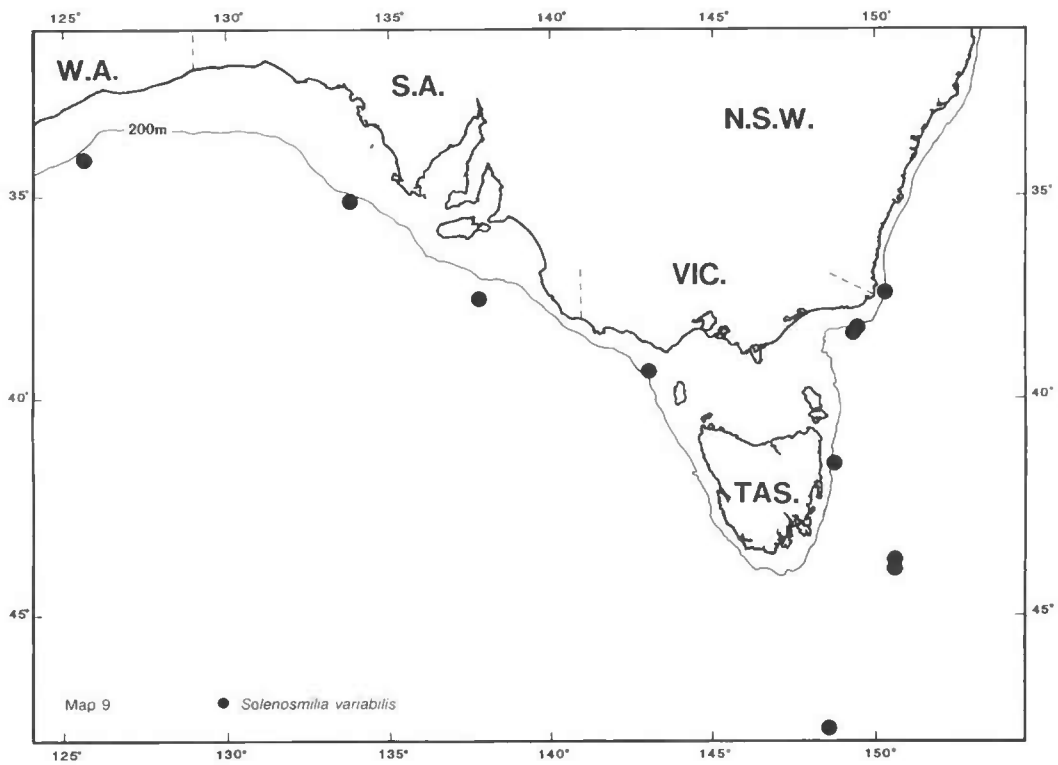
24. *Solenosmilia variabilis* Duncan, 1873

(Figs 8d, e, Map 9)

Solenosmilia variabilis Duncan, 1873: 328, pl. 42, figs 11-18; Hoffmeister, 1933: 14, pl. 4, fig. 7; Cairns, 1979: 136-138, pl. 26, figs 2-4 (synonymy); Cairns, 1982: 31, pl. 9, figs 4, 5.

Diagnosis

Colonies bushy, achieved by equal intratentacular budding resulting in dichotomous branching. Branch anastomosis common. Branch and calicular diameters 5-6 mm. Coenosteum usually smooth and grey, but may be granular or even costate near calicular edges.



Septa hexamerally arranged in 3-4 cycles, the insertion of S_4 very irregular but usually best developed just before intratentacular division. Septal face granulation tall and slender: granules 3-4 times septal width in height. Tabular endothecal dissepiments common and well spaced, allowing for a fast-growing and lightweight corallum. Columella rudimentary or absent; when present, a small, spongy mass.

Discussion

Only two species of colonial deep-water Scleractinia are known from the southern Australian region: *S. variabilis* and *Enallopsammia rostrata* (Pourtalès, 1878). *S. variabilis* is easily distinguished from the latter by having intratentacular budding and a light, bushy corallum.

Material Examined (all single samples)

Western Australia: 'Adelaide Pearl' Stn 1, 1 011-1 020 m, SAM H538.

South Australia: 'Saxon Progress' Stn 2, 916 m, with *D. cristagalli*, SAM H675; *ca* 100 Nm (=183 km) SSE of Cape du Couedic, 900-1 000 m, GN 14-18.ii.1988, SAM H539.

Victoria: 'Derwent Venture' Stn 2, 732-1 098 m, NMV F57078; 'Franklin' Stn Slope 32, 1 000 m, NMV F57166; 'Kimbla' Stn K7/73-7, 640 m, NMV 57152.

New South Wales: Green Cape, 470 fms (=860 m), USNM 85682 (*ex* AM G12259) (Hoffmeister 1933).

Tasmania: 'Soela' Stn 00, *ca* 1 000 m, TM K1127; 'Soela' Stn 16 1987, 1 090-1 150 m, TM K1092.

Cascade Plateau: 'Labrador' Stn 1, 740-1 100 m, SAM H731; 'Labrador' Stn 3, 990-1 150 m, associated with *D. cristagalli*, SAM H732-735.

South Tasmanian Rise: 'Soela' Stn 0, 1 056-1 066 m, NMV F57179.

Distribution

Australia: continental slope from southern Western Australia (125°31′E) eastward to Tasmania and northward to Green Cape, southern New South Wales, also Cascade Plateau and South Tasmanian Rise; 640-1 150 m. Widespread in Atlantic and Indian oceans (but not in Pacific), known also from subantarctic and antarctic seas (but not from Antarctica proper) (Cairns 1982); 220-2 165 m.

Family TURBINOLIIDAE Milne Edwards & Haime, 1857

Trematotrochus Tenison-Woods, 1879

25. *Trematotrochus verconis* Dennant, 1904
(Figs 9a, e, Map 10)

Trematotrochus verconis Dennant, 1904: 5, 6 (in part: pl. 1, fig. 4a); Howchin, 1909: 245; Shepherd & Veron, 1982: 176, fig. 4.54b.

Description

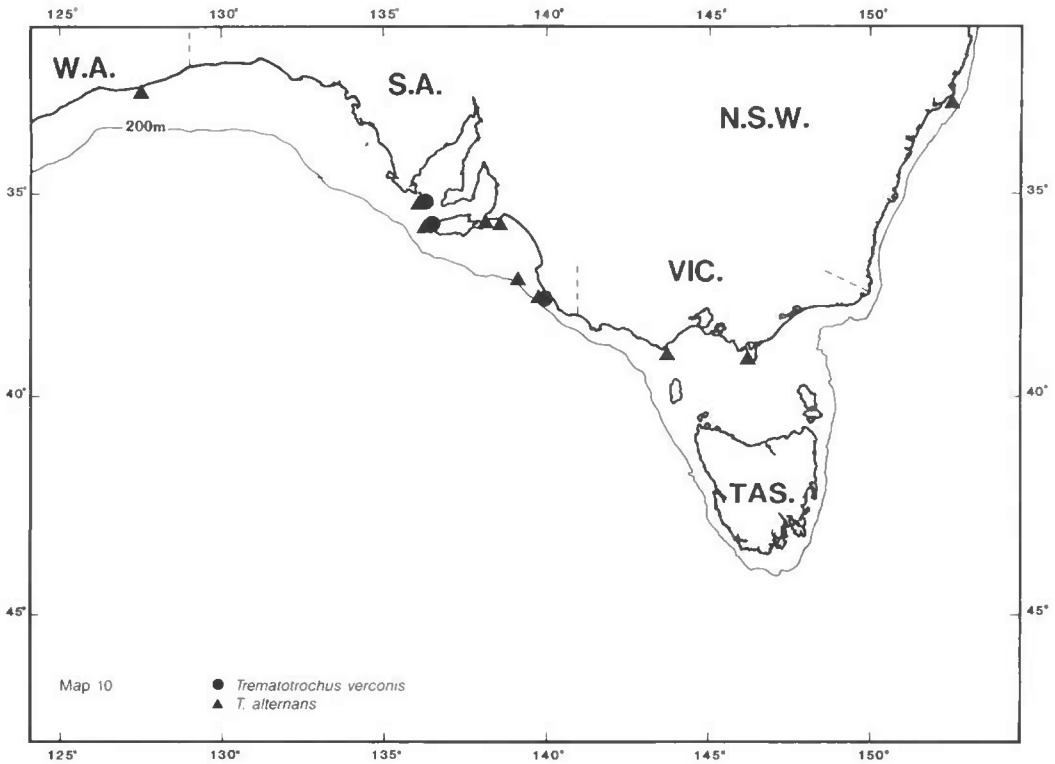
Corallum compressed-cuneiform, with a subacute base. GCD:LCD ranges from 1.45-1.80; GCD:H ranges from 0.63-0.71. Largest specimen examined 5.2 × 3.1 mm in calicular diameter and 8.2 mm tall. Costae equal in width (80-120 μm) and rounded, bearing large (40-50 μm), rounded granules peripherally and smaller, more slender granules (15-17 μm in diameter) laterally. Costae vertical in alignment, only the two principal costae remaining independent to base. Intercostal furrows 60-90 μm wide, regularly transversely bridged by bars 40-60 μm thick that delimit deep elliptical pits, the greater axis of each pit aligned with the costae and measuring 90-110 μm long. Theca imperforate, pits not passing right through.

Septa hexamerally arranged in four cycles, the fourth incomplete, invariably resulting in 40 septa according to the formula: $S_1 > S_2 > S_3 > S_4$. All four end-systems (systems adjacent to principal septa) have a full complement of S_4 (16 S_4), whereas S_4 are usually lacking from the two lateral systems. Thus, the two lateral systems have three size-classes of septa (two bordering S_1, an intermediate S_2, and two small S_3), whereas the four end-systems have four classes of septa (two bordering S_1, an intermediate S_2, two S_3, and four S_4). S_1 highly exsert and thick, have straight inner edges, and extend to columella; the two principal S_1 are slightly larger than other four. S_2 considerably less exsert, have sinuous inner edges, and merge with columella lower in fossa. S_{3-4} progressively less exsert and wide: inner edges of S_3 sinuous, those of S_4 straight. Upper septal edges smooth to finely serrate; septal faces covered with coarse granules up to 60 μm tall. Pali absent. Columella papillose, composed of a staggered row of 5-10 papillae interconnected among themselves as well as to inner edges of S_{1-2}.

Discussion

Eleven species are here recognized in *Trematotrochus: T. corbicula* (Pourtalès, 1878) (Recent, western Atlantic), *T. fenestratus* (Tenison-Woods, 1878) (type-species), *T. clarkii* Dennant, 1899a, *T. complanatus* Dennant, 1899b, *T. lateroplenus* Dennant, 1899b, *T. declivis* Dennant, 1901, *T. mulderi* Dennant, 1901 (Tertiary, Victoria), *T. kitsoni* Dennant, 1901 (Tertiary, Victoria and South Australia), *T. verconis* Dennant, 1904 (Recent, South Australia), *T. hedleyi* Dennant, 1906 (Recent, New South Wales) and *T. alternans* sp. nov. (Recent, Western Australia, South Australia, Victoria and New South Wales).

The species fall into two groups. In the first, which includes the type-species, the theca is fully perforate *(T. corbicula, T. fenestratus, T. clarkii, T. complanatus, T. lateroplenus, T. mulderi, T. hedleyi)*. In the second, the theca is imperforate, the external pits not passing completely through (*T. declivis, T. kitsoni, T. verconis, T. alternans* sp. nov.). Though this difference might in some future revision of the Turbinoliidae be



employed as a generic or subgeneric discriminator, we use it here merely to facilitate comparisons among species.

T. verconis differs from *T. alternans* sp. nov. principally in having four, not three, size-classes of septa (for a fuller comparison, see under the latter). From *T. declivis* it differs in having the fourth septal cycle incomplete, and the calice compressed-cuneate, not circular. In size, shape, and number and symmetry of septa it is very similar to *T. kitsoni*, from which it differs chiefly in the shape of the calice: GCD:LCD about 1.3 for *T. kitsoni*, 1.45-1.8 for *T. verconis*. *T. verconis* might also be compared to *T. lateroplenus*, being very similar in shape (including GCD:LCD), size, and septal number and symmetry, differing primarily in having an imperforate, pitted theca.

Trematotrochus verconis and *T. alternans* are similar in morphology (see Discussion of *T. alternans*), and sympatric populations are known from South Australia. Based on Dennant's (1904) original description and figures of *T. verconis*, it is clear that he had specimens of both species before him. However, he did not specify a holotype, therefore the species to which the name *verconis* is applied should be the one that follows his description of septal symmetry most closely. Syntypes of *T. verconis* are not present at the SAM or AM. Because of the similarity of the two species and the lack of type specimens, we have designated a neotype from the Verco collection near the type-locality: off Cape Borda, Kangaroo I., 55 fms (=101 m), SAM H542.

Material Examined (All JV)

South Australia: East of the North Neptune Is, 45 fms (=82 m) SAM 541(10); off Cape Borda, Kangaroo I., 55 fms (=101 m), SAM H542 (neotype of *T. verconis* Dennant) and SAM H543(15)/USNM 85685(3); off Beachport, 40 fms (=73 m), SAM H544(7)/USNM 85683(I) and 49 fms (=90 m), SAM H545(3)/USNM 85684(I).

Distribution

Known only from South Australia, on the continental shelf at the western approaches to Investigator Strait, and off Beachport in the South-East; 73-101 m. All samples were taken with *T. alternans* sp. nov.

26. Trematotrochus alternans sp. nov.
(Figs 8f-h, 9b, c, Map 10)

Conocyathus compressus Tenison-Woods, 1878: 302-303 (in part: paralectotype deposited at AM).
Trematotrochus verconis Dennant, 1904: 5, 6 (in part: pl. 1, fig. 4b); Shepherd & Veron, 1982: 176, fig. 4.54b.

Description

Corallum compressed-cuneiform, with a rounded base. GCD:LCD ranges from 1.8-2.0; GCD:H ranges from 0.67-0.84. Largest specimen 9.3 × 3.7 in calicular diameter and 11.1 mm tall (AM G15278). Costae equal in width (90-100 μm) and rounded, covered uniformly on all surfaces with fine granules. Costae vertical in alignment, only the two principal costae remaining independent to base. Intercostal furrows about 70 μm wide, periodically bridged transversely by bars about 60 μm wide that delimit deep, elliptical pits, the greater axis of each pit aligned with the costae and about 70 μm long. Theca imperforate, the external pits not passing completely through.

Septal symmetry most easily interpreted as octameral, *i.e.*, 16:16:8 (40 septa) in small to medium-sized specimens and 16:16:24:16 (72 septa) in larger coralla. In specimens having 40 septa, the four pairs of tertiary septa are developed in sectors adjacent to the principal septa (end sectors). In larger specimens with more septa, pairs of tertiary septa occur in the three lateral sectors on both sides of the two principal septa; pairs of quaternary septa occur only in the end sectors directly adjacent to the two principal septa. Additional tertiary septa occur randomly in lateral sectors and quaternaries sometimes irregularly develop in the end sectors, but in general the lateral sectors have only two size-classes of septa: large, thick primary septa alternating with much smaller, thinner secondary septa. The 16 primary septa are highly exsert, have straight inner edges, and extend to the columella. The two principal septa are considerably larger than the other four primary septa. Secondary septa also exsert but usually rudimentary within calice, only about one-quarter width and one-third as thick as primaries. If pairs of tertiary and quaternary septa are present in a sector, the lower cycle septa they flank are accelerated in size. Upper edges of primary septa granular to slightly serrate. Inner edges of all septa straight to slightly dentate in vicinity of columella. Pali absent. Columella composed of a single row of fused papillae.

Discussion

Trematotrochus alternans and *T. verconis*, although morphologically very similar, are easily distinguished by their septal symmetry. In similar-sized specimens, each having 40 septa, *T. alternans* has three size classes of septa (16:16:8), whereas *T. verconis* has four (6:6:12:16). This results in the lateral sectors of *T. alternans* having an alternating arrangement of two very differently sized septa and the lateral half-systems of *T. verconis* having three size classes of septa. *T. alternans* also differs in attaining a larger size, and in having a flatter corallum, quantified by a higher GCD:LCD and a lower GCD:H. Furthermore, *T. alternans* also has finer costal granulation and straight inner septal edges. From the two other imperforate species, *T. declivis* and *T. kitsoni*, *T. alternans* differs in the shape of the calice (compressed-cuneiform, not subcircular or broadly elliptical), and in septal symmetry.

Etymology

The specific name *alternans* (present participle of L. *alternare*, to alternate) refers to the alternation of large and small septa that occurs in the lateral septal sectors.

Material Examined (types; all South Australian and Western Australian samples collected by JV)
Holotype
South Australia: St Francis I., 15-20 fms (=27-37 m), SAM H547(1).
Paratypes
Western Australia: 80 Nm (=146 km) W of Eucla, 81 fms (=148 m), iii.1912, SAM H546(16)/USNM 85714(4).
South Australia: E of North Neptune Is, 45 fms (=82 m), SAM H548(4) and RMNH 18061(6); off Cape Borda, Kangaroo I., 55 fms (=101 m), SAM H554(4); Gulf St Vincent, 17 fms (=31 m), USNM 85688(1) (*ex* SAM H549); Gulf St Vincent, ? depth, RMNH 18062(1); Backstairs Passage, 17 fms (=31 m), SAM H551(1) and 22 fms (=40 m), SAM H552(1); 3 Nm (=5.5 km) S of Tunk Head, 16 fms (=29 m), SAM H550(3); 7 Nm (=12.8 km) SW of Newland Head, 20 fms (=37 m), SAM H553(1); Cape Jaffa, 130 fms (=238 m), SAM H555(1); off Beachport, 40 fms (=73 m) SAM H556(1), SAM H557(7)/USNM 85689(2) and 49 fms (=90 m), SAM H558(10)/USNM 85686(3); no locality, SAM H559(3).
Victoria: 'Kimbla' Stn 80-K-5-48, 82 m, NMV F56909(1); 'Kimbla' Stn K7/73-60, 49 m, NMV F56810(2).
New South Wales: E of Sydney, 150 m, AM G15260(2); Cronulla, JVo, AM G15278(3); off Port Stephens, 71 fms (=130 m), AM G7024, (paralectotype of *Platytrochus compressus* (Tenison-Woods)).

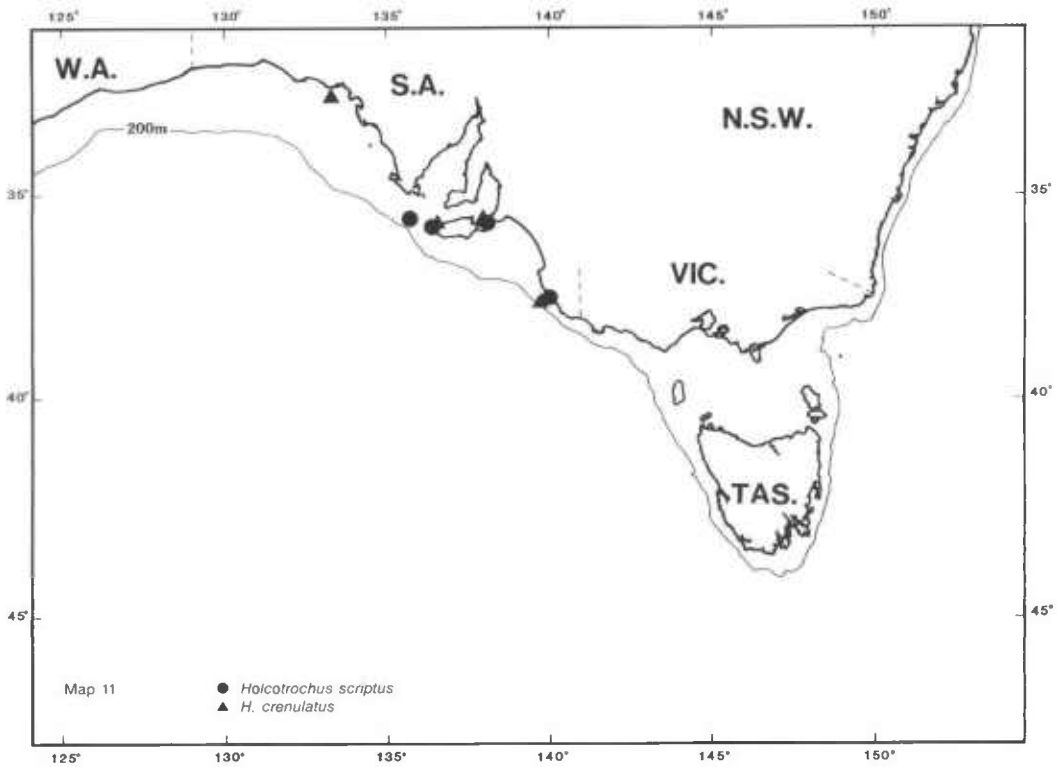
Distribution

Southern and south-eastern Australia, on continental shelf: west to 146 km west of Eucla, Western Australia, north to Port Stephens, New South Wales (no Tasmanian records); 27-238 m.

Holcotrochus Dennant, 1902

27. *Holcotrochus scriptus* Dennant, 1902

(Figs 9d, f, g, Map 11)



Holcotrochus scriptus Dennant, 1902: 1, 2, pl. 1, figs 1a, b; Dennant, 1904: 3; Howchin, 1909: 244; Wells, 1959: 286, pl. 1, figs 6, 7; Shepherd & Veron, 1982: 177, 178.

Description

Corallum cuneiform, with a rounded base and slightly convex lateral faces. Largest specimen known (holotype) 3.5 × 2.0 mm in calicular diameter and 5.5 mm tall; however, all subsequently reported specimens are considerably smaller, rarely exceeding 1.5 mm in GCD and 2.0 mm in height. GCD:LCD = 1.50-1.75. Small specimens often show evidence of attachment to sand grains. Ten costae (six C_1 and four C_2) of equal width (0.18-1.10 mm) occur on each corallum; however, occasionally the basalmost section of a lateral C_1 will be enlarged at the expense or diminution of the C_2 on that face (Fig. 9g). Costae covered with coarse, rounded granules 13-20 μm in diameter and up to 60 μm tall, especially prominent on basal sections of costae. Each costa bears 4-5 granules across its width at any transverse section. Costae separated by broad (60-70 μm), deep (90 μm) intercostal furrows, which bear prominent medial ridges. Medial ridges 35-40 μm wide, rounded, and slightly granular, themselves separated from adjacent costae by small furrows about 10 μm wide. No lateral edge sulcus; principal C_1 fully developed.

Ten septa hexamerally arranged in two cycles, the second incomplete: six S_1 and four S_2, one septum corresponding to each costa. S_1 highly exsert (up to 0.67 mm), with greatly thickened outer edges and relatively narrow inner edges. S_2, which occur only in the four end systems, also highly exsert (0.36 mm). Inner edges of all septa straight and vertical; septal faces covered with coarse granules equivalent in size to costal granules. Pali absent. Fossa deep. Columella a rudimentary fusion of lower, inner edges of 10 septa.

Discussion

Only two species of *Holcotrochus* are known, *H. scriptus* and *H. crenulatus*, both with a record in the Miocene of Victoria and Recent of eastern Australia. *H. scriptus* is distinguished from *H. crenulatus* by: lacking an edge sulcus; having intercostal ridges instead of another cycle of costae; having rounded, convex thecal faces; and having long costae continuous to the base.

Material Examined
South Australia: off Cape Borda, Kangaroo I., 55 fms (=101 m), JV, SAM H561(6)/USNM 85687(2); off Beachport, 40 fms (=73 m), JV, SAM H562(1).
Victoria: Torquay (Miocene), USNM 67966(1).
Queensland: Murray I., eastern Torres Straits, 9-15 m, USNM 45386(2) (Wells 1959).

Distribution
Continental shelf of South Australia: 72 km south of Cape Wiles (Eyre Peninsula), 185 m (Wells 1958, 1959), off Cape Borda, Backstairs Passage, Beachport; Torres Straits: Murray I.; 9-185 m. Miocene: Victoria.

28. *Holcotrochus crenulatus* Dennant, 1904
(Figs 10a, c, d, Map 11)

Holcotrochus crenulatus Dennant, 1904: 3, 4, pl. 2, figs 4a-c; Howchin, 1909: 244; Shepherd & Veron, 1982: 177-178.

Description
Corallum unique in shape, having parallel, flat thecal faces, a rounded base, and a continuous, deep sulcus along lateral thecal edges. Corallum small, largest specimen known (holotype) 2.5 × 1.5 mm in calicular diameter and 3.5 mm tall. In small specimens, grains of sand can often be seen enclosed within basal region. Costae arranged in three incomplete cycles accordingly: 6:6:8, but only fully expressed on upper half of corallum. The four lateral C_1 are quite broad (0.25 mm) and covered by large, smooth granules 18-47 μm in diameter, arranged up to five across a costa at its widest point. The two principal costae rudimentary, only about 0.06 mm wide, bisecting the centre of the lateral edge sulcus and extending only half way to base. Principal costae expressed more fully above calicular edge, where they are continuous with outer part of principal septa. The four C_2 in end systems are also wide (0.18 mm) and granulated (about four granules across widest section near calice). The two lateral C_2 are almost as broad (0.16 mm), and bear 3-4 granules across their widest section, which is about midway on the corallum. C_3, which occur as four pairs in the end systems, about 0.08 mm wide, two granules across at widest point, and, along with the lateral C_2, are about 0.1 mm exsert. Lower half of thecal faces covered by irregularly-shaped areas and horizontal strips, each area covered by 3-7 granules. Each intercostal furrow about 33 μm wide and 15 μm deep, except for lateral edge sulci, each of which is 0.19-0.31 mm wide and 0.15 mm deep, and bisected by the principal C_1 in the upper corallum.

Ten septa hexamerally arranged in two cycles, the second incomplete: six S_1, four S_2. Whereas 20 costae are present, septa correspond only to the six C_1 and four C_2 in the end systems. S_1 highly exsert (0.50 mm), each with a pointed tip and straight, vertical to slightly concave inner edge. Small, sparse granules occur on septal faces, about 0.15 mm tall. S_2 also highly exsert (0.31 mm) but rudimentary; no S_2 correspond to lateral C_2. S_3 not present even though C_3 are slightly exsert. Pali absent. Fossa deep and narrow. Columella a rudimentary fusion of lower, inner edges of 10 septa.

Discussion
In his original description, Dennant (1904) implied that the species was decameral in nature, illustrating 10 equally sized septa. However, all specimens examined, especially small specimens, have six relatively larger septa (S_1) compared with the other four smaller ones (S_2), and, therefore, this species is interpreted as having hexameral symmetry with an incomplete second cycle.

Holcotrochus crenulatus is compared with *H. scriptus* in the Discussion of the latter.

Material Examined (All JV)
South Australia: off St Francis I., 35 fms (=64 m), SAM H563(1); off Cape Borda, Kangaroo I., 55 fms (=101 m), SAM H565(12)/USNM 85692(3); 'Gulf St Vincent & Spencer Gulf', SAM H564 (1, lost) ; off Beachport, 40 fms (=73 m), SAM H566(1).

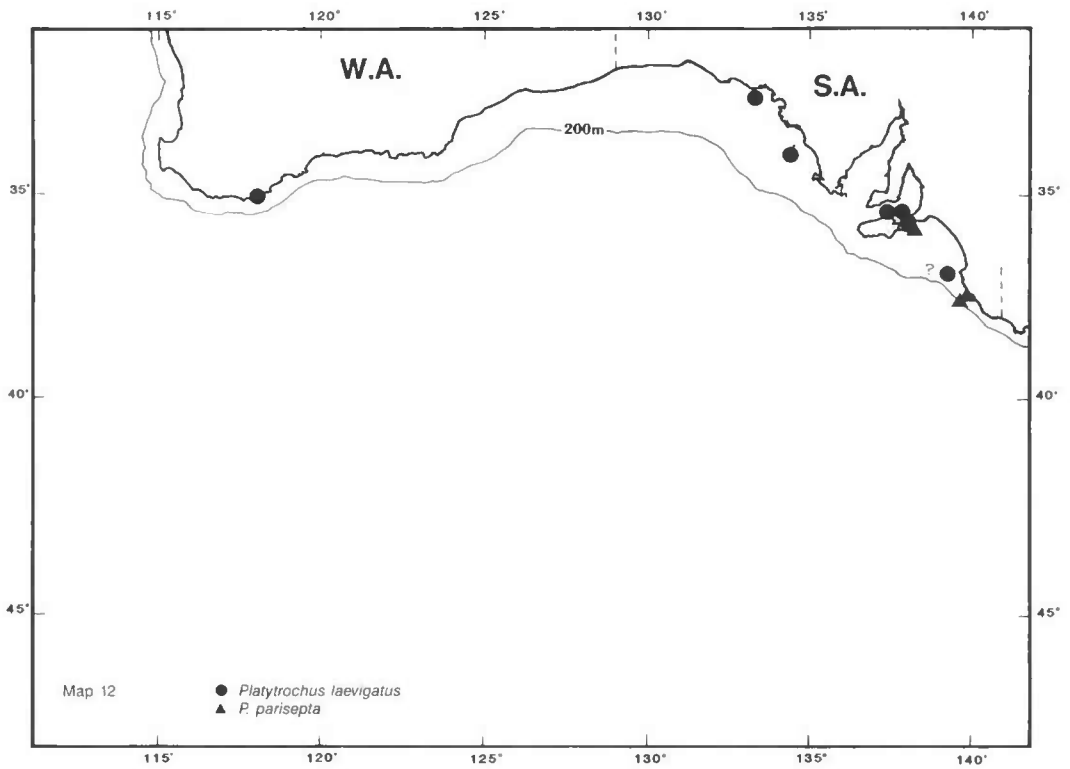
Distribution
Continental shelf of South Australia, from off St Francis I. east to off Beachport; 40-101 m. Miocene: Victoria.

Platytrochus Milne Edwards & Haime, 1848

29. *Platytrochus laevigatus* sp. nov.
(Figs 10b, e, f-h, Map 12)

Platytrochus compressus: Dennant, 1904: 4, 5, pl. 1, figs 3a, b; Howchin, 1909: 245; Eguchi, 1973: 85, pl. 1, figs 8-11; ?Shepherd & Veron, 1982: 178, fig. 4.54d.

Description
Corallum cuneiform, triangular, and highly compressed, the GCD:LCD ranging from 2.0-2.2. Largest specimen examined 10.3 × 4.9 mm in calicular diameter and 13.7 mm tall. Costae equal in width (about 0.20 mm), almost vertical in orientation, and porcellaneous in texture. Costae rounded and smooth peripherally; granular laterally, the granules only about 20μm tall. Intercostal furrows deep (0.25 mm) and narrow (30-35 μm), not porous or pitted. Principal costae independent, meeting at epicentre of base. Pedicel costate. At variable heights along lateral thecal faces, secondary costae trifurcate, the middle segment corresponding to a secondary septum, the two flanking tertiary costae corresponding to the origin of a pair of tertiary septa within calice. Number of costae and



septa is dependent on the number of secondary costae (and septa) that trifurcate, which appears to be related to corallum size. In a specimen having 72 costae (and septa), a maximum of six secondary costae per face (12 per corallum) will trifurcate, the origins of the tertiary and quaternary costae in the four end sectors being obscured at the thecal edge.

Septa apparently octamerally or sedecamerally (×16) arranged, a medium to large-sized corallum having an apparent maximum of 72 septa arranged in four size-classes: 16:16:32:8, the four pairs of quaternary septa also occurring in the end sectors. Smaller coralla have correspondingly fewer septa, usually at the expense of pairs of tertiaries in lateral sectors, not the quaternaries in the end sectors. Sixteen primary septa moderately exsert, having thick (0.30 mm) inner edges that extend into columella. Sixteen secondary septa slightly less exsert and thinner (0.21 mm), extending to columella. Thirty-two tertiary septa only slightly less exsert than S_2, but much thinner (0.10 mm), and extending only half distance to columella. All septa have straight inner edges and faces covered with fine, sparse granulation. Fossa of moderate depth, containing an elongate papillose columella roughly arranged in three parallel rows of 20-30 elements. The papillae of two outer rows are often aligned with and adjacent to secondary septa and may be interpreted as small paliform lobes; however, their placement and presence is irregular within a specimen and among specimens.

Discussion

Vaughan & Wells (1943) listed at least 15 species of *Platytrochus*, mostly from the Cretaceous to Eocene of the United States. From southern Australia seven species have now been recorded, including the two new species described in this paper: *P. compressus* (Tenison-Woods, 1878) (Recent, New South Wales); *P. vacuus* (Tenison-Woods, 1878) (Eocene, Victoria); *P. hastatus* Dennant, 1902b (Eocene, Victoria and Recent, South Australia), *P. airensis* Dennant, 1902b (Eocene, Victoria), *P. curvatus* Dennant, 1902b (Eocene, Victoria), *P. laevigatus* sp. nov. (Recent, South and Western Australia) and *P. parisepta* sp. nov. (Recent, South Australia). *P. laevigatus* is clearly most similar to *P. compressus*, having been identified as such by several authors (see synonymy), including Dennant (1904). Dennant had examined the 'type' of *P. compressus* (but see below), and, although he found at least two differences between that and his South Australian specimens (*i.e.*, the 'type' had only 48 septa and a less compressed calice), he regarded this as intraspecific variation. We also initially identified all South and Western Australian specimens as *P.*

compressus, but after examining the type of *P. compressus* and another typical specimen of *P. compressus* from N.S.W. (USNM 83008), SDC realized that the South and Western Australian specimens were a different species from *P. compressus*. *P. laevigatus* has octameral symmetry with up to 72 septa; specimens of *P. compressus* of equivalent size have hexameral symmetry with 48 septa. *P. laevigatus* is even more compressed than *P. compressus*, having a GCD:LCD of 2.0-2.2 *vs* 1.8 in *P. compressus*. *P. laevigatus* has smooth costae; those of *P. compressus* are coarsely granular. *P. laevigatus* has 1-6 costal trifurcations per septal face; *P. compressus* consistently has only two trifurcations per face, always leading to C_3 in the four half-systems one removed from the end half-systems. There may also be a geographic separation, *P. compressus* being known only from off New South Wales, *P. laevigatus* from South and Western Australia.

Two specimens, which must be considered as syntypes, were mentioned by Tenison-Woods (1878) in his original description of *Conocyathus compressus*, both stated to be deposited at the Macleay Museum. Only one specimen is now in the Macleay Museum, and another specimen labelled as a type from the type-locality is in the AM (G 7024). The specimen in the Macleay Museum is consistent with the original description and Dennant's later observations; the AM specimen is *Trematotrochus alternans*, only superficially resembling *P. compressus*. Because of the mixed nature of the syntype series, we designate the Macleay Museum specimen as lectotype of *P. compressus*, the AM specimen thereby becoming a paralectotype.

Etymology

The specific name *laevigatus* (Latin for smooth, polished, slippery) refers to the smooth, porcellaneous costae of this species, specimens often slipping from the fingers in the course of examination.

Material Examined (Types)

Holotype

South Australia: SAM H569(1), St Francis I., 15-20 fms (=27-37 m), JV.

Paratypes

Western Australia: SAM H567(4), King George Sound, 12-14 fms (=22-26 m), JV; SAM H568(3), King George Sound, 28 fms (=51 m), JV.

South Australia: SAM H570(1), St Francis I., 15-20 fms, JV; SAM H571(3)/USNM 85694(5), St Francis I., 40 m, NH, WZ 28.i.1982; NMV F56815(5), Investigator Strait, Stn Y-15, JWa (Eguchi 1973, as *P. compressus*); RMNH 18057(1), Investigator Strait; SAM H572(3), between Gulf St Vincent and Investigator Strait, 15 fms (=27 m), JV; SAM H573(1), 574(3), 575(3)/USNM 85695(1), RMNH 18056(3), Gulf St Vincent, JV; SAM H576(3)/USNM 85693(1), SAM H577(1), Backstairs Passage, 22 fms (=40 m), JV; ?SAM H578(1), Cape Jaffa, 90 fms (=165 m), JV.

Distribution

Continental shelf of southern Australia: King George Sound, Western Australia; South Australia from St Francis I. and Pearson I. to Cape Jaffa; 22-51 m, 165 m.

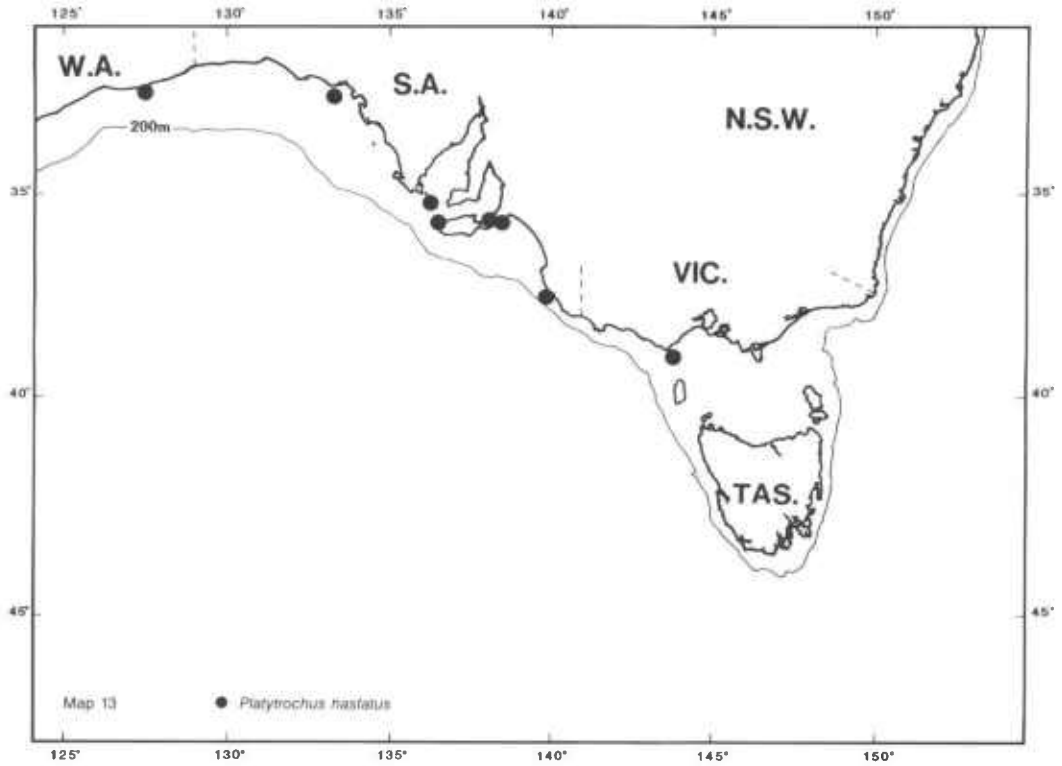
30. *Platytrochus hastatus* Dennant, 1902
(Figs 11a-f, Map 13)

Platytrochus hastatus Dennant, 1902b: 257, 258, pl. 5, figs 2a, b; Dennant, 1904: 4; Howchin, 1909: 245; Shepherd & Veron, 1982: 178, fig. 4.54j.

Description

Corallum cuneiform, triangular, and highly compressed; however, not as compressed or broad in edge angle as *P. laevigatus*, as evidenced by a GCD:LCD of 1.6-1.7. Largest specimen examined (NMV F56908) 5.4 × 3.0 mm in calicular diameter and 8.9 mm in height. Costae equal in width (about 0.1 mm), almost vertical in orientation, and porcellaneous in texture. Lowest portion of corallum, *i.e.*, basalmost 1.5-2.0 mm, a smooth, noncostate cone 0.20-0.25 mm in diameter basally and up to 0.9 mm in greater diameter at transition to upper costate portion. Delicate conical pedicel often broken off or eroded. Costae rounded; smooth peripherally and granular laterally, the granules about 10 μm tall. Intercostal furrows narrow (30-35 μm) and shallow (40 μm). Principal costae independent, in fact, virtually all costae extend to smooth pedicel; however, in fully developed coralla (*i.e.*, those with 40 septa), two secondary costae on each face trifurcate (Fig. 11a): the middle costa of each trifurcation becomes the secondary costa in the sectors one removed from the end sectors; the flanking costae become the tertiary costae of the same sectors. As in *P. laevigatus*, the number of costae, and thus septa, is roughly a function of corallum size: 24 costae occur just above the conical pedicel, 32 costae at a GCD of 2-3 mm, and 34-40 costae at a GCD of 3-4 mm.

Septa decamerally arranged in three complete cycles, a medium to large-sized specimen having 40 septa arranged: 10:10:20; however, an alternative interpretation indicated by the examination of certain larger specimens is hexameral symmetry (6:6:12:16), the S_1 being slightly wider and thicker than the S_2, the 16 S_4 present as eight pairs in the eight end half-systems. Primary septa moderately exsert, having vertical inner edges that extend to columella. Principal septa larger than other eight primaries. Secondary septa slightly less exsert and about three-quarters width of primaries. Tertiary septa slightly less exsert than secondaries but often equal to or slightly wider than



secondaries. Inner edges of all septa straight; septal faces covered with granules up to 50 μm tall. Fossa of moderate depth, containing an elongate strip of about 10 staggered, tuberculate columellar papillae, some of which are placed directly adjacent to the secondaries.

Discussion

P. hastatus is most similar to *P. airensis* (Fig. 11g, h), similarities including the number and arrangement of septa, columellar structure, and even number of costal trifurcations per corallum face. The drawings of their calices, presented side by side by Dennant (1902b: pl. 5) are virtually indistinguishable. A direct comparison of type-specimens, however, reveals that *P. hastatus* has an attenuated pedicel (*P. airensis* has none), a more compressed calice (GCD:LCD of *P. airensis* is only 1.45), and, in general, is less robust in corallum shape.

Material Examined (all South Australian samples collected by JV)

Western Australia: 80 Nm (=146 km) W of Eucla, 81 fms (=148 m), JV iii.1912, SAM H579(2).

South Australia: St Francis I., 15-20 fms (=27-37 m), SAM H580(1); W of St Francis I., 35 fms (=64 m), SAM H581(7)/USNM 85690(4); off St Francis I., 35 fms, SAM H582(4)/USNM 85690(2); E of North Neptune Is, 45 fms (=82 m), SAM H583(3); off Cape Borda, 55 fms (=101 m), SAM H584(9); Backstairs Passage, 22 fms (=40 m), SAM H587(2); 7 Nm (=12.8 km) SW of Newland Head, 20 fms (=37 m), SAM H588(6); off Beachport, 49 fms (=90 m), SAM H585(2), and 55 fms, RMNH 18058(4); no locality, SAM H586(1).

Victoria: 'Kimbla' Stn 80-K-5-47, 86 m, NMV F56908(1); two syntypes of *P. hastatus* (Tertiary), NMV P27094.

Other: holotype of *P. airensis*, NMV P27093.

Distribution

Continental shelf of southern Australia, from 146 km west of Eucla, Western Australia, to south-east of Cape Otway, Victoria (no Tasmanian records); 27-148 m. Tertiary: Victoria.

31. *Platytrochus parisepta* sp. nov.
(Figs 12a-d, Map 12)

?*Platytrochus hastatus:* Dennant, 1904: 4 (in part: some specimens from Backstairs Passage, 22 fms (=40 m)).

Description

Corallum cuneiform and compressed, with a triangular basal region, the edges becoming vertical and almost parallel in upper corallum. GCD:LCD = 1.50-1.65. Largest specimen (holotype) 5.32 × 3.50 mm in calicular diameter and 8.57 mm in height. Costae equal in width (0.21 mm), almost vertical in orientation, and porcellaneous in texture. As in *P. hastatus*, the lower part of the corallum is a noncostate cone but this section is largely atrophied in the five specimens examined. Costae rounded, smooth peripherally and granular laterally, the granules small (about 15 μm in diameter). Intercostal furrows narrow (about 40 μm) and deep (about 0.20 mm). All septa on lateral faces independent; costal trifurcations absent.

Septa decamerally arranged in four cycles (40 septa), the third and fourth incomplete. The apparent adult state is hypothesized to be: 10: 10:12:8 (see Text-fig. 3), although the holotype is slightly asymmetrical, having only 38 septa. Each of the four end sectors contains five septa (one secondary, two tertiary, and two quaternary); the four sectors one removed from the end sectors contain only the secondary septum; and the remaining two lateral sectors contain three septa (one secondary and two tertiary). Primary and secondary septa moderately exsert and of almost equal width and thickness, both series of septa extending to columella. Two principal primary septa wider and thicker than other eight primaries. Tertiary septa slightly less exsert and less thick than secondaries, but equally as broad. Quaternary septa, which occur in pairs only in half-sectors adjacent to the principal septa, thin and about three-quarters width of a tertiary. Inner edges of all septa straight; septal faces covered by fine granules. Fossa moderate in depth, containing a columella consisting of an elongate strip of 15-17 papillae roughly arranged in two rows, and having no apparent relationship to the septa.

Discussion

Platytrochus parisepta has a mixture of characteristics of both *P. laevigatus* and *P. hastatus*, but favouring the latter. It has the deep intercostal furrows of *P. laevigatus*, but a much less compressed corallum (GCD:LCD 1.5-1.65 *vs 2.0-2.2 for P. laevigatus*) and fewer septa. With *P. hastatus* it shares a moderately compressed calice, a noncostate pedicel, and the same number of septa, but differs in having deep intercostal furrows and a fuller, larger corallum. Characters unique to this species are its complete lack of costal trifurcations on the corallum faces, the almost equal width of the S_{1-3}, and its septal symmetry (Text-fig. 3).

Etymology

The name *parisepta* (L. *pars*, equal) is a noun in apposition and alludes to the virtually equal width and thickness of the primary to tertiary septa.

Material Examined (Types, all JV)

Holotype

South Australia: SAM H589(1), Backstairs Passage, 22 fms (=40 m).

Paratypes

South Australia: SAM H590(1)/USNM 85691(1), Backstairs Passage, 22 fms (=40 m); SAM H591(1), Beachport, 110 fms (=201 m).

Distribution

Australia: known only from two localities off South Australia: Backstairs Passage and off Beachport; 40 m, 201 m.

Australocyathus gen. nov.

Deltocyathus: Dennant, 1904: 6.

Diagnosis

Corallum solitary and tympanoid in shape, with a flat to concave base; corallum free, with no evidence of transverse division. Theca imperforate; costae granular, corresponding to septa. Four cycles of highly exsert septa, the higher cycle septa regularly fused together. Paliform lobes present before all but last cycle of septa, P_3 often multiple. Columella papillose. Ahermatypic.

Discussion

Among the 10 other imperforate, paliferous turbinoliid genera (Cairns 1989a), *Australocyathus* is most similar to *Pepouocyathus* Gravier, 1915, but can be distinguished by its exclusively tympanoid corallum shape, smaller paliform lobes, and multiple P_3 per septum. *Australocyathus* also has a better developed fossa and differently shaped septa. It is similar to *Thrypticotrochus* Cairns, 1989a in having multiple P_3 but differs in: corallum shape (*Thrypticotrochus* is conical with frequent asexual fragmentation), septal insertion (all septa of *Thrypticotrochus* are independent), and other aspects of paliform lobe number (*e.g.*, *Thrypticotrochus* has multiple lobes on S_{1-3}).

Dennant (1904), understandably, originally placed the only species in this genus, *A. vincentinus*, in the genus *Deltocyathus*, based on its similarity in corallum shape, septal arrangement, deep costal furrows, and overall similarity to *Deltocyathus italicus* var. *australieusis* Duncan, 1870. Although the septal arrangement and corallum shape is very similar to that of *Deltocyathus*, *Australocyathus* is distinguished by its deep, narrow intercostal furrows, which allies it to the Turbinoliidae, not the Caryophylliidae. *Deltocyathus italicus* var. *australiensis* Duncan, 1870 was recently shown by Cairns (1989a) to belong to *Peponocyathus*, a closely related turbinoliid genus.

Etymology

The name, of masculine gender, is an allusion to the austral distribution of the genus.

Type-Species

Deltocyathus vincentinus Dennant, 1904, here designated.

Distribution

Southern Australia.

32. *Australocyathus vincentinus* (Dennant, 1904) comb. nov.
(Figs 12e-g, 13a, b)

Deltocyathus vincentinus Dennant, 1904: 6, 7, pl. 2, figs 1a-c; Howchin, 1909: 245; Shepherd & Veron, 1982: 176, fig. 4.54a.

Description

Corallum discoidal to tympanoid, with slightly inward-inclined walls, such that a corallum 9.9 mm in basal diameter and 5.3 mm tall would have a calicular diameter of only about 7.5 mm. Largest specimen reported 11 mm in basal diameter and 5.5 mm tall (GCD:H = 0.5). Base flat to slightly concave, usually with a small epicentral boss. Costae equal in width (0.31-0.33 mm) and rounded, separated by deep (0.35-0.40 mm at calicular edge), narrow (0.10-0.11 mm) intercostal furrows. Costal granules triangular, about 60 μm tall and uniformly distributed (*i.e.*, nonlinearly) on costal faces. Costal insertion pattern identical to that of septa.

Septa hexamerally arranged in four cycles (48 septa). S_1 independent and attain the columella. S_2 also attain the columella but each is joined by a pair of S_3 near columella; pairs of S_4 also fuse to each S_3 slightly farther away from epicentre. S_1 have straight, vertical inner edges and finely serrate, highly exsert upper edges, their highest point 1-2 mm within thecal wall. S_{2-4} progressively less exsert, but all having straight, finely serrate edges. Septa covered with numerous, prominent, wide-based, triangular granules (up to 90 μm tall), often linearly arranged in vertical rows. Small paliform lobes (P_1) and slightly broader and higher P_2 occur in most coralla. In larger coralla, two or three narrow P_3 occur on each S_3 in region where S_4 fuse to S_3. Inner edges of S_4 non-paliferous but slightly dentate. Fossa circular and large (defined by the vertical, inner edges of the S_{1-2}), and slightly deeper than the upper thecal edge. Columella rudimentary, composed of several fused papillae or a low, solid fusion.

Discussion

Comparisons with *Peponocyathus australiensis* are made in the Discussion of that species.

Material Examined (all collected by JV)

Western Australia: 80 Nm (=146 km) W of Eucla, 81 fms (=148 m), iii.1912, SAM H592(1).

South Australia: Spencer Gulf, SAM H593(3)*; off Point Marsden, Kangaroo I., 15 fms (=27 m), SAM H594(27)*/USNM 85706(5)*, and 17 fms (=31 m), SAM H595(1); Gulf St Vincent, 9 fms (=16.5 m), SAM H596(8)*, 17 fms (=31 m), SAM H597(4)*, 'deep water', SAM H598(9)*, no depth, SAM H599(8)*, SAM H600(31), SAM H601(84)/USNM 85699(11); Yankalilla Bay, 20 fms (=37 m), SAM H602(86)*; between Gulf St Vincent and Backstairs Passage, 17-22 fms (=31-40 m), SAM H605(6)*; Backstairs Passage, USNM 86923, (*ex* AM G12059)(1)); Newland Head, 20 fms (=37 m), SAM H603(10)*; off Porpoise Head, 17 fms, SAM H604(2)*; Encounter Bay, 20 fms (=37 m), SAM H606(1); Broken Head (locality not found), SAM H607(1)*. (* Regarded as paratypes by virtue of Dennant's original annotations).

Distribution

Continental shelf of southern Australia: 146 km west of Eucla, Western Australia; Spencer Gulf to Encounter Bay, South Australia; 16-148 m.

Peponocyathus Gravier, 1915

33. *Peponocyathus australiensis* (Duncan, 1870)
(Figs 13c, d)

Deltocyathus italicus var. *australiensis* Duncan, 1870: 297, pl. 19, fig. 4.
Leptocyathus stimpsonii Pourtalès, 1871: 12, pl. 3, figs 1-3.
Deltocyathus orientalis Duncan, 1876: 431, pl. 38, figs 4-7.
Deltocyathus minutus Gardiner & Waugh, 1938: 198.
Peponocyathus orientalis: Veron, 1986: 608.
Peponocyathus australiensis: Cairns, 1989a: 30-32, pl, 14d-j, 15a-d (synonymy).

Diagnosis

Corallum bowl-shaped, rarely exceeding 8.0 mm in calicular diameter. Costae equal in width (0.18-0.22 mm), separated by very deep (0.70 mm), narrow (0.10 mm) intercostal furrows. Each costa bordered peripherally by a uniserial row of blunt, cylindrical granules. Costal insertion plan identical with that of septa. Septa hexamerally arranged in four complete cycles. Septal insertion pattern same as that of *Australocyathus:* S_1 independent, each S_2 joined by pairs of S_3 and each S_3 joined by pairs of S_4, progressively farther from epicentre. S_1 highly exsert, their highest point not far from columella; inner edges straight and vertical, usually bordered by a small paliform lobe. S_2 less exsert, attaining the columella through a prominent paliform lobe. S_3 smallest of septa, each bordered internally by a tall, broad paliform

lobe (P_3), pairs of which fuse to adjacent P_2. S_4 slightly larger than S_3, their internal edges fused to adjacent P_3. Septal faces covered with numerous, wide-based, triangular granules up to 50 μm tall, often aligned in vertical rows. Fossa circular and small (sometimes absent in smaller specimens), its base usually rising well above calicular edge. Columella papillose and usually robust.

Discussion

The two specimens reported herein are relatively small (4.3, 3.5 mm in calicular diameters) and poorly preserved (dead when collected), and serve only to verify the occurrence of this widespread species in South Australian waters. Living specimens from Australia have been reported only once before from off Queensland (Veron 1986) and the species is also known from the Miocene of Victoria (Duncan 1870). The present diagnosis was abstracted from Cairns (1989a).

Peponocyathus australiensis is very similar to small specimens of *Australocyathus vincentinus*, as previously noted by Dennant (1904). *P. australiensis* is most accurately distinguished by its smaller, bowl-shaped corallum, more exsert and relatively larger paliform lobes, uniserially granular costae, and in having only one P_3 per S_3.

Material Examined

South Australia: off Cape Jaffa, 300 fms (=549 m), JV, SAM H608(2 (1 missing)).

Distribution

Australia: off Cape Jaffa, South Australia; southern Great Barrier Reef, Queensland (Veron 1986: 608, under *P. orientalis*); 339 m, 549 m; Victoria (Miocene). Atlantic, Japan, Formosa, Hong Kong, Philippines, Indonesia, Hawaii, New Zealand; 44-635 m; Japan, Ryukyus, Taiwan, Ceram, New Zealand, Vanuatu, Tonga (Eocene-Pleistocene)(Cairns 1989a).

Idiotrochus Wells, 1935

34. *Idiotrochus emarciatus* (Duncan, 1865)
(Figs 14e, f, Map 14)

Sphenotrochus emarciatus Duncan, 1865: 183, 184, pl. 8, figs 2a-d.
Sphenotrochus excicus Duncan, 1870: 298, pl. 19, fig. 6.
Sphenotrochus emarciatus var. *perexigua [sic, perexiguus]* Dennant, 1906: 151, 152; Howchin, 1909: 245 (new synonymy).
Idiotrochus emarciatus: Squires, 1961: 18.
Idiotrochus perexigua: Cairns, 1989a: 36, pl. 18c.