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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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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: Flabellum tuthilli sp. nov., Paraconotrochus zeidleri gen. et sp. nov., Trematrotrochus alternans sp. nov., Platrotrochus laevigatus sp. nov., P. parisepa 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 saraisae Zibrowius, 1974, *Conorochus sp. cf. C. finicolum (Alcock, 1902), Stephanocyathus platypus (Moseley, 1876), *Deltocyathus magnificus Moseley, 1876, Solenostomia variabilis Duncan, 1873, Pernocyathus australiensis (Duncan, 1870), *Gypnia annulata Duncan, 1872, Stenocyathus verticiformis (Pou rallès, 1868, *Plactrochites scaphula Alcock, 1902, Notocyathus recta Dennant, 1906 and *Endolypmannia rostrata Pourtalès, 1878. Dendrophyllia atrata Dennant, 1906 is transferred to Astrangia Milne Edwards & Haine, 1848, Deltocyathus vincentinus Dennant, 1904 is transferred to Australocyathus gen. nov., and Monomyces radiatus (Dennant, 1904) is synonymized with Rhizotrichus 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.).


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 & Haine, 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 Culicinia australiensis sp. nov. (already recorded by Dennant 1904: 9, as C. rubecola (Quoy & Gaimard, 1833)), Flabellum tuhilli 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 Notocyathus 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 Culicina australiensis Hoffmeister, 1933, Trematrotrochus alternans Cairns & Parker sp. nov., Platrotrochus 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. rufoeola* by Tenison-Woods 1878: 324-325 and as *C. tenella* Dana, 1848 by Hoffmeister 1933: II, see below).

Eguchi (1973) listed specimens of *Platytrochus compressus* (Tenison-Woods, 1878) (= *P. laevigatus* sp. nov. of present paper) and *Culicia hoffmeisteri* Squiers, 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. mariae* Wells, 1962. Shepherd & Veron reviewed the shallow-water scleractinians of southern Australia, listing 20 species, of which their *Astrangia woodyi* (non Wells, 1955) and *Dendrophyllia atrata* Dennant are synonyms of the species referred to below as *Astrangia atrata* (Dennant, 1906).


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 *Coscinaraeaspp.*, *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: *Fungiacanthus dennantii* sp. nov. (Bathycactis 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., *Trematothyrax alternans* sp. nov., *Platytrochus parasepetia* sp. nov.), while a fourth (*Stephanocyathus* sp.) is held in abeyance pending the collecting of further specimens. Finally, a further 41 species are added to the region's fauna, of which six (*) are new records for Australia:


It will be noted from the main account that five species of turbinoliids (*Trematothyrax verconis* Dennant, 1904, *Holocorythus crenulatus* Dennant, 1904, *Platytrochus paraspetia* sp. nov., *Australocyathus victoriae* and *Idiocyathus emarginatus* (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 turbinolid 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 shell grit. 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 shell grit 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

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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
\textit{Dunocystthus parasiticus} Tenison-Woods, 1878 (now
SAM H61i) in the dredging from 190 m, 64 km south-
west of the Neptunes, January 1905.

\textbf{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 \textit{Puracyathus
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
delimitated by the primaries and 20 half-sectors, further
delimited by the secondary septa. The four sectors
(or systems) adjacent to the two principal septa are

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{text-figure1.png}
\caption{Cutaway drawing of a species of \textit{Caryophyllia} illustrating the basic morphological features of
an attached solitary scleractinian.}
\end{figure}
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.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD</td>
<td>Lesser calicular diameter</td>
</tr>
<tr>
<td>GCD</td>
<td>Greater calicular diameter</td>
</tr>
<tr>
<td>GCD:H</td>
<td>Ratio of greater calicular diameter to height of corallum</td>
</tr>
<tr>
<td>GCD:LCD</td>
<td>Ratio of greater calicular diameter to lesser calicular diameter</td>
</tr>
<tr>
<td>LEL:H</td>
<td>Ratio of lateral edge length to height of corallum</td>
</tr>
</tbody>
</table>

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
2. Corallum not branching (reptoid, encrusting, or cerioid); shallow-water habitat (0-100 m) ... 4
   - Corallum branching; deep-water habitat (200-200 m) ... 3
3 - Corallum uniplanar, robust; calices occur on only one side of corallum; calices often rostrate
   - Epithelium variabilis
   - Corallum bushy, lightweight; calices oriented in all directions; calices not rostrate
   - Sclerosmilia variabilis

4 - Budding intratentacular; adjacent corallite centres linked by septa
   - Carphylophila sarsiae
   - Budding extratentacular; adjacent corallites discrete, their centres not linked

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

6 - Corallum chaliceiform in shape; well-developed collincs separate rows of corallites
   - Cacosclerae mariae
   - Corallum usually encrusting or laterally attached; calices absent
   - Cacosclerae niueilli

7 - Corallites closely spaced (cerioid), intercalricular coenosteum sparse; corallum massive (up to 3 m)
   - Pleistisma versipora
   - Corallites usually not closely spaced (reptoid to phaceloid); coralla relatively small (rarely over 4 cm)

8 - Corallum brown to black; theca costate
   - Astrangia atata
   - Corallum white; epithecate

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 hojmeisleri

10 - Corallum attached to substrate
   - A. mariae
   - Corallum free of substrate (but may be attached to fragment of parent corallum)

11 - Columella absent or extremely rudimentary
   - Nutophyllia etheridgi
   - Columella present: fascicular, labyrinthiform, spongy, or papillose

12 - Pedicel small in diameter (about 1/10 GCD), base reinforced by 6-8 rootlets; epithecate
   - Rexzorochus tubercularus
   - Pedicel massive (about half GCD), lacking rootlets; costate
   - Desmophylla crispagalli

13 - Upper theca porous (synapticulothecate); sepal arranged in Porraltalids Plan; columnna spongy
   - Theca not porous (epithecate or septothecate); sepal arranged normally; columnna fascicular, labyrinthiform, or papillose

14 - Inner edges of S, lacinate; corallum rarely larger than 13 mm GCD
   - Balanophyllia dentata
   - Inner edges of S, smooth; corallum larger, up to 28 mm GCD
   - Balanophyllia bairdiana

15 - Pali present
   - Pali absent

16 - Calices with 24 septa; only six pali (P6) present; corallum cylindrical
   - Stenophylla sermiformis
   - Calices with 48 or more septa; 12-24 pali present; corallum conical (ceratoide)

17 - Pali in two crowns before all but last cycle (P1,3)
   - Pali in one crown before penultimate cycle of septa (S3, or secondary septal cycle)

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

19 - Calices large (up to 39 mm in diameter) and discoidal; inner edges of septa highly dentate
   - Scyphistoma australis
   - Calices smaller (< 17 mm in GCD) and conical (ceratoide); inner edges of septa smooth

20 - Columnna fascicular; theca thin
   - Crispatoxylophora inornata
   - Columnna labynnthiform; theca thick

21 - Theca porous (synapticulothecate)
   - Conotrochus sp. of C. funicolumma
   - Theca not porous (epithecate, septothecate, or pitted)

22 - Corallum discoidal; septa and costae alternate in position, joined by synapticulothecae
   - Leptosmilia formosaissima
   - Corallum cuneiform, with a straight-edged base caused by transverse division; costae not present

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
   - Septa correspond in position to costae

25 - Corallum tympanoid, calice circular; costae granular, intercostal furrows deep and wide; no thecal spines
   - Dunoxylophora parasiticus
   - Corallum compressed, calice elliptical; costae smooth, intercostal furrows shallow and thin; one basal pair of thecal edge spines
   - Idiotoxochus emarciatus

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

27 - Corallum compressed-cuneiform
   - Corallum not compressed: bowl-shaped or tympanoid

28 - Intercostal furrows regularly pitted, but not perforate
   - Intercostal furrows solid, not pitted or perforate

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
   - Trematoxylophora alternans
   - Lateral sectors of calice with three size-classes of septa (S3, GCD:LCD 1.45-1.80)
   - Trematoxylophora verconis
30 - Corallum discoidal (hat base) or bowl-shaped (flat)
31 - Corallum with deep, broad thecal edge sulci; costae
degenerate toward base; 20 costae
- Holotrochus crenulatus
- Corallum lacking edge sulci; costae continuous to
base; 10 costae and intercostal ridges
- Holotrochus scriptus
32 - Pedicel tapering to a noncostate, smooth cone; calices
with 40 septa; GCD:LCD 1.5-1.7
- Pedicel not a smooth cone; calices with 72 septa;
GCD:LCD > 2.0; Platynorchus laevifanis
33 - Two costal trifurcations per thecal face; gradation in
septal width of S; Platytheca hastata
- No costal trifurcations; S; virtually equal in width
- Platytheca partiseta
34 - Corallum tympanoid, with a flat base
- Astralocyathus vincentensis
- Corallum bowl-shaped, with a convex base
- Peponocyathus australiensis
35 - Corallum discoidal (flat base) or bowl-shaped (flat
to convex base)
- Corallum flabellate (laterally compressed), conical
(ceratoid) or cylindrical
- Flabellum (F.) transversale
36 - Corallum discoidal, with a relatively high GCD:H
ratio (about 4)
- Corallum bowl-shaped, with a lower GCD:H ratio
(less than 2)
- 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
- Corallum smaller (up to 58 mm in GCD) and less
compressed: GCD:LCD 1.3-1.8, thecal face angle
40°-50°; septa octamerally arranged (16 primary septa)
in four cycles; calicular margin smooth
- Fungiacyathus (F.) anastre
corallum
- Corallum free, not attached to parent corallum
- Fungiacyathus (F.) spiniger
37 - All septa directed straight toward epicentre; septal
edges bear tall, slender teeth for entire length (no pali)
- Anthemiphyllia dentata
- 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)
38 - Corallum free, not attached to sector of parent
corallum
- Aulocyathus recidivis
39 - Edges of corallum acute, usually crested for all or
part of length; basal edge angle > 70°
- Edges of corallum rounded (not crested); edge angle
40°-50°; Flabellum (F) transversale
36 - Corallum smaller (up to 58 mm in GCD) and less
compressed: GCD:LCD 1.3-1.8, thecal face angle
49°-61°; septa hexamerally symmetrical in up to six
cycles (192 septa); calicular margin smooth
- Fungiacyathus (F.) anastre
corallum
- Corallum robust, discrete paliform lobes before all
but last cycle of septa; corallum less than 30 mm in
calicular diameter
- Fungiacyathus (S.) sp.
42 - Corallum cylindrical and extremely small (calicular
diameter < 1.5 mm); 16 septa in two cycles
- Gynia annulata
- Corallum laterally compressed or conical (ceratoid
or trochoid). GCD well over 2 mm; 28 or more sepa
- Gynia annulata
43 - Corallum conical, calice circular to slightly elliptical
(GCD:LCD < 1.3); columella robust (fascicular,
labyrinthiform, or papillose)
- Corallum laterally compressed, calice highly elliptical
to elongate (GCD:LCD > 1.3); columella rudimentary
- Corallum conical, calice circular to slightly elliptical
(GCD:LCD > 1.3); columella robust (fascicular,
labyrinthiform, or papillose)
44 - Corallum lacking edge sulci; costae continuous to
base; 10 costae and intercostal ridges
- Holotrochus crenulatus
- Corallum extremely fragile (usually fragmented) and
absent (composed of fusion of inner edges of larger
septa)
46 - Corallum lacking edge sulci; costae continuous to
base; 10 costae and intercostal ridges
- Holotrochus crenulatus
- Corallum extremely fragile (usually fragmented) and
absent (composed of fusion of inner edges of larger
septa)
47 - 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) transversale
- 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
48 - Sixteen primary costae dark brown; thecal edges
crested for most of length
- Fungiacyathus (F.) spiniger
- Theca entirely white, no costal striping; thecal edges
crested only on lower half of corallum
- Fungiacyathus (F.) spiniger

TAXONOMIC SECTION

Order Scleractinia Bourne, 1900
Suborder Fungiina Verrill, 1865
Superfamily Fungiicea Dana, 1846
Family Fungiacyathidae Chevalier, 1987

Fungiacyathus Sars, 1872

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

Bathyctis palifera Alcock, 1902: 38. pl. 5, figs 34,
34a; Hoffmeister, 1933: t. 4, fig. 6.
Fungiacyathus paliferus: Cairns, 1989a: 9, 10, pl. 2c-
i, 3a-c (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: $C_1 > C_3 > C_4 > C_5$. 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 $S_3$ 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) dennantii sp. nov.
(Figs 1d, e, g, Map 1)
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 corallà, usually only 24 of the expected 48 septa are present in any specimen. Si 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. S1,2 extend to epicentre of calice, the S2, 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 Si and corresponds to the area of fusion with adjacent S1. Pairs of S1 fuse with S2 at a distance of about one-third calicular radius from epicentre, each Si, consisting of about four tall septal spines and a lower, peripheral shoulder. Pairs of S1 fuse to S1 at a distance of about two-thirds calicular radius from epicentre, each S1 consisting of four or five small trabecular spines. Lateral edges of trabecular spines, especially those of S1,12, 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 S1. Columella nonextant, the calicular epicentre lying on the fracture plane.

Discussion

Cairns (1989a) listed the 17 species in the subgenus Fungiacyathus (Bathyaciatu), two of which, like F. dennani, are fissiparous: F. fissilis Cairns, 1984 (Hawaii) and F. crispus (Pourtales, 1871) (western Atlantic). F. dennani 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(l).

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(l).

Distribution

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

Family MICRABACIIDAE Vaughan, 1905

Letepsammia Yabe & Eguchi, 1932

3. Letepsammia formosissimaa (Moseley, 1876)
(Figs 1f, h, Map 2)

Stephanophyllia formosissimaa 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.


Letepsammia formosissimaa: 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 synapticularae. Costae alternate in position with septa. Larger specimens bear a peripheral marginal shelf. Septa arranged in typical micrabacid fashion: septa of first two cycles straight and nonbifurcate; the 12 S1 lead to multiple bifurcations in a complex but consistent
pattern (Cairns 1989a: text-fig. 1). A complete corallum has 120 septa. S is 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 Ss.

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 Agaricinacea Gray, 1847
Family SIDERASTREIDAE Vaughan & Wells, 1943
Coscinaraea Milne Edwards & Haime, 1848

(Figs li, 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
Colonies 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 li). 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 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).

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


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 collumella (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).

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 cast to Pearson I., eastern Great Australian Bight, South Australia; 1-20 m.

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(l), 360(3); Goat I., Nuays Archipelage, 12-15' (=3.7-4.6 m), WZ, KGH 10.iii.1987, SAM H361(l); St Francis I., 3-5 m, WZ 25.i.1982, SAM H362(l); Flinders I., SAS, TM K862 (7 fragments); off Boston I., 3-8 m, WZ, KGH 17.ii.1988, SAM H363(l); Marum I., 20' (=6.1 m), WZ 10.i.1984, SAM H364(l) and 15-35' (=4.6-10.7 m), WZ, KGH 20.11.1986, SAM H365(l); reef NW of Hareby I., 15-20' (=4.6-6.1 m), WZ, KGH 28.i.1986, SAM H366(l); Kirkby I., 10-45' (=3-13.7 m), WZ, KGH 28.i.1986, SAM H367(l); Reevesby I., 8-20' (=2.4-6.1 m), WZ, KGH 24, 25, 30.i.1986, SAM H368-370(l); Edithburgh, 15 m, WZ, KGH 19.xi.1986, SAM H371(II); 3 km W of Glenelg, 20 m, anon., xi.1972, SAM H372(l); ca 3 Nm (=5.5 km) off Glenelg, 35' (=10.7 m), KGH ix.1982, SAM H374(l); Aldinga Reef, 60' (=18 m), SAS 6.iii.1966, SAM H375(l).

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 Faviicæae Gregory, 1900
Family FAVIIDAE Gregory, 1900

Plesiastrea Milne Edwards & Haime, 1848

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

Astraea versipora Lamarck, 1816: 64.
Astraea galaxea Quoy & Gaimard, 1833: 216, pl. 17, figs 10-14.
Plesiastrea versipora: Milne Edwards & Haime, 1857: 490, 491, pl. D, 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, 1848b: 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 praecox Dennant, 1904: 9, pl. 2, figs 3a, b; Howchin, 1909: 247.

Observations

Corallite extremely variable in all 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>S>S), 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 columnella, 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 exert and have finely dentate inner edges. Septocostae variable in expression: usually SC, are present, sometimes a costa corresponds to each septicum, but often the coenosteum is noncostate and simply vesicular. Columnella rudimentary, composed of several weak trabeculæ. 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 (l); King George Sound, WAM 277-89 (l).

South Australia: Pearson I., WZ 24.xi.1976, SAM H376(l); Whitleebee Point, WZ I.iii.1975, SAM H383(l); St Francis I., 3-5 m, WZ 23-26.i.1982, SAM H377(l), 378(l), 667(l); Franklin Is, 7-15 m, WZ, KGH, PA 21-25.ii.1983, SAM H379-382 (14), H668(l), 13(l), 378(l), 667(l); Franklin Is, 7-15 m, WZ, KGH, PA 25.ii.1983, H671(l); Port Blanche, 6-20' (=1.8-6.1 m), WZ, KGH, PA 26.i.1987, SAM H384(l), 385(l); Mouse I., 3-5 m, WZ, KGH, PA 26.i.1987, SAM H385(l), 386(l), and 15'(=4.6 m), WZ, et al. 26.11.1986, SAM H387(l); Port Denison, 10-25' (=3-7.6 m), WZ, KGH, 22.i.1986, SAM H388(4); Marum I., 20' (=6.1 m), WZ 9.11.1984, SAM H389(l), 15'(=4.6 m), WZ.
Family RHIZANGIIDAE d’Orbigny, 1851

**Culicina Dana, 1846**

7. *Culicina australiensis* Hoffmeister, 1933
   (Figs 2a, d, g)

*C. rubeola*: Dennant, 1904: 9.

*C. australiensis* Hoffmeister, 1933: 12, pl. 3, figs 3, 4; Wells, 1958: 263, pl. 1, figs 3, 4; Squires, 1960: 200, fig. 8.


*C. 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 x 2.2 cm, consisting of 18 corallites (SAM H420). Corallites cylindrical, with a circular diameter; corallites up to 11 mm tall. Corallites epithecate.

Septa hexamerally arranged in four complete cycles. S₃₂ 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). S₃ about half width of S₃₂ and lobate for entire length, bearing 2-3 large lobes apically and 2-3 progressively narrower and taller lobes adjacent to columella. S₄ quite narrow, but bear 4-8 tall, slender lobes (Fig. 2d); inner edges of S₄ do not reach columella. Septa closely spaced (about 0.11 mm apart), the thickness of an S₃₂ being about 0.16 mm.

In large coralla, all sepa 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. Posses, containing a papilllose columella of 10-15 elements, the innermost lobes of the S₃₂ grading imperceptibly into columella.

**Discussion**

Although found within 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 Macleay 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 S₃ (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 L., 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 L, 15-20 fms (=27-37 m), JV, SAM H408; W of St Francis L, 35 fms (=64 m), JV, SAM H409; near E. Franklin L, 6 m, PA, NH 25.xii.1983, SAM H410; near Boston L, 10-25' (=3-7.6 m), WZ, KGH 17x.xi.1988, SAM H411; Kirkby I, 20-30' (=6-1.92 m), KGH, NH 31.xi.1986, SAM H412, and 10-45' (=3-13.7 m), WZ, KGH 28.1.1986, SAM
sometimes dissected by narrow clefts that delineate as half of a septum (0.23-0.33 mm wide). In other and larger corallites often have a variable number of specimens, however, inner edges of S, are less lobate, very rudimentary S,. S, composed of three or four 20-22 septa per corallite is not uncommon, however, 20-22 septa per corallite is not uncommon, 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, and their lower septal dentition and columella are composed of laciniate trabeculae. S, usually same size as S, and therefore often indistinguishable, or slightly smaller, having smaller and finer septal lobes. S, about half width of S, 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, sometimes fuse with inner edge of adjacent S, S, about 0.1 mm thick; S, about 80 µm thick; all septa widely and evenly spaced about 0.25 mm apart. Inner edges of S, reach columella; inner edges of S, reach columella via their paliform lobes. If an S does not bear a P, its inner edge extends only about half distance to columella. Septa nonexmostat, 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 F, P, larger and higher than columellar elements and triangular in shape.

Description

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, and their lower septal dentition and columella are composed of laciniate trabeculae. 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.

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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.
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; 9-40 m. Pliocene: Australia from eastern Great Australian Bight (D'Entrecasteaux Reef) to off Sydney, New South Wales; no records from Tasmania; 9-40 m.

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.


?Astrangia woodsii: Shepherd & Veron, 1982: 176, fig. 4.54c; Veron, 1986: 601, 201 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 X 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). S₁₂ 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. S₁ about three-quarters width of S₁₂ with an equal number (but smaller in size) of septal teeth. S₂ about half width of S₁, composed of 6-7 septal teeth. S₃ independent, sepa of both cycles reaching the columella. S₄ also reach columella but their inner edges tend to curve toward, but do not fuse with, the S₂ within their respective systems. Likewise, pairs of S₃ curve toward, but do not fuse with, the respective S₁ in their half-systems. This arrangement of septa tends to isolate the six S₁ 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 S₁₂ septal teeth.

Discussion

Only one other species of Astrangia is known from Australia. A. woodsii Wells, 1955, described from off Brisbane. A. woodsii 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 17.1.1980, SAM H466(1); Backstairs Passage, 22 fms (=40 m), JV, USNM 85673(1) (ex SAM H443); S.Aust. (no data), SAM H444(1).


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.


_Scolymia vitiensis_ Bruggeiman, 1877: 304, 305.

_Homophyllia australis_: Bruggeiman, 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.

_Culcita 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 pedicle, 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, broad pedicel, which is sometimes up to 90% of bowl-shaped to turbinate, and firmly attached by a 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); Hope Town, 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.i.1983, SAM H453(1), in rockpools, WZ, PA 26.i.1983, SAM H454(6); Port Blanche, Streaky Bay, 6-20’ (=1.8-6.1 m), WZ, KG 9.ii.1988, SAM H455(6); Sheringa, 3 m, MK 3.i.1979, SAM H456(1); Coffin Bay, 1-5’ (=0.3-1.8 m), WZ, KG 6.ii.1987, SAM H457(8); Donnington Reef, 3 m, anon. 28.ii.1978, SAM H458(2); Tumby Bay jetty, 1-5 m, WZ, KG 21.ii.1988, SAM H459(8); Reevycay 1°, 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, KG 24.ii.1986, SAM H463(3), 10-15’ (3-4.6 m), WZ, KG 25.i.1986, SAM H464(8); Turfey’s Rocks, 5-10’ (=1.5-3 m), WZ, KG 27.i.1986, SAM H465(1); Roxby 1°, 20° (=6 m), NH 9.ii.1984, SAM H466(1), xdepth, NH 25.ii.1982, SAM H467(2); Langton 1°, 12° (=1.5-3.7 m), WZ, KG 25.i.1986, SAM H468(24)/USNM 85703(3); N of Partney Shoal, 10-25’ (=3-7.6 m), WZ, KG 22.i.1986, SAM H469(1); Smith Rocks, intertidal, ES 28.i.1986, SAM H470(3); reef E of Blythe 1°, 1-20’ (=1.5-6.1 m), WZ, KG 29.ii.1986, SAM H471(11)/USNM 85709(4); Marum 1°, 15-20’ (=4.6-6.1 m), WZ 8-13.iii.1984, SAM H472-476(27), 10-35’ (=3-10.7 m), WZ, KG 20.23.iii.1986, SAM H477(2), 478(4); E of Lusby Rocks, 10-15’ (=3-4.6 m), WZ, KG 24.1.1986, SAM H479(4); Lusby 1°, 20’ (=6.1 m), WZ, 11.ii.1984, SAM H480(1); Winceby 1°, 30’ (=9.2 m), WZ, 12.ii.1984, SAM H481(1); Kirkby I., 10-45’ (=3-13.7 m), WZ, KG 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 Poirtalès, 1878

II. 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:
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 S3 pairs. Most coralla very uneven in S3 development, the same specimen having half-systems with no S3, some with one pair of S3, and some half-systems with a full two pairs of S3. S1 independent, extending to columella and conferring an easily recognized hexameral symmetry upon calice. S2 also extend to columella but are loosely joined by innermost septal spines of adjacent S3 near columella. Likewise, S3 usually joined by innermost septal spines of adjacent S4 several mm from columella. S4 rudimentary and do not attain the columella. All septa low in profile and equally exert 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 S1 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 S1. 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 S3, 14-15 per S4, and 9-10 per S5; smaller specimens have correspondingly fewer spines. Fossa relatively shallow, containing a papillose columnella, which is simply a circular field of the innermost S1,2 septal spines.

**Discussion**

There are three described Recent species of Anthemiphyllia: A. patera Pourtalés, 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 columnella (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 S3.

**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:** 'Kimbia' 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 Sca, Indonesia; 75-522 m. Pleistocene: Ryukyu Is.

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

Family CARYOPHYLLIIIDAE Dana, 1846

**Caryophyllia** Lamarck, 1801

12. Caryophyllia planitiamellata Dennant, 1906 (Figs 4g-i, Map 4)
Caryophyllia planilamellaia 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).

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 coralium with a massive pedicel, four size-classes of septa (S12 > S3 > S5 > S7) with highly exert S3, relatively narrow pali, and a deeper fossa. It is known from circum-Southern hemisphere locations and New Zealand at 35-1116 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 Pacific (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(56), 300 fms (=549 m), JV 25.xii.1905, SAM H507(5), 500 fms (=821 m), SAM H508(6), 200 fms (=366 m), SAM H509(56), all JV; 'Silent Victory' Stn 2, 446 m, 'Silent Victory' Stn 1, 300-412 m, SAM H510(5), 110 fms (=201 m), SAM H511(1); 'Silent Victory' Stn 2, 705 m, NMV F56825(1) and 677-714 m, NMV F56823(1); 'Silent Victory' Stn 1, 330-570 m, SAM H512(2).

Victoria: W of Cape Nelson, 165-201 m, 28.vii.1969, NMV F56849(3); off Cape Nelson, 220-293 m, v.1969, NMV F56807(1); 'Vema' Stn 18-105, 369 m, USNM 82176(1); SE of Portland, 220-293 m, 9.vi.1969, NMV F56817(3); 0, 400’ (=1220 m), SAM H510(5); 'Halcyon' Stn 2, 705 m, NMV F56825(1) and 677-714 m, NMV F56823(1); 'Silent Victory' Stn 1, 330-412 m, SAM H512(2); 'Silent Victory' Stn 2, 330-570 m, SAM H513(1); 'Silent Victory' Stn 2, 330-570 m, SAM H513(1); 'Silent Victory' Stn 2, 330-570 m, SAM H512(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.i.1979, TM KI19(1); 'Soela' Stn 51, 520 m, SAM H517(6)/USNM 85680(2); BANZARE Stn H15, 128 m, SAM H515(1), H516(26) (C. clavus of Wells 1958); Cape Lodi, 7 depth, v.1954, NMV F56814(1); 'Soela' Stn 3-84-77, 506 m, NMV F56787(2)/USNM 85719(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, 1220 m.

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


Caryophyllia sp. Zibrowius, 1974b: 755, 756, pl. 1, fig. 11, pl. 2, fig. 1.


Description

Corallum ceratoid and straight, firmly attached by robust, stereome-reinforced pedicle 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 hexamerially arranged in four cycles (48 septa, 12 pali), and six have septa heptamerially arranged in four cycles (56 septa, 14 pali). S12 (or 14 primaries) highly exert (up to 3 mm) and thick (up to 1 mm thick), with straight inner edges that almost attain the columella, overlapping with the P1 in distance toward the columella. S1 (or secondaries) much less exert (about 1 mm), about three-quarters width of S12, and have thickened, slightly sinuous inner edges. S4 (or tertaries) equally exert as S1 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) P1 occur in fossa, each palus separated from its corresponding S1 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], 1090-1150 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, 930-1150 m. Northeastern Atlantic (Zibrowius 1980), off Bermuda, South Africa, St Paul I., New Zealand; 520-2200 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
Coralum 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: $S_{1-2} > S_3 > S_4$. $S_{1-2}$ moderately exert and have straight inner edges that almost attain the columella. $S_3$ half as exert as $S_{1-2}$ and have slightly sinus inner edges that extend almost as far toward columella. $S_4$ equally exert 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.
comu Moseley, 1881, and a small specimen from 'Soela' Station 30. Hoffmeister's specimen from Bass Strait is much larger than the holotype (6.4 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. comu (Challenger' Stn 163), slightly larger than the holotype of C. inornatus, has three pairs of S,(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 Crispatorochus and recognized 12 species, noting C. inornatus to be most similar to C. galapagensis Cairns, 1991.

Material Examined

Victoria: 'Soela' Stn 30, 190 m, WZ, SAM H519(1).
New South Wales: paralectotype of C. comu, 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. funiculomma (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,) 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.

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 nonepithecal. 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, whereas lateral half-systems often lack pairs of S, S, 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, less exsert and only about 0.8 width of S,. Their lower, inner edges often

distinctive thecal rim (or septal notch) characteristic of all species of Conotrochus.
fused to their adjacent \( S_1 \) or \( P_2 \). \( S_2 \) rudimentary, only about 0.2 width of \( S_2 \). 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 \( P_1 \), 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; ‘Soela’ Stn 45, 41°14’S, 144°07’E, 25.5 Nm (=46.5 km) W of Richardson Point, 520 m, coll. W. Zeidler 19.x.1984, SAM H524(4).

New South Wales: ‘Kapala’ Stn K75-09-08, 29°26’S, 153°49’E, 250 fms (=457 m), 12.x.1975, AM GI5044(2) (Cyathoceras sp. of Veron 1986: 606, fig.).

Other material

New South Wales: ‘Kapala’ Stn K75-09-08, 29°26’S, 153°49’E, 250 fms (=457 m), 12.x.1975, AM GI5044(2) (Ceratotrochus 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 1, 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 pedicle diameter. Wall thick, covered with epitheca. Septa 62, hexamerally arranged in five cycles, the fifth incomplete: every system has one pair of \( S_1 \) and one system has both pairs of \( S_1 \). \( S_1 \) appear to be equal in size, their thickened, lower, inner edges fusing to the columella. \( S_1 \) only slightly narrower, also fusing with columella. \( S_2 \) rudimentary, unless flanked by a pair of \( S_1 \), in which case they are almost as large as an \( S_1 \), their lower, inner edges fusing to inner edges of the adjacent \( S_1 \) near the columella. \( S_1 \) rudimentary, equivalent in size to \( S_1 \) 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 (II-16 mm in calicular diameter vs 6-8 mm) with more septa (>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 la, b, 2a-c; Howchin, 1909: 246.

Ceratotrochus (Conotrochus) typus: Wells, 1958: 265, 266, pl. 1, figs 14, 15.
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 $S_{j,3}$ 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 $S_4$, five having one pair of $S_4$, and two half-systems having both pairs of $S_4$. $S_4$ equal in width in larger coralla and have straight, vertical inner edges that attain the columella. $S_4$ about three-quarters width of $S_{j,2}$ and $S_3$ much smaller, about one-third width of $S_1$, unless flanked by a pair of $S_3$, in which case the flanked $S_4$ is three-quarters to full width of an $S_3$, when present, equivalent in size to unaccelerated $S_3$. 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(l), K7/73-47, 274 m, NMV F56808(l), 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(l), 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.

\[\text{Paracyathus} \text{ Milne Edwards \& Haime, 1848} \]

18. **Paracyathus vitatus** Dennant, 1906

(Map 6)

**Paracyathus vitatus** 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: \(S_1 > S_2 > S_3\); however, Dennant's illustrated holotype shows only 46 septa, one end half-system lacking a pair of \(S_1\). All septa exsert, but higher cycle septa progressively less so. Septal faces covered by tall, pointed granules. Pali in two crowns before \(S^1\), 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 columns before the \(S_1\) and \(S_2\), as would be the case in *Paracyathus*.

Many species of *Paracyathus* are found throughout the tropical and temperate regions of the world. Besides *P. vitatus*, three others have been reported from Australia: *P. conceps* Gardiner \& Waugh, 1938 by Wells (1964); *P. porphyreus* Alcock, 1893; and an undescribed species alluded to by Veron (1986). Comparisons of *P. vitatus* 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)

**Ceratophryina platypus** Moseley, 1876: 554.

**Stephanocyathus 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, wherein 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. \(C_{\perp}\) ridged from epicentre to calice, prominently near calice. \(C_{\perp}\) ridged only on vertical thecal faces above point of thecal inflection. Calice circular; calicular margin highly serrate, having tall apices corresponding to the 12 \(S_1\) and much smaller apices for the \(S_2\).

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. \(S_2\) 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 \(S_1\). \(S_{1,4}\) much less exsert, rising only 1.5-2.0 mm above calicular edge. \(S_{1,4}\) of approximately same size, but each \(S_4\) adjacent to the \(S_1\) within a half-system is usually slightly longer than the \(S_1\), and the other \(S_4\) in the half-system (adjacent to the \(S_1\)) is usually slightly shorter than the \(S_1\). Inner edges of \(S_4\)
sometimes loosely fused to inner edges of S, within same half-system. If pairs of S, are developed, the flanked S, is accelerated to about three-quarters width of an S, Otherwise, S, rudimentary, extending only several mm from calicularedge. 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,.

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 F5679I(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 K1I29(3); halfway between Woolnorth Point and King I., 183 m, AM l.iii.1979, TM K1I28(2); 'Soela' Stn 5l, 520 m, SAM H533(3); off Sandy Cape, 560 m, Evans 7.ix.1984, TM K1I33(2); FRV 'Challenger' Stn 4, 963 m, TM K1I31(1); 'Derwent Venture' Stn 1, 500-650 fms (=915-1 900 m), NMV F56966(l), F56967(1); 'Franklin' Stns Slope 45, 800 m, NMV F57176(1), Slope 46, 720 m, NMV F57158(1); 'Bluefin' Stn 1, 713 m, TM K1I32(1); FRV 'Challenger' Stn 3, 625 fms (=1 144 m), TM K1I30 (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. Fossa shallow. Columella elongate, 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, and their adjacent S, and much smaller apices corresponding to S,.

Septa hexamerally arranged in five cycles, the last incomplete (72 septa); every half-system contains one pair of S, S, equal in size and 3-4 mm exsert. Each S, 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, surround columella and are easily distinguished from it by their lamellar shape and elevation above columella. S, narrower and less exsert (about 2.5 mm) than S, 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, extend above calicular edge, whereas the apices of the P, crown terminate 2-3 mm lower in fossa, about 1 mm above columella. S, flanked by S, are accelerated to a size equivalent to that of an S, and their inner edges solidly fused to adjacent P,. Unflanked S, and S, 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. oldkami* (Alcock, 1894). The species described above is easily distinguished from *S. platypus* by its distinctive paliform lobes, large columella, and equal-sized S,.

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,4) and in having its P, fused to its P, only its P, 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 tatei* Dennant, 1899a: 117-118, pl. 3, figs 1a-c.

**Odontocyathus sexradii** Alcock, 1902: 23, pl. 3, figs 2-2b.

**Odontocyathus stella** Alcock, 1902: 24, pl. 3, figs 2a, 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.


**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,. 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, and their adjacent S, and much smaller apices corresponding to S,.

Septa hexamerally arranged in five complete cycles (96 septa). S, highly exsert (up to 8 mm) and by far the largest septa. S 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, are pigmented dark brown. S, only about 2.5 mm exsert and correspondingly narrow, but also bear equal-sized paliform lobes, together with the P, forming a crown
of lobes encircling and penetrating the columella. $S_{3,5}$ progressively less exsert and wide, except for those $S_1$ directly adjacent to $S$, which are highly exsert. Each $S_1$ 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 even farther from columella; however, inner edges of pairs of $S_4$ are usually solidly fused to the $P_4$ 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 papillate and elliptical in shape, composed of several central papillae flanked by the 12 $P_{1,2}$.

Description

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. sundiacus (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


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-1, 8a, Map I)

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 $C_{1,5}$ 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 $S_1$, slightly smaller than $S_1$, 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 $P_2$, $S_4$ relatively smaller and nonpaliferous, their inner edges loosely joined to adjacent $P_2$. Thus, only the six $S_4$ 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 $P_3$ 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 $P_3$.

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 septa 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 septa.

Material Examined

South Australia: ‘Silent Victory’ Stn 3, 150-170 m, SAM H540(l).
Victoria: ‘Franklin’ Stn Slope 27, 1500 m, NMV F57164(l).
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; Vcron, 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 (C₁⁻³) 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 S₁ (up to 324 septa). S₁ 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 S¹², 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, 800-1 000 m, TM K1123(2).

Victoria: 'Sarda' Stn 1, 150-156 m, NMV E56881(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: B3-138, 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 *Eunallocorallia rostrata* (Pourtales, 1878). *S. variabilis* is easily distinguished from the latter by having intratentacular budding and a light, bushy corallum.

**Material Examined**

**Western Australia:** Adelaide Peak 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/K7-3, 640 m, NMV 57152.

**New South Wales:** Green Cape, 470 fms (=860 m), USNM 85682 (ex AM GI2259) (Hoffmeister 1933).

**Tasmania:** Soela Stn 00, ca 1 000 m, TM K1127; Soela Stn 16 987, 1 090-1 150 m, TM K1092.

**Cascade Plateau:** Labrador Stn 3, 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 andantarctic seas (but not from Antarctica proper) (Cairns 1982), 220-2 165 m.

Family TURBINOLIIDAE Milne Edwards & Haim, 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 x 3.1 mm in calicular diameter and 8.2 mm tall. Costae equal in width (80-120 mm), and rounded, bearing large (40-50 mm), rounded granules peripherally and smaller, more slender granules (15-17 mm in diameter) laterally. Costae vertical in alignment, only the two principal costae remaining independent to base. Intercostal furrows 60-90 mm wide, regularly transversely bridged by bars 40-60 mm thick that delimit deep elliptical pits, the greater axis of each pit aligned with the costae and measuring 90-110 mm 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: $S_4 > S_3 > S_2 > S_1$. 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 $S_3$, an intermediate $S_2$, and two small $S_1$), whereas the four end-systems have four classes of septa (two bordering $S_3$, an intermediate $S_2$, two $S_1$, and four $S_0$). $S_2$ highly exsert and thick, have straight inner edges, and extend to columella; the two principal $S_1$ are slightly larger than other four. $S_3$ considerably less exsert, have sinuous inner edges, and merge with columella lower in fossa. $S_4$ progressively less exsert and wide: inner edges of $S_4$ sinuous, those of $S_4$ straight. Upper septal edges smooth to finely serrate; septal faces covered with coarse granules up to 60 mm tall. Pali absent. Columella papillose, composed of a staggered row of 5-10 papillae interconnected among themselves as well as to inner edges of $S_1$.

**Discussion**

Eleven species are here recognized in *T. verconis* (Pourtales, 1878) (Recent, western Atlantic), *T. fenestraus* (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. fenestraus, 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(1) and 49 fms (=90 m), SAM H545(3)/USNM 85684(1).

**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

Coralum 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 x 3.7 in calicular diameter and 11.1 mm tall (AM GI5278). 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 mediumsized 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 denticy 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 l., 15-20 fms (=27-37 m), SAM H547(1).
Paratypes
Western Australia: 80 Nm (=146 km) W of Eucla, 81 fms (=148 m), iiii.912, 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 l., 55 fms (=101 m), SAM H554(4); Gulf St Vincent, 17 fms (=31 m), USNM 8568(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(4), 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 GI5260(2); Cronulla, JVo, AM GI5278(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 II)
Holcotrochus scriptus Dennant, 1902: 1, 2, pl. 1, figs la, 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, and four C,) of equal width (0.18-1.10 mm) occur on each corallum; however, occasionally the basalmost section of a lateral C, will be enlarged at the expense or diminution of the C, 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, fully developed.

Ten septa hexamerally arranged in two cycles, the second incomplete: six S, and four S,, one septum corresponding to each costa. S, highly exsert (up to 0.67 mm), with greatly thickened outer edges and relatively narrow inner edges. S,, 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.
costae are present, septa correspond only to the six 0.15 mm deep, and bisected by the principal C, in the end systems. S, highly exsert edge suici, each of which is 0.19-0.31 mm wide and deep, except for lateral about 33 "m wide and 15 nm.

Principal costae expressed more fully above calicular area covered by 3-7 granules. Each intercostal furrow 0.1 mm exsert. Lower half of thecal faces covered by irregularly-shaped areas and horizontal strips, each widest point, and, along with the lateral C,. are about midway on across widest section near calice). The two lateral C, are quite broad (0.25 mm), almost vertical in orientation, and nearly porcellaneous in texture. Costae rounded and smooth peripherally; granular laterally, the granules only about (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, also highly exsert (0.31 mm) but rudimentary; no S, correspond to lateral C,, S, not present even though C, 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,) compared with the other four smaller ones (S,), 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
South Australia: off Cape Borda, Kangaroo I., 55 fms (=101 m), JV, SAM H563(1); off Cape Borda, Backstairs Passage, Beachport; Torres Straits: Murray I.; 9-185 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 II)

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, 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, in end systems are also wide (0.18 mm) and granulated (about four granules across widest section near calice). The two lateral C, are almost as broad (0.16 mm), and bear 3-4 granules across their widest section, which is about midway on the corallum. C,, 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, 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, in the upper corallum.

Ten septa hexamerally arranged in two cycles, the second incomplete: six S, four S,, whereas 20 costae are present, septa correspond only to the six C, and four C, in the end systems. S, 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, also highly exsert (0.31 mm) but rudimentary; no S, correspond to lateral C,, S, not present even though C, 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,) compared with the other four smaller ones (S,), 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 laevisatus 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 137 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 costae. 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 deccameraly (X16) 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 Ss, 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 papilllose 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 Platyrochus, 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, 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. laevigalus from South and Western Australia.

Two specimens, which must be considered as syntypes, were mentioned by Tenison-Woods (1878) in his original description of Conocytus 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-series, were mentioned by Tenison-Woods (1878) in Western Australia. Macleay Museum specimen thereby becoming a paralectotype. P. compressus, P. laevigalus, the AM specimen is consistent with the original description and Dennant’s later observations; the AM specimen is Trematotrechus 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 Ila-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 x 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 pedicle 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. 1la): 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 pedicell, 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 S1 being slightly wider and thicker than the S2, the 16 S4 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 columnar 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, columnar 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(I); 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(I).

**Victoria:** ‘Kimbla’ Stn 80-K-5-47, 86 m, NMV F56908(I); 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 x 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 of almost equal width and thickness, both series of septa extending to the lower part of the corallum. GCDiLCD = 1.5-1.65. Largest specimen (holotype) 5.32 x 3.50 mm. 

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

Australocyathus gen. nov.

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, P₃ often multiple. Columella papillose. Ahermatypic.

Discussion
Among the 10 other imperforate, paliform turbinoloid genera (Cairns 1989a), Australocyathus is most similar to Peponocyathus Gravier, 1915, but can be distinguished by its exclusively tympanoid corallum shape, smaller paliform lobes, and multiple P₃ per septum. Australocyathus also has a better developed fossa and differently shaped septa. It is similar to Thrypticotrochus Cairns, 1989a in having multiple P₃, 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 S₃). 

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. australiensis 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 Caryophylliidiae. Deltocyathus italicus var. australiensis Duncan, 1870 was recently shown by Cairns (1989a) to belong to Peponocyathus, a closely related turbinoloid genus.

Material Examined (Types, all JV)
Holotype
South Australia: SAM H589(I), Backstairs Passage, 22 fms (=40 m).

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

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

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 S₁₃, and its septal symmetry (Text-fig. 3).

Eurytrophus pariseptia is distinguished from P. hastatus by its exclusively tympanoid corallum shape, smaller paliform lobes, and multiple P₃ per septum. Australocyathus also has a better developed fossa and differently shaped septa. It is similar to Thrypticotrochus Cairns, 1989a in having multiple P₃, 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 S₃).

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. australiensis 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 Caryophylliidiae. Deltocyathus italicus var. australiensis Duncan, 1870 was recently shown by Cairns (1989a) to belong to Peponocyathus, a closely related turbinoloid 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)

Description
Corallum discoidal to tympanoid, with slightly inward-inclined walls, such that a corallum 9.9 mm in basal diameter and 5.5 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). S₁ independent and attain the columnella. S₂ also attain the columnella but each is joined by a pair of S₅ near columnella; pairs of S₅ also fuse to each S₅ slightly farther away from epicentre. S₅ have straight, vertical inner edges and finely serrate, highly exsert upper edges, their highest point 1-2 mm within thecal wall. S₅ 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 (P₁) and slightly broader and higher P₅ occur in most coralla. In larger coralla, two or three narrow P₅ occur on each S₅ in region where S₅ fuse to S₅. Inner edges of S₅ non-paliferous but slightly dentate. Fossa circular and large (defined by the vertical, inner edges of the S₅), and slightly deeper than the upper thecal edge. Columnella 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(I).
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(3), SAM H601(84)/USNM 85992(1), Yankalilla Bay, 20 fms (=37 m), SAM H602(86)*; between Gulf St Vincent and Backstairs Passage, 17-22 fms (=31-40 m), SAM H603(4)*; Backstairs Passage, USNM 86923, (ex AM GI2059(1)), Newland Head, 20 fms (=37 m), SAM H603(4)*, off Porpoise Head, 17 fms, SAM H604(2)*, Encounter Bay, 20 fms (=37 m), SAM H606(1), Broken Head (locality not found), SAM H607(I)*. (* 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.
Deltocyathus stimpsonii Pourtalès, 1871: 12, pl. 3, figs 1-3.
Deltocyathus orientalis Duncan, 1876: 431, pl. 38, figs 4-7.
Peponocyathus orientalis: Veron, 1986: 608.

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: S₁ independent, each S₂ joined by pairs of S₅, and each S₅ joined by pairs of S₅, progressively farther from epicentre. S₅ highly exsert, their highest point not far from columnella; inner edges straight and vertical, usually bordered by a small paliform lobe. S₅ less exsert, attaining the columnella through a prominent paliform lobe. S₅ smallest of septa, each bordered internally by a tall, broad paliform.
lobe (P₃), pairs of which fuse to adjacent P₂, S₄ slightly larger than S₁; their internal edges fused to adjacent P₁. 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 P₃ per S₃.

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.
Idiotrochus perexigua: Cairns, 1989a: 36, pl. 18c.