

## Notes on Indo-Pacific Scleractinian Corals. Part 10.<sup>1</sup> Late Pleistocene Ahermatypic Corals from Vanuatu<sup>2</sup>

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THE OCCURRENCE OF A DEEP-WATER invertebrate fauna of late Pleistocene age (25,280 ± 400 yrs. B.P.) on the island of Santo, Vanuatu (formerly New Hebrides), has been briefly described by H. S. Ladd (1975, 1976, 1982). The richly fossiliferous unlithified sands and silts on the Kere and Navaka rivers were first made known by the geologists of the New Hebrides Geological Survey (Mallick 1971; Mallick and Greenbaum 1975). Subsequent collections were made by members of the United States Geological Survey (USGS) and the National Museum of Natural History, Washington (USNM). The rich fauna of non-reef corals was made available to the writer for study by the late H. S. Ladd.

The ahermatypic coral fauna of 16 genera and 19 species is one typical of sandy or silty bottoms in moderately deep water (200 m) and consists mainly of small free-living caryophyllids and flabellids. Only five species are attached forms, fixed to shells, bryozoans, or octocoral axes. The faunal facies is that of contemporary calcareous sands and silts such as off the eastern and southern Australian coasts, Hawaii, Philippines, and southern Japan, and that of the Pleistocene deposits of the Ryukyu Islands (Yabe and Eguchi 1932*b*), Shortland Islands (Guppy 1885), Philippines (Eguchi 1941), and Java (Umbgrove 1950). All of the 19 species except two (*Deltocyathus heteroclitus* and *Flabellum vanuatu*) are extant forms of the western Pacific.

Pertinent to this brief study is the collection of recent Australian ahermatypes in the Australian Institute of Marine Science (AIMS), briefly examined by the writer in 1982. In it were found, *inter alia*, specimens of a new genus, *Bourneotrochus*, identical to some puzzling fossil examples from Vanuatu. Thanks are due to J. E. N. Veron of AIMS for permission to describe these.

Types and figured specimens are deposited in the National Museum of Natural History (USNM), Washington.

### FAMILY FUNGIIDAE DANA

#### GENUS *Diaseris* MILNE EDWARDS & HAIME

#### *Diaseris distorta* (Michelin, 1842)

*Fungia distorta* Michelin 1842, p. 316; 1843, pl. 5.

*Diaseris distorta* M. E. & H. 1851, p. 118; 1860, p. 35, pl. D12, fig. 4.

?*Diaseris distorta* Umbgrove 1946, p. 533, pl. 81, figs. 3, 4.

*Diaseris distorta* Veron & Pichon 1980, p. 121, figs. 194–196 (synonymy).

MATERIAL: Two worn specimens, disassociated fragments.

OCCURRENCE: Kere River: USGS Sta. 25718. Recent: Red Sea eastward through central Pacific to Hawaii; Japan; Galápagos (?). 10–100 m. Pliocene, Java (Umbgrove).

#### GENUS *Fungiacyathus* SARS

#### *Fungiacyathus fragilis* Sars

Figure 1, 1, 2

*Fungiacyathus fragilis* G. O. Sars 1872, p. 58, pl. 5, figs. 24–32.

<sup>1</sup> Numbers 1–9 of these notes were published in *Pacific Science* as nos. 1 and 2, vol. 13, pp. 286–290, 1955; no. 3, vol. 15, pp. 189–191, 1961; no. 4, vol. 20, pp. 203–205, 1966; nos. 5 and 6, vol. 22, pp. 274–276, 1968; no. 7, vol. 25, pp. 368–371, 1971; no. 8, vol. 26, pp. 183–190, 1972; no. 9, vol. 36, pp. 211–219, 1982.

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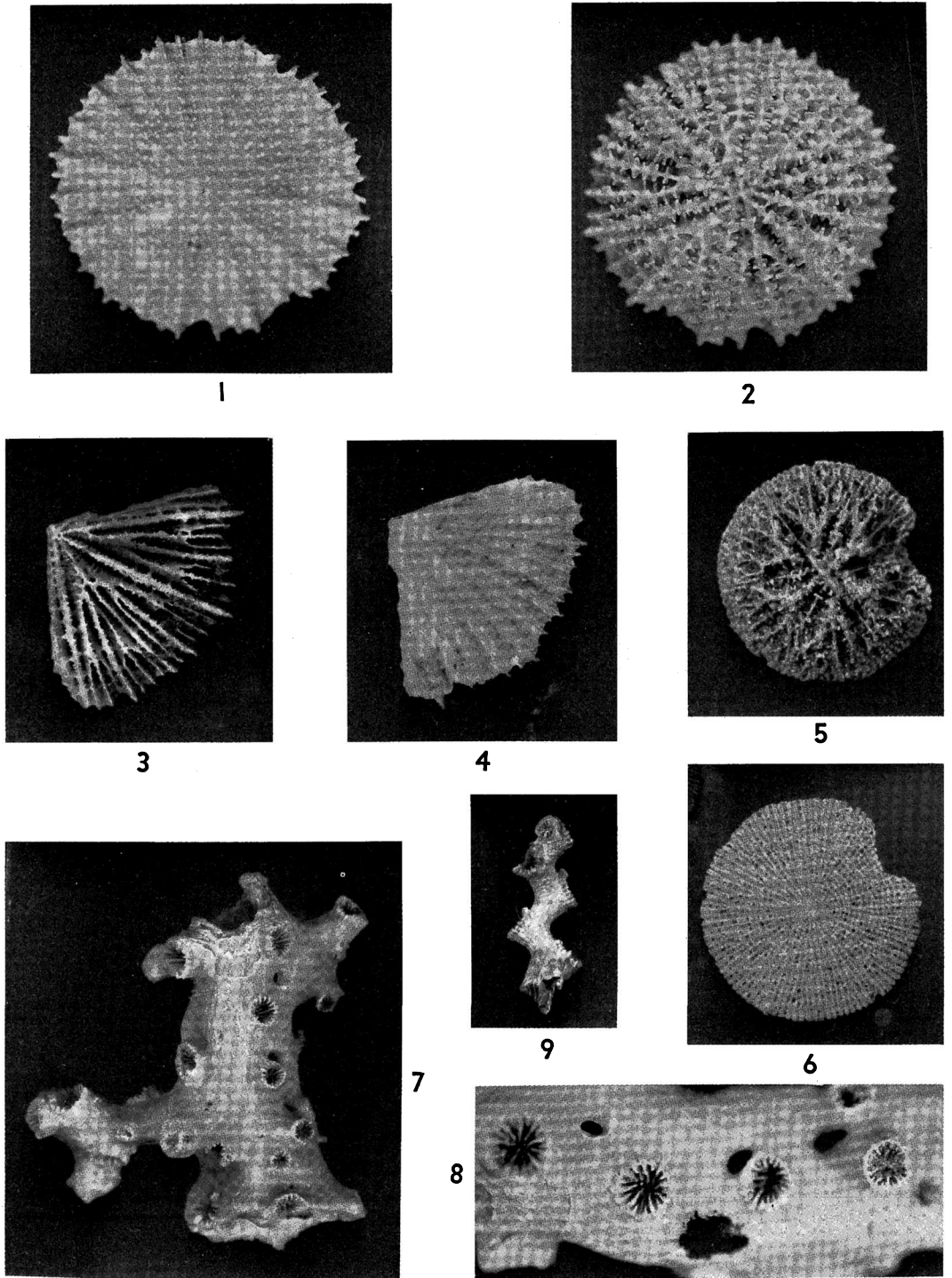


FIGURE 1. 1, 2, *Fungiacyathus fragilis*, USNM 71837,  $\times 8$ ,  $\times 8$ , Navaka R., USGS Sta. 24918; 3, 4, *F.* sp. cf. *stephanus*, USNM 71838,  $\times 4$ ,  $\times 4$ , Kere R., USGS Sta. 25715; 5, 6, *Stephanophyllia japonica*, USNM 71839,  $\times 4$ ,  $\times 4$ , Navaka R., USGS Sta. 24918; 7, 8, *Madrepora porcellana*, USNM 71840,  $\times 4$ ,  $\times 8$ , Kere R., USGS Sta. 25715; 9, *M. porcellana*, USNM 71841,  $\times 4$ , Navaka R., USGS Sta. 24918.

*Fungiacyathus fragilis* Zibrowius 1980, p. 23, pl. 5.

*Fungiacyathus fragilis* Cairns 1982, p. 9, pl. 1, figs. 3–7 (synonymy).

*Bathyactis kikaiensis* Yabe & Eguchi 1942a, p. 155, pl. 12, figs. 6, 7.

**MATERIAL:** Twenty-four examples, ranging in diameter from 2 to 11 mm. The septa in specimens up to  $cd = 8.5$  mm are relatively thick and strongly spinose laterally, the smallest with only three cycles. One,  $cd = 2.5$  mm, has four cycles with primary septa strongly crested. At  $cd = 4$  mm the “canopied” condition of the junctions of the second and third cycles has developed. At  $cd = 6$  mm the 48 fifth cycle septa are present. At  $cd = 14$  mm the septa are proportionally thinner but thickly spinose laterally.

**OCCURRENCE:** Navaka River: USGS Sta. 24918 (17 specimens); Kere River: USGS Sta. 25718 (7 specimens). Plio-Pleistocene: Japan. Recent: Atlantic, Hawaii, New Zealand, Antarctic (Macquarie Ridge). 285–2200 m.

*Fungiacyathus* sp. cf. *F. stephanus* (Alcock)

Figure 1, 3, 4

*Bathyactis stephana* Alcock 1893, p. 14, pl. 5, figs. 12, 12a.

*Bathyactis stephana* Alcock 1898, p. 28, pl. 3, figs. 5, 5a.

*Bathyactis stephana* Alcock 1902, p. 38.

*Fungiacyathus stephanus* Gardiner & Waugh 1939, p. 252.

**MATERIAL:** A fragment representing one quarter of a flat-based corallum ( $cd = 12$  mm est.) with five complete cycles of septa, of which those of the first two or three cycles rise as tall, smooth-margined folia, is referred to this species.

**OCCURRENCE:** Kere River: USGS Sta. 25715. Recent: Bay of Bengal, Macassar Straits, Natal. (34)–1240 m.

FAMILY MICRABACHIIDAE VAUGHAN

GENUS *Stephanophyllia* MICHELIN

*Stephanophyllia japonica* Yabe & Eguchi

Figure 1, 5, 6

*Stephanophyllia japonica* Yabe & Eguchi 1934, p. 281, figs. 1–3; 1942a, p. 156, pl. 13, figs. 8a–c.

**MATERIAL:** Two specimens, the larger ( $d = 8$  mm) well preserved, with five complete septal cycles, the base nearly flat with equal beaded costae.

**OCCURRENCE:** Navaka River, USGS Sta. 24918. Plio-Pleistocene: Ryukyu Islands; Kagoshima, Japan.

FAMILY OCULINIDAE GRAY  
GENUS *Madrepora* LINNAEUS

*Madrepora porcellana* (Moseley)

Figure 1, 7, 8, 9

*Neohelia porcellana* Moseley 1881, p. 176, pl. 10, figs. 7, 7a.

*Neohelia porcellana* Pratt 1900, p. 591, pls. 62, 63.

*Neohelia porcellana* Hickson 1903, p. 344.

**MATERIAL:** Several more or less fragmentary pieces of small colonies of this species seem to be distinct from the cosmopolitan *Madrepora oculata* (Linnaeus). The calices are very small (1–1.5 mm) with generally fewer septa.

**OCCURRENCE:** Kere River: USGS Stas. 25718 and 25715; Navaka River: USGS Sta. 24918. Recent: off Api Island, Vanuatu (*Challenger* Sta. 177, 115 m [type]); Lifu, Loyalty Island (Pratt gives no locality but most of Willey's corals came from Sandal Bay, Lifu); northwestern Australia, 140–141 m, 20.7°C.

FAMILY CARYOPHYLLIIDAE DANA  
GENUS *Caryophyllia* LAMARCK

*Caryophyllia scobinosa* Alcock 1902

Figure 2, 1–4

*Caryophyllia scobinosa* Alcock 1902, p. 8, pl. 1, figs. 1, 2a.

*Caryophyllia scobinosa* Yabe & Eguchi 1942a, p. 119, pl. 10, figs. 4, 5 (synonymy).

*Caryophyllia scobinosa* Gardiner & Waugh 1938, p. 177, pl. 3, fig. 7.

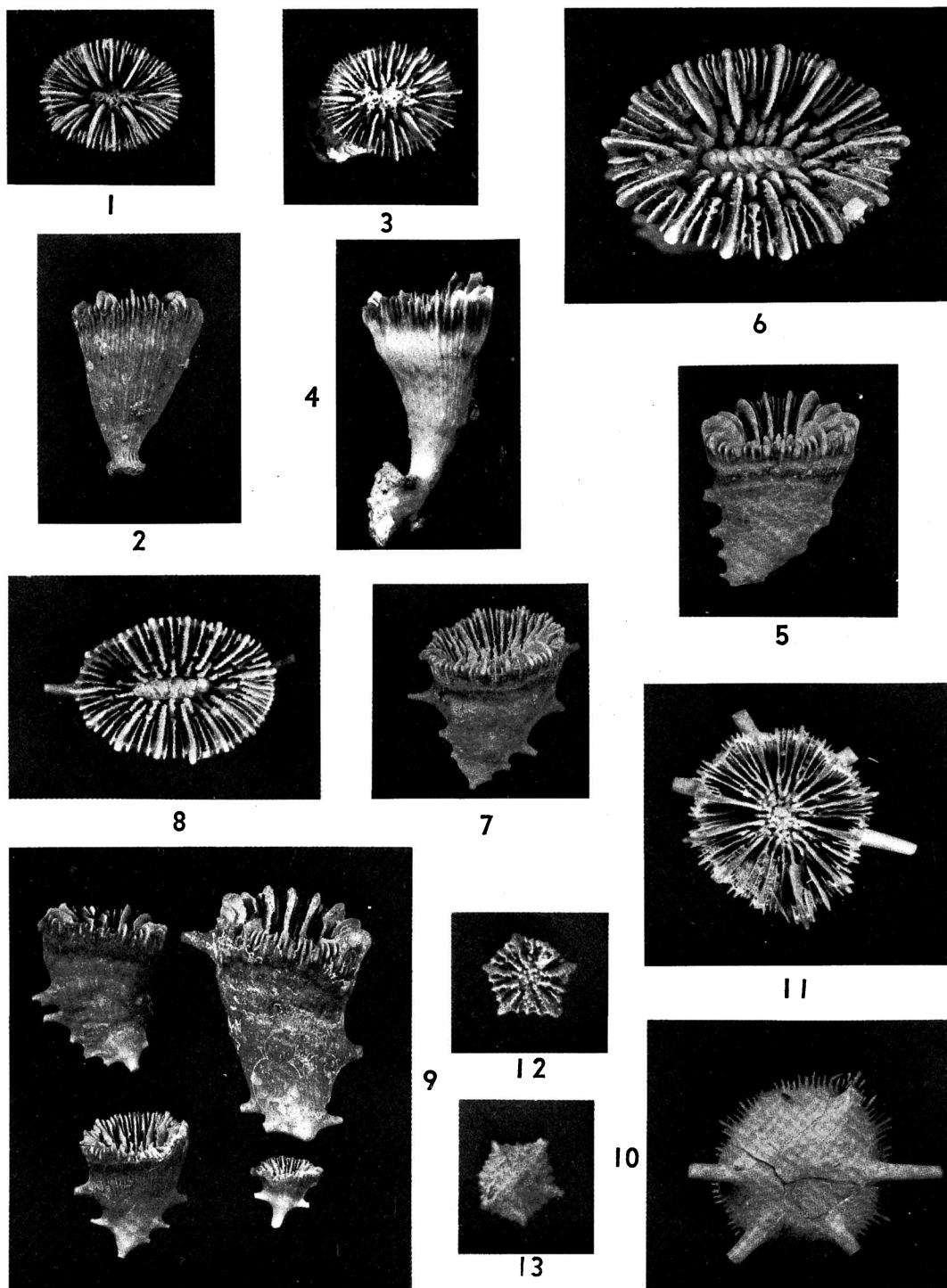


FIGURE 2. 1, 2, *Caryophyllia scobinosa*, USNM 71842,  $\times 1$ ,  $\times 1$ , Kere R., USGS Sta. 25715; 3, 4, *C. scobinosa*, USNM 71843,  $\times 1.5$ ,  $\times 1.5$ , Kere R., USGS Sta. 25715; 5, 6, *Acanthocyathus grayi*, USNM 71844,  $\times 1$ ,  $\times 1.5$ , Kere R. USGS Sta. 25715; 7, 8, *A. grayi*, USNM 71845,  $\times 1$ ,  $\times 1.5$ , Kere R., Sta. SM242; 9, *A. grayi*, USNM 71846,  $\times 1$ , Kere R., USGS Sta. 25715; 10, 11, *Stephanocyathus (Acinocyathus) spiniger*, USNM 71847,  $\times 1.5$ ,  $\times 1.5$ , Navaka R., USGS Sta. 24918; 12, 13, *A. (C.) spiniger*, USNM 71848,  $\times 4$ ,  $\times 4$ , Navaka R., USGS Sta. 24918.

**MATERIAL:** Fifteen conical to cornute coralla attached to bits of shell or sand, ranging in size from  $cd = 8 \times 9$  mm,  $h = 15$  mm, to  $cd = 15 \times 19$  mm,  $h = 25$  mm. Costae low, rounded, finely granulate. Specimens less than  $cd = 9 \times 10$  mm have only four complete cycles of septa, regularly arranged. In larger examples fifth cycle septa occur irregularly in many of the systems. Columella of curled laths.

**OCCURRENCE:** Kere River, USGS Sta. 25715, Sta. SM 242. Recent: western Indian Ocean, 786–805 m; Indonesia, 535–794 m; Japan, 119–522 m.

GENUS *Acanthocyathus* MILNE EDWARDS & HAIME

*Acanthocyathus grayi* MILNE EDWARDS & HAIME

Figure 2, 5–9

*Acanthocyathus grayi* M. E. & H. 1848, p. 293, pl. 9, figs. 2, 2a.

*Acanthocyathus grayi* Yabe & Eguchi 1941, p. 211, figs. 3a, b.

*Acanthocyathus grayi* Umbgrove 1950, p. 641, figs. 27–32 (synonymy).

*Acanthocyathus grayi* Eguchi & Miyawaki 1975, p. 57.

**MATERIAL:** Twenty-one typical specimens with calices ranging from  $6 \times 10$  mm to  $16 \times 23$  mm. In larger calices there are from 58 to 65 septa in four complete cycles plus 10–17 septa of the fifth. One example has two short spines on one flank, and five on one end and three on the other. Most specimens are tinted a pale red brown, deeper in shade toward the calice.

**OCCURRENCE:** Kere River: USGS Sta. 25715; Sta. SM 242. Recent: off coast of Burma; Andamans; Indonesia; Sulu Sea; Japan. 37–490 m.

GENUS *Stephanocyathus* SEGUENZA  
SUBGENUS *Acinocyathus* N.S.GEN.

TYPE SPECIES: *Stephanotrochus spiniger* Marenzeller 1888. Recent, Japan.

This subgenus is proposed to include species of *Stephanocyathus* with six elongate, slender basal spines corresponding to the costae of the six primary septa. *Stephanotrochus* (*Stephanocyathus*) lacks basal spines; *S.* (*Odontocyathus*) has 12 short, blunt or ragged spines corresponding to the 12 primary and secondary costae. Other species of *S.* (*Acinocyathus*), some of which are probably synonyms of *S.* (*A.*) *spiniger* are: *Trochocyathus? mantelli* Milne Edwards & Haime 1857 (Oligocene, New Zealand), *Stephanotrochus tatei* Dennant 1899 (U. Oligocene, Victoria, Australia), *Odontocyathus coloradus* Smith 1913 (Miocene/Pliocene, Nasbate I., Philippines), *Odontocyathus japonicus* Yabe & Eguchi 1932 (Neogene, Japan), *Odontocyathus stella* and *O. sexradiis* Alcock 1902 (Recent, Indonesia).

ETYMOLOGY: *akaina* (Greek = spine).

*Stephanocyathus* (*Acinocyathus*) *spiniger* Marenzeller

Figure 2, 10–13

*Stephanotrochus spiniger* Marenzeller 1888, p. 20.

*Odontocyathus spiniger* Eguchi 1968, p. C39, pl. C23, figs. 1, 2; pl. C26, figs. 12–14 (synonymy).

*Stephanocyathus* (*Odontocyathus*) *spiniger* Eguchi & Miyawaki 1975, p. 57.

**MATERIAL:** One worn specimen ( $cd = 20$  mm,  $h = 10$  mm) with the tips of the six horizontal spines broken off. A very small individual (Figure 2, 12, 13;  $cd = 3$  mm) from the same locality strongly resembles *Aplocyathus armatus* (Michelotti, 1838) of the Oligocene and Oligocene of Europe, examples of which are characterized by an apparent pentamerous symmetry due to reduction of one of the six normal systems, with suppression of one spine.

In a recent specimen from the Philippines ( $cd = 20$  mm) the spines are very long, gently tapering, with a spread of about 50 mm.

**OCCURRENCE:** Navaka River, USGS Sta. 24918. Neogene: Philippines, Japan. Recent: Philippines, Indonesia, Japan. 120–560 m.

GENUS *Heterocyathus* MILNE EDWARDS &  
HAIME

*Heterocyathus aequicostatus* Milne Edwards  
& Haime

Figure 4, 1

*Heterocyathus aequicostatus* M. E. & H.  
1848, p. 321, pl. 10, fig. 8.

*Heterocyathus aequicostatus* Eguchi 1968,  
p. C30 (but not pl. C28, fig. 1; pl. C29, figs.  
8, 9) (synonymy).

*Heterocyathus aequicostatus* Folkeson  
1919, p. 8, pl. 1, figs. 4-9.

MATERIAL: One specimen, cd = 7 mm,  
covering part of the shell of a small *Conus*, and  
two worn examples.

OCCURRENCE: Kere River, USGS Sta.  
25718. Navaka River: USGS Sta. 24918. Neo-  
gene: Japan, Ryukyus, Taiwan, Philippines,  
Indonesia. Recent: western Pacific, Indian  
Ocean, Persian Gulf, Red Sea, South Africa.  
10-658 m.

GENUS *Deltocyathus* MILNE EDWARDS &  
HAIME

*Deltocyathus heteroclitus* n. sp.

Figure 3, 1-6

DESCRIPTION: Corallum solitary, free, and  
discoid, with a slightly convex base. Costae  
corresponding to all septa, rounded, granu-  
lated, scarcely distinguishable toward center  
of base. Six short, blunt spines project hori-  
zontally from six of the  $S_3$  septa, giving the  
corallum a roughly hexagonal outline. Septa  
hexamerally arranged in four cycles, the last  
incomplete. The holotype and three of the  
paratypes have 36 septa, the other two para-  
types have 34. The arrangement of the septa  
in each system is consistent and peculiar:  $S_1$   
septae are thin, thickening at the wall where  
they continue as costae, with a slender palus  
near the junction with the columella. Each  $S_2$   
is joined near the columella by a pair of  $S_3$ . At  
the junction of an  $S_2$  with one of the  $S_3$  bear-  
ing a pair of  $S_4$  a pair of thick pali form a tall  
chevron. The palus-bearing  $S_3$  with its pair of

$S_4$  is the largest septum in each system, thick-  
ening at the margin where it continues as one  
of the six blunt spines. The other  $S_3$  in each  
system lacks a pair of  $S_4$ . The columella is  
formed by the fused inner ends of  $S_1$  and  $S_2$ .

MATERIAL: Six specimens, all from USGS  
Sta. 24918: five paratypes with cd's 2.5 mm  
(circular, no spines), 2.5 mm (small spines),  
3.0 mm, 3.7 mm, 3.8 mm, and holotype 4 mm.

REMARKS: The curious disposition of the  
septae in each of the systems distinguishes this  
from other recent and fossil species of *Deltocyathus*.  
Two other calcarate species are (1) *D. calcar* Pourtalès  
of the western Atlantic (Cairns 1979) with spines  
extending from the  $S_1$  septae, and (2) *D. ornatus* Gardiner  
1899 from the Loyalty Islands, which bears 12  
spines extending from the unthickened  $S_3$  septae.  
Specimens of the latter from off the southern Great  
Barrier Reefs, Queensland, in the collections at the  
Australian Institute of Marine Science show clearly 24  
 $S_4$  attached in pairs to the 12 spiniferous  $S_3$ . In the  
present form the  $S_1$  are small, the  $S_2$  are not much  
larger, but one of the  $S_3$  in each system is  
thickened beyond the junction with the pair of  
 $S_4$  and continues into a prominent short, blunt  
spine.

ETYMOLOGY: *heteroclitus*, Latin, differing  
from the norm.

HOLOTYPE: USNM 71849, Navaka River,  
USGS Sta. 24918.

PARATYPES (5): USNM 71850, 71851, Navaka  
River, USGS Sta. 24918.

OCCURRENCE: Navaka River, USGS Sta.  
24918.

GENUS *Bourneotrochus* N.G.

TYPE SPECIES: *Bourneotrochus veroni* n. sp.  
Recent, off southern  
Great Barrier Reefs, Queensland,  
Australia, 348-531 m.

DIAGNOSIS: Solitary, free, discoidal del-  
tocyathids, increasing asexually by transverse  
division (strobilation). Calice shallow, with  
pali before all but last cycle of septae. Base flat,

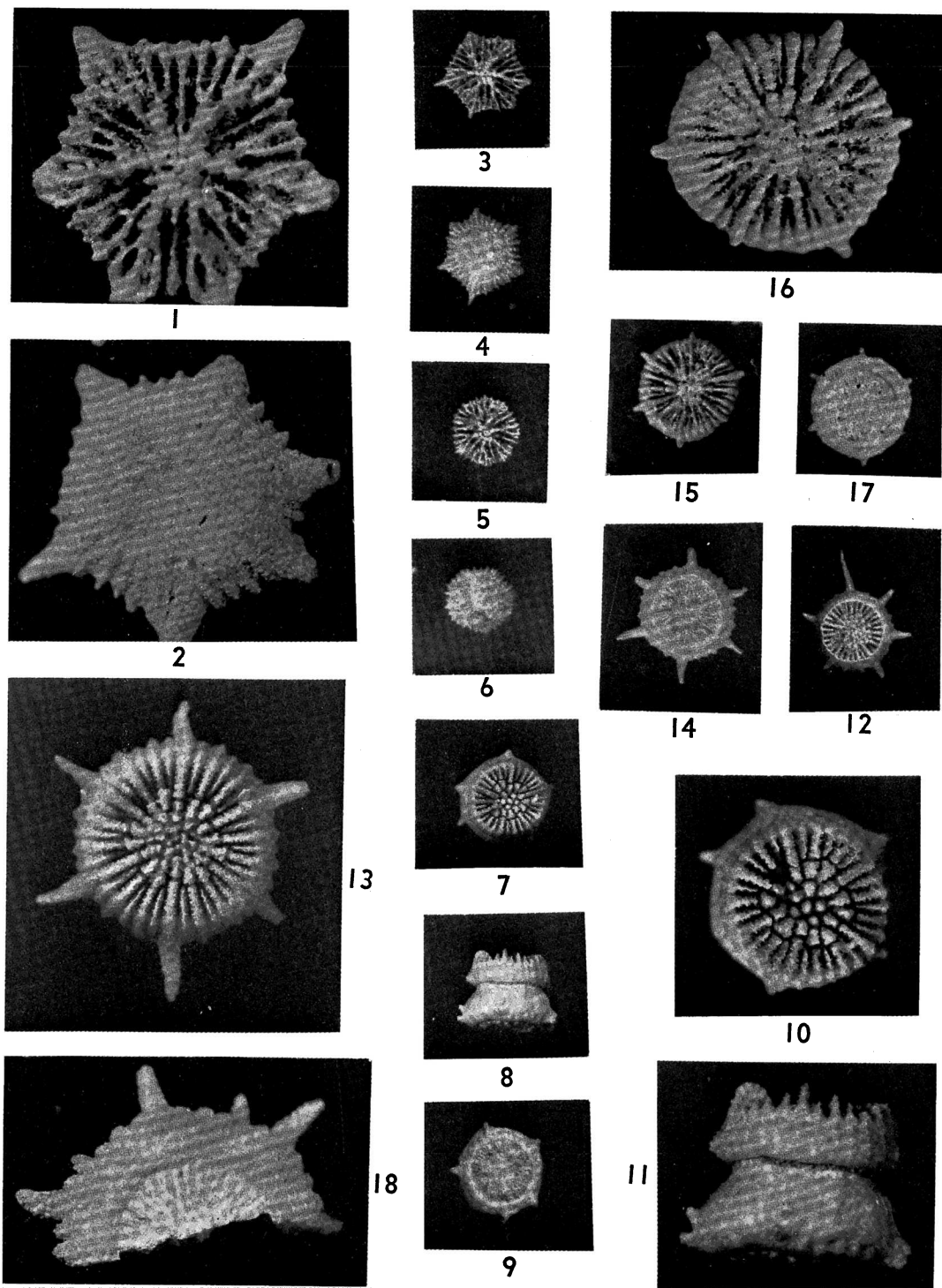


FIGURE 3. 1, 2, *Deltocyathus heteroclitus* n. sp., holotype USNM 71849,  $\times 8$ ,  $\times 8$ , Navaka R., USGS Sta. 24918; 3, 4, *D. heteroclitus*, paratype USNM 71850,  $\times 4$ ,  $\times 4$ , Sta. 24918; 5, 6, *D. heteroclitus*, paratype USNM 71851,  $\times 4$ ,  $\times 4$ , USGS Sta. 24918; 7, 8, 9, *Bourneotrochus veroni* n. g., n. sp., holotype USNM 75852, calice  $\times 4$ , lateral of anthocaulus-anthocyathus  $\times 4$ , base of anthocaulus  $\times 4$ , N of Fraser Island, Queensland, 476–531 m; 10, 11, calice and lateral of same  $\times 10$ ,  $\times 10$ ; 12, *B. veroni*, paratype USNM 71853, calice  $\times 4$ , same locality; 13, *B. veroni*, USNM 71854,  $\times 8$ , 25 mi E of Lady Musgrave Island, Queensland, 348–357 m; 14, base of same,  $\times 4$ ; 15, 16, 17, *B. veroni* USNM 71855,  $\times 4$ ,  $\times 8$ ,  $\times 4$ , Navaka R., USGS Sta. 24918; 18, *B. veroni*, base,  $\times 16$ , same locality.

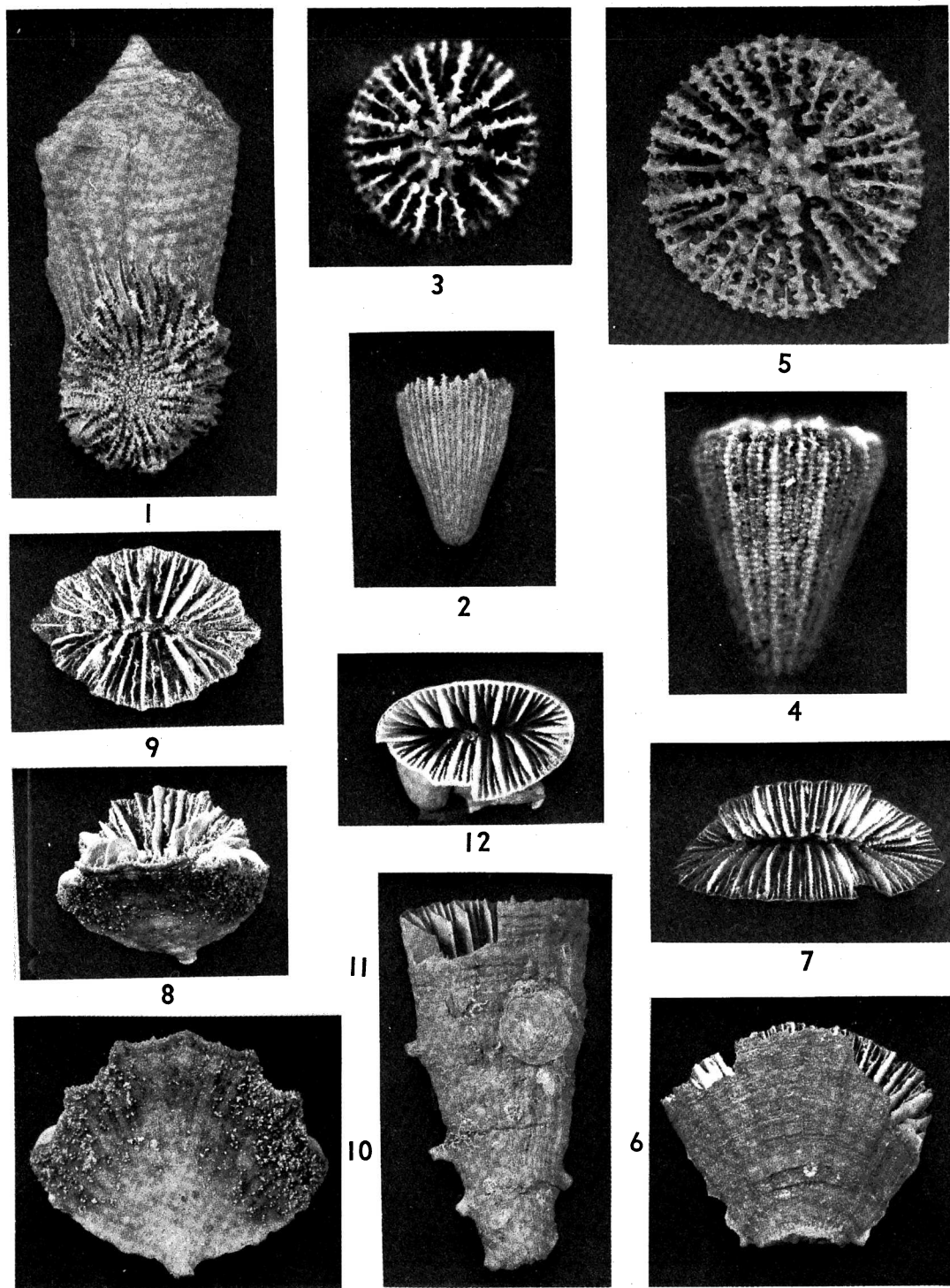


FIGURE 4. 1, *Heterocyathus aequicostatus* USNM 71856,  $\times 4$ , Kere R., USGS Sta. 25718; 2, 3 *Citharocyathus conicus* USNM 71857,  $\times 4$ ,  $\times 4$ , Navaka R., USGS Sta. 24918; 4, 5, *C. conicus* USNM 71857,  $\times 4$ ,  $\times 8$ , same locality; 6, 7, *Flabellum paripavoninum* USNM 71858,  $\times 1.5$ ,  $\times 1.5$ , Kere R., USGS Sta. 25718; 8, 9, 10, *F. sp. cf. F. deludens*, USNM 71859,  $\times 1$ ,  $\times 1$ ,  $\times 1.5$ , Navaka R., USGS Sta. 24918; 11, 12, *F. vanuatu* n. sp., holotype USNM 71860,  $\times 1.5$ ,  $\times 1.5$ , Kere R., USGS Sta. 25715.



marked by scar healed after division. The discoidal form distinguishes this genus from other caryophylliid genera exhibiting transverse division.

ETYMOLOGY: The genus is named for Gilbert C. Bourne (1861–1933), British zoologist.

*Bourneotrochus veroni* n. sp.

Figure 3, 7–18

*Trochocyathus hastatus* Bourne 1903 *pars*, p. 32, pl. 6, figs. 8–11, *not* pl. 5, figs. 2–5.

DESCRIPTION: Corallum small, discoidal, and free, with flat or slightly concave base with scar of former attachment, or attached with impending transverse division to calicular surface of a similar parent corallum (“anthocyathus”). Corallum contracting slightly from base to calice rim, in lateral aspect resembling a squat, truncated cone. Costae equal, subacute finely granulated or subspinose. Associated with each of the six  $S_1$  is a blunt spine up to 2 mm long, projecting outward and slightly down from near the basal margin. Septa in four complete cycles, each of the six  $S_3$  lacking a pair of  $S_4$ . Septa scarcely exert, decreasing in length with increasing cycle number. Pali present before  $S_1$ , larger ones before  $S_2$  and  $S_3$ , except that they are present only before  $S_3$  that are flanked by  $S_4$ —a total of 18 pali. Septa and pali granulose or spinose. Fossa shallow.

	DIMENSIONS		
	cd	bd	h
Australia			
Holotype			
(“anthocyathus”)	2.2	3.5	1.5 mm
(“anthocaulus”)	3.0	3.2	1.0
Paratype			
1	2.5	3.0	0.9
2	3.0	3.6	1.5 (incipient division)
3	2.8	3.	1.0
Vanuatu	3.5	3.75	0.75

REMARKS: Bourne’s *Trochocyathus hastatus* included two different forms: a free stephanocyathid bearing six long horizontal basal

spines, *Stephanocyathus* (*Acinocyathus*) *hastatus* (1903, pl. 5, figs. 2–5); the other (pl. 6, figs. 8–11), represented by three very small deltocyathids with basal scars, here designated as *Bourneotrochus veroni*, which Bourne “safely identified as the young forms of *T. hastatus*. They are of considerable interest for they show that the free forms of this species are derived by strobilation from a . . . trophozoid.” Although Bourne’s identification of the small forms with *T. hastatus* was in error, this is the first recognition of transverse fission in a caryophylliid, previously known only in the fungiids and flabellids. By coincidence in the same year, Dennant (1903: 214) suggested strobilation in his new Eocene (Australia) genus *Pleuropodia*, another very small coral of uncertain affinities. The occurrence of anthocyathi still attached to parent anthocauli of nearly equal size in the specimens from Queensland described above indicates that the adult stage represented by the anthocaulus, itself an anthocyathus from a previous division, is the full size attained in *B. veroni*, and that *T. hastatus*, a much larger form, as restricted here, with unscarred base, is quite a different coral. Further examination of the Queensland dredged material may reveal the *Deltocyathus*-like initial sexual generation.

Specimens of *Dunocyathus parasiticus* Woods 1878, of which *Deltocyathus rotaeformis* Woods 1878 is a synonym (Wells 1958), from the same localities as *Bourneotrochus veroni* are also examples of strobilation: *D. rotaeformis* is a discoidal anthocyathus with basal scar which in some individuals is covered by poststrobilation extensions of the flat costae over the scar; *D. parasiticus*, commonly immersed in *Bipora*, is the turbinate anthocaulus.

ETYMOLOGY: The genus is named for Gilbert C. Bourne (1861–1933), British marine zoologist. The species is named for J. E. N. Veron, Australian scleractinian systematist and ecologist.

HOLOTYPE: USNM 71852, 43 mi. N of Fraser Island, Queensland, 476–531 m.

PARATYPES: (1). USNM 71853, as above. (2).

USNM 71854, 25 mi. E of Lady Musgrave Island, Queensland, 348–357 m.

OCCURRENCE: Pleistocene: Vanuatu, USGS Sta. 24918. Recent: off southern Great Barrier Reefs, Queensland (holotype and paratypes), 348–531 m; off Tutanga Island, Funafuti, 766? m, Hawaii, 274–336 m.

GENUS *Peponocyathus* GRAVIER

*Peponocyathus orientalis* (Duncan)

*Deltocyathus orientalis* Duncan 1876, p. 431, pl. 38, figs. 4–7.

*Peponocyathus orientalis* Yabe & Eguchi 1932b, p. 444, figs.

*Deltocyathus* (*Paradeltocyathus*) *orientalis* Yabe & Eguchi 1937, p. 131, pl. 20, figs. 1–10; 1942a, p. 123.

*Deltocyathus* (*Paradeltocyathus*) *orientalis* Squires & Keyes 1967, pp. 13, 24, pl. 3, figs. 1–7.

*Deltocyathus* (*Paradeltocyathus*) *orientalis* Wells 1976, p. G9, pl. 3, figs. 1–3.

*Peponocyathus orientalis* Cairns 1979, p. 115, pl. 50, figs. 8, 9.

MATERIAL: Twelve typical bowl-shaped coralla of this common western Pacific turbinolid, well illustrated by Yabe & Eguchi and Cairns.

OCCURRENCE: Navaka River: USGS Sta. 24918. Eocene-Pleistocene: Tonga (Eua), New Zealand, Japan, Taiwan, Ceram. Recent: New Zealand, Japan, Philippines, Indonesia, Indian Ocean. 75–550 m.

GENUS *Citharocyathus* ALCOCK 1902

*Citharocyathus conicus* Alcock 1902

Figure 4, 2–5

*Citharocyathus conicus* Alcock 1902, p. 22, pl. 3, figs. 18, 18a.

*Citharocyathus venustus* Alcock 1902, p. 22, pl. 3, figs. 19, 19a.

*Citharocyathus conicus* Faustino 1927, p. 78, pl. 6, figs. 6, 7.

*Citharocyathus conicus* Yabe & Eguchi 1932b, p. 443; 1942a, p. 122, pl. 10, figs. 17, 18.

*Citharocyathus conicus* Yabe & Eguchi 1941, p. 212, figs. 4a, 4b.

*Citharocyathus conicus* Eguchi 1941b, p. 62.

*Notocyathus conicus* Yabe & Eguchi 1946, p. 6, figs. 1, 2.

MATERIAL: Nine specimens of the slender *venustus* form (conical angle = 27°), ranging in size from  $cd = 2.72$ ,  $h = 3.5$  mm, to  $cd = 4.5$ ,  $h = 6.25$ .

OCCURRENCE: Navaka River, USGS Sta. 24918. Pliocene, Mindoro, Philippines; Pliocene-Pleistocene: Ryukyus. Recent: Indonesia, China Sea, Philippines, Japan. 62–522 m, 12°–26°C.

FAMILY FLABELLIDAE BOURNE

GENUS *Flabellum* LESSON

*Flabellum paripavoninum* Alcock

Figure 4, 6, 7

*Flabellum paripavoninum* Alcock 1894, p. 187.

*Flabellum paripavoninum* Alcock 1898, p. 21, pl. 2, figs. 2, 3, 3a, b.

*Flabellum pavoninum paripavoninum* Vaughan 1907, p. 59, pl. 3, figs. 1–4.

*Flabellum paripavoninum* Faustino 1927, p. 46, pl. 2, figs. 1–4.

MATERIAL: Two specimens, one a large corallum ( $cd = 11 \times 27$  mm,  $h = 22$  mm, lateral angle 63°) with basal cicatrix, the other an immature corallum ( $cd = 6 \times 12$ ,  $h = 12$  mm, lateral angle 82°) with basal pedicel. The basal scar of the larger corallum is like those characteristically found in coralla of the *F. stokesi* species group, the effect of strobilation. Vaughan and Faustino both thought the fracture was accidental, although Faustino noted that many specimens from the Philippines were similarly broken and figured one of them (1927, pl. 2, figs. 3, 4). It appears that transverse fission, supposedly not a character of the *F. pavoninum* group, does occur.

Corallum colored a faded purple-brown, as noted by Alcock in his specimen ("pale madder").

OCCURRENCE: Kere River: USGS Stas. 25715 and 25718. Recent: Hawaii, Philippines, Laccadive Sea. 198–1160 m.

*Flabellum* sp. cf. *F. deludens* Marenzeller

Figure 3, 8–10

*Flabellum deludens* Marenzeller 1904, p. 209, pl. 17, fig. 10.

*Flabellum deludens* Vaughan 1907, p. 63, pl. 5, figs. 5a, 5b.

*Flabellum deludens* Yabe & Eguchi 1942a, p. 135, pl. 12, fig. 1.

*Flabellum deludens* Yabe & Eguchi 1942b, p. 101, pl. 5, figs. 9, 10, 11.

*Flabellum deludens* Eguchi 1968, p. C44, pl. C22, figs. 4, 5; pl. C25, figs. 3, 4.

MATERIAL: One specimen, well preserved except for an incomplete margin of the calice; four worn, small fragmentary juveniles. A related species is *Flabellum aotearoa* Squires (1964, Squires & Keyes 1967) from New Zealand.

OCCURRENCE: Navaka River, USGS Sta. 24918. Recent: Indian Ocean; South Pacific; Japan; Hawaii. 82–1200 m. New Zealand (*Flabellum aotearoa*), 130–184 m.

*Flabellum vanuatu* n. sp.

Figure 4, 11, 12; Figure 5, 1

DESCRIPTION: Corallum compressed elongate conical, lateral edges subacute or narrowly rounded, bearing hollow spines (lateral angle 20°–22°). Calice regularly oval, very deep. Base truncate with cicatrix. Septa non-exsert, lateral faces with discrete acute granulations, in three groups diminishing in thickness and length: 16/16/32 = 64 septa, in the holotype. In the largest paratype: 20/20/40. Columella deep in the calice, composed of a few septal trabeculae from inner edges of the larger septa.

DIMENSIONS  
h (cicatrix to  
calice rim) cd

Holotype	37 mm	11 × 19 mm
Paratype		
1	20	6 × 8
2	26	9 × 13
3	28	10 × 18
4	33	11 × 18
5	39	11 × 20
6	46	13 × 23

MATERIAL: Thirteen specimens (holotype and 12 paratypes), from Kere River, USGS Sta. 25715; one specimen from Kere River, USGS Sta. 25718.

REMARKS: A readily distinguished species marked by (1) the very low lateral angle, about 10° less than the least lateral angle of any other taxon of the *Flabellum stokesi* species group (30° in *F. irregulare* Semper), (2) more lateral spines (from three to five on each side), and (3) proportionally higher corallum and smaller basal scar.

ETYMOLOGY: *vanuatu*, noun in apposition (Vanuatu, *olim* New Hebrides).

HOLOTYPE: USNM 71860, Kere River, USGS Sta. 25715.

PARATYPES (12): USNM 71861, Kere River, USGS Sta. 25715.

OCCURRENCE: Kere River, USGS Sta. 25715 and 25718.

FAMILY DENDROPHYLLIIDAE GRAY  
GENUS *Dendrophyllia* BLAINVILLE

*Dendrophyllia subcornigera* Eguchi

Figure 5, 4, 5

*Dendrophyllia subcornigera* Eguchi 1968, p. C64, pl. C32, figs. 3, 4.

*Dendrophyllia subcornigera cylindrica* Eguchi 1968, p. C64, pl. C32, figs. 1, 2.

?*Dendrophyllia ijimai* Eguchi 1968, p. C65, pl. C16, figs. 1, 2; pl. C22, fig. 1; pl. C30, figs. 4, 5.

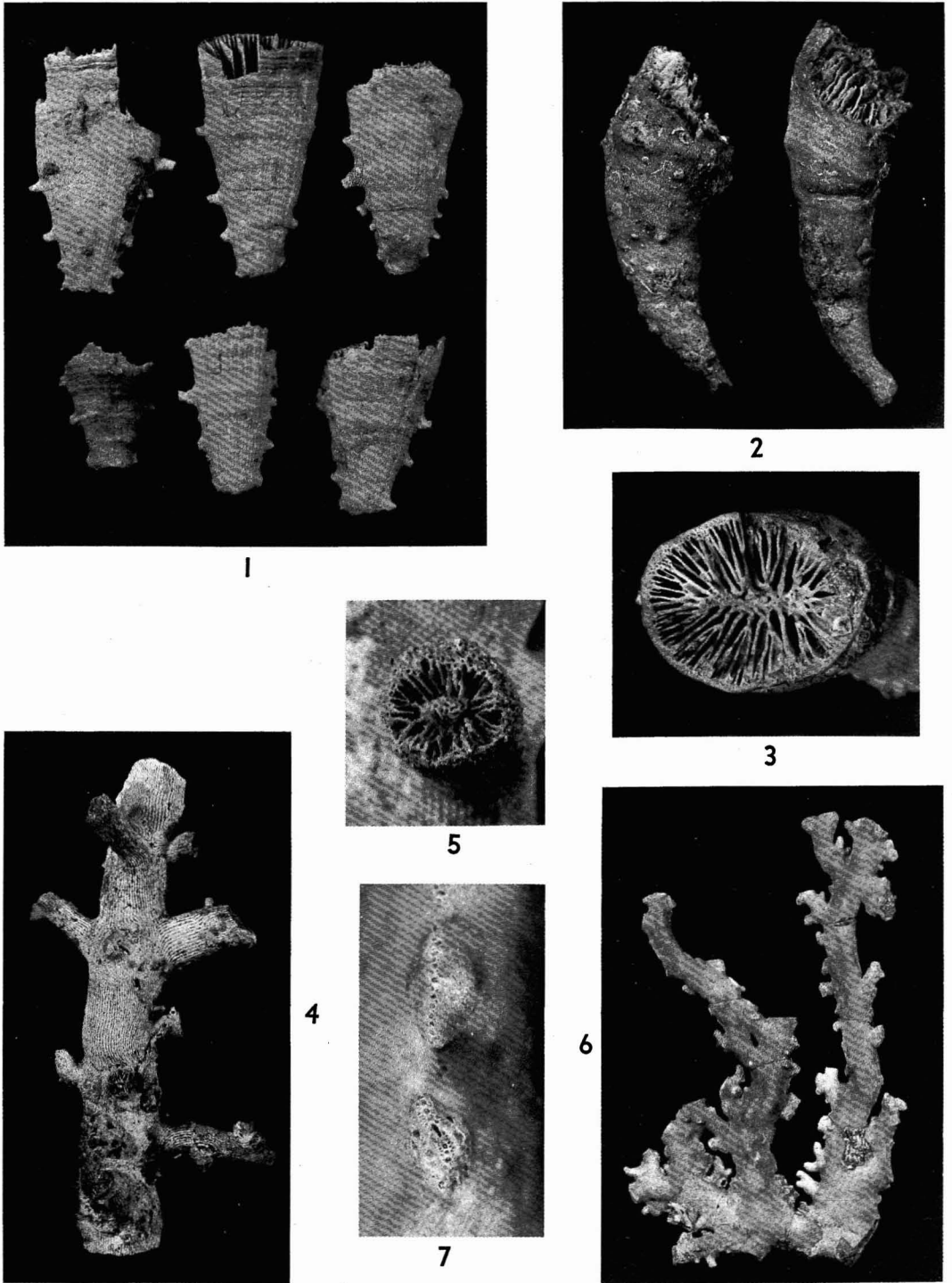


FIGURE 5. 1, *Flabellum vanuatu* n. sp., holotype USNM 71860 (top center) and 5 paratypes USNM 71861,  $\times 1$ , Kere R., USGS Sta. 25715; 2, 3, *Balanophyllia gigas*, USNM 71862,  $\times 1$ ,  $\times 2$ , Kere R., USGS Sta. 25715; 4, 5, *Dendrophyllia subcornigera* USNM 71863,  $\times 1$ ,  $\times 4$ , Kere R., USGS Sta. 25715; 6, 7, *Distichopora nitida*, USNM 71864,  $\times 0.5$ ,  $\times 4$ , Kere R., Sta. SM 242.

**MATERIAL:** A number of fragments of this arborescent form, marked by axial corallites 10 mm in diameter, tapering to 5 mm with scattered slender lateral corallites, and calices with 4 septal cycles, are referred to this species which probably subsumes Eguchi's *Dendrophyllia ijimai*.

**OCCURRENCE:** Kere River: USGS Sta. 25715. Recent: Seto, Japan (*Dendrophyllia subcornigera*, no depth data); Sagami Bay, Japan (*D. ijimai*), 36–360 m.

### GENUS *Balanophyllia* WOOD

#### *Balanophyllia gigas* v.d. Horst

Figure 5, 2, 3

*Balanophyllia gigas* v. d. Horst 1922, p. 58, pl. 8, fig. 22.

*Balanophyllia gigas* Eguchi 1941b, p. 63.  
*Balanophyllia gigas* Yabe & Eguchi 1942a, p. 139.

*Balanophyllia gigas* Eguchi 1968, p. C51, pl. C21, figs. 1, 2; pl. C31, figs. 5, 6.

*Balanophyllia gigas* Eguchi & Mori 1973, p. 47.

**MATERIAL:** Two large, worn cornute examples,  $cd = 14 \times 18$  mm,  $h = 57$ – $62$  mm, measured along convex side. Wall solid, imperforate, faintly costate.

*Balanophyllia gigas* was a manuscript name of Brueggemann's (BMNH 76.10.11.23) mentioned by Moseley (1881, p. 193), finally described and figured by van der Horst in 1922.

**OCCURRENCE:** Kere River, USGS Sta. 25715. Pliocene: Mindoro, Philippines; Pleistocene: Honshu, Japan; Recent: Japan, Indonesia. 90–500 m.

### ORDER STYLASTERINA HICKSON & ENGLAND FAMILY STYLASTERIDAE GRAY GENUS *Distichopora* LAMARCK

#### *Distichopora nitida* Verrill

Figure 5, 6, 7

*Distichopora nitida* Verrill 1864, p. 46.

*Distichopora nitida* Boschma 1959, p. 151, pl. 19, figs. 4–7; pl. 10, fig. 4; pl. 9, figs. 4–7; pls. 11–13 (synonymy).

*Distichopora nitida* Eguchi 1968, p. 41, pl. 4, fig. 4, 5; pl. 25, figs. 1, 2.; pl. 26, figs. 6, 7, 9; pl. 27, figs. 1–3.

**MATERIAL:** One large piece of corallum from Kere River, faded ochre in color ("*Distichopora ochracea*" Quelch). Several small, worn fragments from the same locality.

**OCCURRENCE:** Kere River, USGS Stas. 25715, 242. Recent: central tropical Pacific. 90–180 m.

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