MADREPORARIA FROM THE TOGIAN REEFS (GULF OF TOMINI, NORTH-CELEBES)

by

J. H. F. UMBGROVE

INTRODUCTION

The coral reefs of the Togian islands grow up as steep barrier reefs and atolls. Moreover small fringing reefs occur along the islands. The geological structure of the islands, as well as the history and morphology of the reefs are treated in a separate paper[1]). I will here mention only one of the striking features of the reefs. The reefs are situated in a zone, famous for the unruffled calm and undisturbed quiet of the sea, because they are protected from the influence of both monsoons. In a curve from West to North they are sheltered against the North monsoon by the Northern arm of Celebes; on the South of this group the Eastern arm of Celebes breaks the influence of the South East monsoon, which, blowing across the Banda Sea is only faintly felt in the Gulf of Tomini (fig. 1).

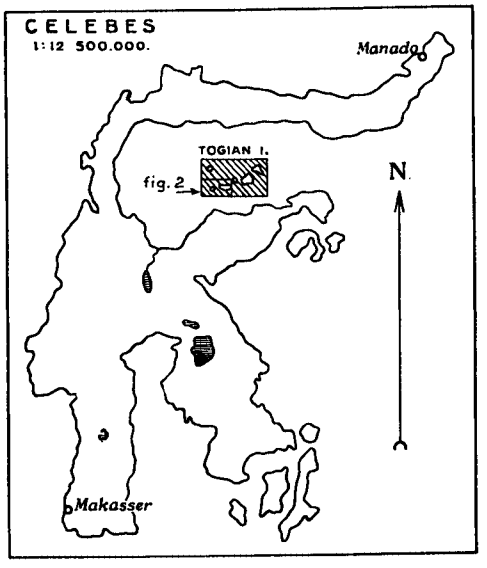


Fig. 1.

Shingle ramparts are completely lacking on these reefs, nor do sand cays occur. And we cannot on the Togian reefs distinguish the different facies-types which I described from the Batavia reefs and the Spermonde Archipelago, such as the foliosa facies, and the rhodophyceae facies. As a matter of fact I searched in vain after *Monti-*

1) J. H. F. Umbgrove. De Atollen en barrière-riffen der Togian eilanden. Leidsche Geologische Mededeelingen, vol 11, 1939, pp. 132—187, figs. 1—26.

pora foliosa, a coral which abounds along the outer slopes of the shingle ramparts in the Batavia reefs. And Melobesiae, though not entirely absent, are only poor incrusting forms never cementing different corals or other organisms into a solid structure comparable to a lithothamnium ridge.

It would be an error to attribute the absence of shingle ramparts exclusively to the steepness of the reefs, for also along the Spermonde shelf (S. Celebes) we find a barrier, that descends steeply on the side of the open sea, and yet we find there on the barrier, reef-islands with shingle ramparts of a considerable size.

I have treated at length the congruence between these negative characteristics in the morphology of the Togian reefs and the data on the wind-effect and subsidence in the paper mentioned above.

In that paper a map showing all localities and numbers of the material collected, rock specimens as well as corals, may be found. Fig. 2 shows only the localities where corals were collected and the numbers they bear. These numbers are mentioned also in the systematic part below. I collected the corals as far back as the year 1928, when I had the opportunity of visiting the Gulf of Tomini on board of the "Eridanus", a hydrographic vessel of the Netherlands East Indian Government Navy under command of Lieut.-Commander H. Spits whom I am much indebted for his untiring and helpful assistance. During our stay in the Gulf of Tomini the "Eridanus" in cooperation with H. M. "Van Doorn" finished the hydrographic survey of the Togian island group. The new chart of the Navy based on their survey has been published in the year 1931 (no. 192) and should be consulted by any one interested in these islands.

Corals were collected from the fringing reefs as well as from the barrier reefs (see fig. 2).

Fringing reefs: localities A—C.

A nos. 13—28 [1]), near the Northwestern cape of Batoe Daka on a shallow sandy flat.

B nos. 29—86, near Tandjong Kalema, South coast of Batoe Daka, shallow sandy bottom with coral patches.

C nos. 427—462 near Tandjong Batoetigang, South coast of Batoe Daka.

I cannot mention a single coral species from the fringing reefs, which

1) Nos. 13—28 etc. refer to the coral specimens described in the systematic part below; their localities are indicated on fig. 2.

does not occur on the barrier reef either. But some species flourishing on the fringing reefs are seldom met with on the barrier.

Among the most conspicuous corals occurring in great number on the sandy bottom near the shore are *Acrohelia horrescens, Seriatopora hystrix, Leptastrea purpurea, Galaxea fascicularis*; not rare are: *Favia matthai, Favites abdita, Orbicella curta, Pavona divaricata, Porites nigrescens, Porites* spec. and *Acropora (Isopora) palifera.*

Although the ecological conditions may show some points in common with the ramosa-facies of the Batavia reefs I failed to find a single

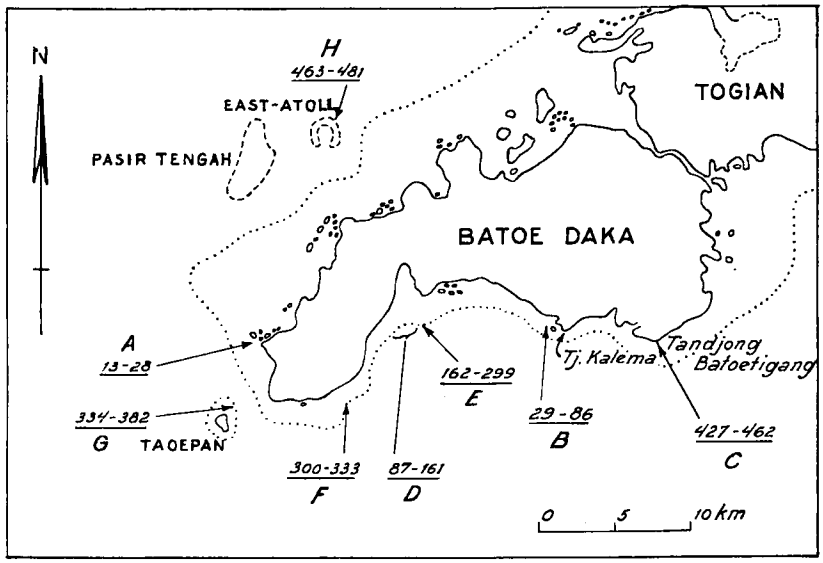


Fig. 2.

specimen of *Montipora ramosa* on the Togian reefs, on the other hand a form like *Acrohelia horrescens* is conspicuously lacking on the Batavia reefs.

A number of corals belonging to the common species of the barrier may occasionally be found on the fringing reefs too, especially where the bottom gradually deepens towards the lagoon. I made some detailed records at locality C of which Fig. 3 shows a schematic section. It is a place where the barrier reef is not separated from the shore by a deep lagoon. (For other sections the reader is referred to my paper on the morphology and history of the island group quoted before). At "A" where the water is very shallow,—not deeper than 25 cm, in places the corals even being exposed

at low tide—I noticed the following species: *Seriatopora hystrix, Pocillopora damicornis, Acrohelia horrescens, Orbicella curta, Favia speciosa, Favia matthai, Favia eridani, Favites abdita, Galaxea fascicularis, Coeloria rustica,* a few small colonies of *Symphyllia recta, Pavona divaricata, Pavona frondifera, Porites viridis, Porites nigrescens, Acropora (Isopora) palifera,* many foliated sponges, viz., *Phyllogorgia foliascens* (Pallas) [1]) and foraminifera among which are *Calcarina, Baculogypsina* and *Marginopora vertebralis* (Quoy et Gaimard); also calcareous algae of the genus *Halimeda* abound; *Marginopora* abounds on the barrier reefs as well.

At "B" where the water is about 120 cm deep at low tide, I noticed: *Platygyra phrygia, Symphyllia nobilis, Lobophyllia corymbosa, Goniastrea pectinata, Favia pallida, Fungia echinata, Fungia concinna, Fungia fungites, Halo-*

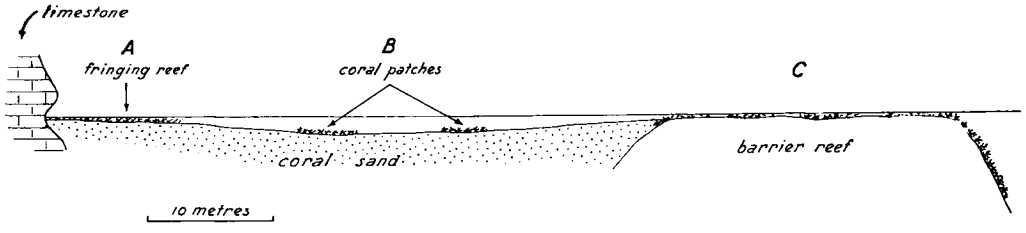


Fig. 3.

mitra robusta, Coeloseris mayeri, Pavona decussata, Pavona (Polyastra) obtusata, Porites spec., *Goniopora tenuidens,* strongly branched *Acropora palifera,* a long-topped *Acropora* spec., *Millepora alcicornis,* a few specimens of *Heliopora coerulea,* great fan shaped growths of *Isis* spec. and reddish brown tubiform sponges (*Chalina* spec.) [1]), a species which abounds on the Togian reefs.

Barrier reefs, localities D—H (see fig. 2).
D nos. 87—161)
E nos. 162—299) reefs belonging to the barrier South of Batoe Daka.
F nos. 300—333)
G nos. 334—382, barrier reef of Taoepan, east side.
H nos. 463—481, East-atoll, east side.

Localities D to H are on reefs which are very steep along the outer as well as along the lagoon side.

The table below reviews the species collected. During the last days of my visits to the reefs I did not find corals which I did not collect before. So I believe to have made a rather representative collection of Madrepo-

1) Identification by Dr. Stiasny, Leiden.

raria from the shallow parts of the reefs. However, I must emphasize the fact that the species are all shoal water corals, as I had no diving hood at my disposal. Without any doubt many more genera and species live in the deeper water along both the outer and inner sides of the barrier and atoll reefs.

The barrier and atoll reefs grow generally up to the surface of the sea and are exposed at low tide. So these parts of the reefs have to stand a great deal of decaying material and fine sediment (the latter derived principally from boring animals such as Echinids, Holothurians etc.).

In these chracteristics, moreover in the absence of a prevailing wind effect and the considerable breadth of the barrier and atoll reefs the Togian reefs differ widely from the Batavia reefs. And indeed the aspect of the coral fauna is very different too. On my first visit to the barrier reef South of Batoe Daka the great profusion of astraeid corals being among the most important shallow water reef builders struck me as one of the most characteristic features. This first impression was strengthened by all my later visits to these barrier and atoll reefs.

I will mention here that some species have been met with only exceptionally, viz., *Physogyra astraeiformis, Cyphastrea chalcidicum, Favia eridani, Hydnophora tenella* var. *applanata, Scapophyllia cylindrica, Mycedium elephantotus, Tridacophyllia lactuca, Coscinaraea acuticarinata.*

As to the rest of the Madreporaria I may say that astraeid corals together with perforate corals are the principal reef builders, but the genera *Pocillopora, Seriatopora, Fungia, Halomitra, Pavona, Psammocora* and *Coeloseris* too are abundantly represented.

The new species *Psammocora togianensis* is widely distributed on the barrier reefs.

Apart from the Madreporaria I will mention *Heliopora coerulea, Millepora alcicornis* and *Isis* among the most common reef builders.

In the table below the corals are listed and their distribution on five well known reefs is indicated. As to the composition of these lists and their significance the reader is referred to my paper on the Madreporaria from the bay of Batavia, where I made some comments, that are applicable—mutatis mutandis—to the present table [1]). Also remarks on synonymy, species problem and a complete list of corals known from Amboina may be found in that paper.

Species of the genus *Acropora* are not considered in this paper. Dr. J.

---

1) J. H. F. Umbgrove. Madreporaria from the bay of Batavia. Zoologische Mededeelingen, vol. 22, 1930, pp. 1—64, pls. 1—18.

Verwey, Director of the Zoological Station at Den Helder, will study the *Acroporas* from Togian and publish the results in a monograph on that genus. Dr. Verwey identified 15 species of *Acropora* from the Togian reefs; a preliminary list is given below in the systematic part.

I presented my collection of corals from the Togian reefs to the Rijksmuseum van Natuurlijke Historie at Leiden (Holland) excepted for a suite of 67 specimens which I sent to the Museum of the Geological Survey at Bandoeng, Java.

The corals in the Bandoeng Museum are the following: nos. 17, 22, 35 (pars), 36, 37, 45, 49, 61, 69, 72, 75, 77, 83, 90, 91 (pars), 99, 115 (pars), 117, 120, 126, 129, 131, 132, 135, 137, 142 (pars), 144 (pars), 149 (pars), 153 (pars), 155 (pars), 166, 169, 181, 192 (pars), 194, 196 (pars), 197, 199, 202, 218, 222, 239, 242 (pars), 243 (pars), 244, 247, 260, 272 (pars), 277 (pars), 281 (pars), 303, 317, 323, 328, 330, 332 (pars), 336, 344, 346 (pars), 355, 362, 366 (pars), 367, 375, 438 (pars), 475, 479.

In the Leiden Museum the Togian species and intergrading series are fully represented.

I thank Mr. C. van Werkhoven for the excellent photographs he made of the corals.

Madreporaria from the Togian reefs	Cocos-Keeling	Batavia	Amboina	Murray Island	Samoa
1. *Seriatopora hystrix* Dana	·	×	×	×	·
2. *Pocillopora damicornis* (L.)	×	×	×	×	×
3. *Pocillopora eydouxi* M. Edwards	×	×	·	×	×
4. *Stylophora pistillata* (Esper)	·	×	×	×	·
5. *Acrohelia horrescens* (Dana)	·	·	·	×	·
6. *Physogyra astraeiformis* nov. spec.	·	·	·	·	·
7. *Orbicella curta* Dana	·	·	·	×	×
8. *Orbicella versipora* (Lam.)	×	·	·	·	·
9. *Cyphastrea microphthalma* (Lam.)	×	×	×	·	×
10. *Cyphastrea chalcidicum* Klunzinger	·	×	·	·	·
11. *Leptastrea purpurea* (Dana)	×	×	·	×	×
12. *Galaxea fascicularis* (L.)	·	×	×	×	×
13. *Favia speciosa* (Dana)	×	×	×	×	·
14. *Favia pallida* (Dana)	·	×	·	×	×
15. *Favia matthaii* Vaughan	·	·	·	·	·
16. *Favia stelligera* (Dana)	<	×	·	·	×
17. *Favia eridani* nov. spec.	·	·	·	·	·
18. *Favites abdita* (Ellis et Sol.)	×	×	×	×	×
19. *Favites flexuosa* (Dana)	·	×	·	·	·
20. *Favites favosa* (Ellis et Sol.)	·	×	·	·	·

Madreporaria from the Togian reefs	Cocos-Keeling	Batavia	Amboina	Murray Island	Samoa
21. *Favites virens* (Dana)	·	×	·	×	·
22. *Favites yamanarii* Yabe et Sug. var. *profunda* Umbgrove	·	×	·	·	·
23. *Favites*? cf. *spectabilis* (Verrill)	·	·	·	·	·
24. *Favites halicora* (Ehrenberg) → *Acanthastrea hemprichii* (Ehr.)	·	·	·	×	×
25. *Goniastrea retiformis* (Lam.)	·	×	×	×	×
26. *Goniastrea pectinata* (Ehrenberg)	·	×	·	×	×
27. *Goniastrea planulata* E. H.	·	·	·	·	·
28. *Coeloria rustica* (Dana)	·	×	×	×	·
29. *Coeloria astreiformis* E. H.	·	·	·	×	(×)
30. *Coeloria astreiformis* E. H. → *C. rustica* (Dana)	·	·	·	·	·
31. *Platygyra phrygia* (Ellis et Sol.)	×	×	·	·	×
32. *Hydnophora microconos* (Lam.)	×	×	×	×	×
33. *Hydnophora rigida* (Dana)	·	×	·	·	×
34. *Hydnophora tenella* Quelch var. *applanata*, nov.	·	·	·	·	·
35. *Merulina ampliata* (Ellis et Sol.)	·	×	×	·	·
36. *Merulina scabricula* Dana	·	·	·	·	×
37. *Merulina togianensis* nov. spec.	·	·	·	·	·
38. *Scapophyllia cylindrica* E. H.	·	×	·	·	·
39. *Lobophyllia corymbosa* (Forskål)	·	×	·	·	·
40. *Lobophyllia costata* (Dana)	·	×	×	×	×
41. *Symphyllia recta* (Dana)	·	×	×	×	×
42. *Symphyllia recta* → *agaricia* E. H.	·	·	×	·	·
43. *Symphyllia recta* → *valenciennesii* E. H.	·	·	·	·	·
44. *Symphyllia radians* E. H.	·	×	×	·	·
45. *Echinopora lamellosa* (Esper)	×	×	·	·	·
46. *Echinopora* cf. *gemmacea* (Lam.)	·	×	·	·	·
47. *Echinopora horrida* Dana	·	×	·	·	·
48. *Mycedium elephantotus* (Pallas)	·	·	·	·	·
49. *Tridacophyllia lactuca* (Pallas)	·	×	×	·	·
50. *Fungia echinata* Pallas	·	×	×	·	·
51. *Fungia scutaria* Lam.	×	×	·	·	·
52. *Fungia paumotensis* Stutchb.	·	·	×	·	·
53. *Fungia concinna* Verrill	·	×	·	×	·
54. *Fungia repanda* Dana	·	×	×	·	·
55. *Fungia danai* E. H.	·	×	×	·	·
56. *Fungia valida* Verrill	·	·	·	·	·
57. *Fungia fungites* (Linné)	×	×	×	×	×
57a. *Fungia fungites* (Linné) → *repanda* (Dana)	·	×	·	·	·
58. *Halomitra robusta* (Quelch)	·	(×)	(×)	·	·
59. *Pavona decussata* Dana	×	×	×	·	×
60. *Pavona divaricata* Lam.	·	×	·	·	×
61. *Pavona frondifera* Lam.	·	×	·	·	×
62. *Pavona varians* (Verrill)	×	×	×	×	·
63. *Pavona* (*Polyastra*) *obtusata* (Quelch)	·	·	·	·	·
64. *Psammocora contigua* (Esper)	·	×	·	·	×
65. *Psammocora togianensis* nov. spec.	·	·	·	·	·
66. *Coscinaraea acuticarinata* nov. spec.	·	·	·	·	·

Medraporaria from the Togian reefs	Cocos-Keeling	Batavia	Amboina	Murray Island	Samoa
67. *Coeloseris mayeri* Vaughan	·	×	·	×	·
68. *Astreopora myriophthalma* (Lam.)	×	×	·	·	·
69. *Montipora venosa* (Ehrenb.)	·	·	×	×	×
70. *Montipora informis* Bernard	×	·	×	·	·
Acropora 15 spec. to be described by Dr. Verwey	·	·	·	·	·
71. *Goniopora tenuidens* (Quelch)	·	×	×	×	·
72. *Porites viridis* Gardiner	·	·	·	×	·
73. *Porites nigrescens* Dana	×	·	·	·	·
74. *Porites nigrescens* Dana var. *togianensis* nov.	·	·	·	·	·
75. *Porites capricornis* Rehberg	·	·	·	·	·
76. *Porites eridani* nov. spec.	·	·	·	·	·
Porites spec. diversae	·	·	·	·	·
	18	48	27	27	25

SYSTEMATIC PART

MADREPORARIA IMPERFORATA

Family SERIATOPORIDAE Milne Edwards et Haime

Genus **Seriatopora** Lamarck

Seriatopora hystrix Dana

(Pl. XXI figs. 1, 2, 5 and 6)

For synonymy see Umbgrove, 1939, p. 20.

In my paper on the corals from the bay of Batavia I made some remarks on the uncertainness of the taxonomic value, which prevails among the too many species names in the genus *Seriatopora*.

Seriatopora is abundant on the Togian reefs and the present species is a common one on the sandy bottom in the shallow water of the fringing reefs. There it grows in fragile loosely branched colonies of about one to two decimeter diameter, its colour varying from pale yellow to pink or purple. I collected eight colonies, nos. 14, 25, 28, 156, 157, 166, 214, 215.

Identification is based on Vaughan's description and figures of Dana's type and on the excellent figures of Bedot's.

With the exception of no. 215 the corals are loosely branched with sharp ending branches. The calices are of the different types, figured by Bedot in his plate 7 figs. 20—22, but usually of the type of his fig. 20.

No. 215 is a small colony, 90—100 mm in diameter with more or less intertangled branches, having shorter conical apices, some of them being even rather obtuse, reminding of *S. octoptera* Klunzinger. Part of this specimen is figured in my plate XXI fig. 1.

The colonies are, nearly without exception, crowded with galls, formed by a little crab, *Hapalocarcinus marsupialis*. On page 89 of his book "A year on the Great Barrier Reef" Dr. C. M. Yonge mentions that this crab was met with abundantly in *Seriatopora* and *Pocillopora*, and was found also in *Stylophora*. On the Togian reefs I found galls on *Seriatopora* and on *Pocillopora eydouxi*. I never saw galls on the reefs in the bay of Batavia. I am figuring a few of these interesting galls in plate XXI figs. 2, 5 and 6.

Genus **Pocillopora** Lamarck

Pocillopora damicornis (Linné)

For synonymy see Umbgrove, 1939, p. 21.

A suite of this species comprises the forms, named *typica* var. *bulbosa* and var. *cespitosa* by Hoffmeister.

The varieties are numbered as follows:

var. *bulbosa* (Ehrenberg) no. 124, with very thin branches,

var. *cespitosa* (Dana) nos. 125, 126, 134, 159,

var. *cespitosa* juvenilis nos. 13, 107.

There are also forms strongly resembling Vaughan's var. *stylophoroides* of *P. cespitosa:* nos. 122, 189, 266, 350.

The extreme types have a very different aspect but they are connected by an intergrading series of forms.

Pocillopora eydouxi Milne Edwards

(Pl. XXI figs. 3, 4 and 8)

For synonymy see Umbgrove, 1939, p. 22.

I discussed the synonymy of *P. eydouxi* in my 1939 paper. Here I may add only that the basal parts of some specimens may have a very irregular shape reminding of *P. verrucosa*. Full-grown specimens are, however, of a very characteristic growth-type having large flattened fronds, which usually are broadened at the top, even slightly fanshaped, occasionally contorted. *P. modumanensis* Vaughan and *P. woodjonesi* Vaughan seem closely allied species. However, I did not find transitional forms of *P. eydouxi* into one of these species. I am figuring a large healthy specimen (no. 152) in plate XXI fig. 4. I collected three more specimens (nos. 116, 117, 118), one of them (no. 118) showing great galls formed by a crab (*Cryptochirus*?), which is so absolutely enclosed in the gall that there is not the slightest possibility of escape. Only a row of small openings arranged circularly show the existence of the galls, which otherwise should not have

been noticed. In one branch more than one gall may occur (see plate XXI figs. 3 and 8). When living the coral was pale brown with pink coloured verrucae.

Genus **Stylophora** Schweigger

Stylophora pistillata (Esper)

For synonymy see Umbgrove 1939, p. 23.

Three good specimens were collected, nos. 15, 24 and 72. When living the corals are of a pink colour. In the collection of the Institute of Mining at Delft is moreover an excellent specimen collected S.W. of Naukliu, Timor, by Prof. Molengraaff.

Family OCULINIDAE Edwards et Haime

Genus **Acrohelia** Edwards et Haime

Acrohelia horrescens (Dana)

(Pl. XXI fig. 7)

For synonyms see Thiel, 1932, p. 35.

This species is a common one in the calm shallow water on the reef flat. I collected a suite bearing the numbers: 39, 40, 42, 46, 47, 48, 50, 51, 144, 145, 430. The shape of the calices is varying. Types which have only slightly projecting septa resembling the specimen figured by Faustino, occur side by side of specimens of the type figured in Mayor's paper and of corals with extremely exsert septa. I am giving an illustration of the last named type (no. 430) in plate XXI fig. 7. When living the coral has brown branches and calices; the exsert septa, however, are splendidly white.

Family EUSMILIIDAE Verrill

Genus **Physogyra** Quelch

Physogyra astraeiformis nov. spec.

(Pl. XXII figs. 1 and 2)

? 1936 *Physogyra lichtensteini* (E. H.), Yabe, Sugiyama and Eguchi, p. 18, pl. 8 fig. 6.

No. 155 is a large colony, comparatively light, which was strongly attached to the bottom and caused much trouble to become loosened. Corallum columnar, hemispherical at the top, 40 cm high; average diameter of the column 18 cm, becoming broader towards the broad base of attachment where it measures 28 cm. It differs from all specimens of *Physogyra* described up to now in having calices of the astraeiform type, no continuous and sinuous valleys occurring in this colony as in *Ph. lichtensteini* E. H.

and in *Ph. somaliensis* Vaughan or in one of the other species placed among the synonyms of *Ph. lichtensteini* by Matthai (1928). The type of the calices is illustrated by Pl. XXII fig. 2. In the basal part of the coral the calices are even separated by a dense vesicular structure as is illustrated by Pl. XXII fig. 1. Centres of calices at distances of 10 to 14 mm, depth up to 14 mm. When living the coral had a light yellowish white colour. In the collection of the Institute of Mining at Delft is a worn-off specimen collected on the beach of the island Dammar (East Indies) by Dr. G. A. F. Molengraaff. Though I am not certain I believe that the specimen named *Ph. lichtensteini* by Yabe c.s. and figured in their Pl. 8 fig. 6, may belong to the present species.

Family ORBICELLIDAE Vaughan

Genus **Orbicella** Dana

Orbicella curta Dana

(Pl. XXII fig. 3)

1846 *Orbicella curta* Dana, p. 209, pl. 10 figs. 3, 3a—3c.
1846 *Orbicella coronata* Dana, p. 211, pl. 10 figs. 4, 4a, 4b.
1914 *Favia wakayana* Gardiner, Matthai, p. 104, pl. 25 fig. 4 (with synonyms).
1914 *Favia solidior* M. Edwards et Haime, Matthai, p. 105, pl. 25 fig. 8, pl. 28 fig. 1 (with synonyms).
1918 *Orbicella curta* Dana, Vaughan, p. 86, pl. 17 fig. 32, pl. 28 figs. 2, 3, 4, 4a, 5.
1936 *Orbicella curta* Dana, Yabe, Sugiyama and Eguchi, p. 22, plate 50 fig. 5 (with synonyms).

Vaughan (1918, p. 100) suggested that *Orbicella solidior* perhaps might be only a variant of *O. curta*. Indeed, from the suite of corals, collected on the Togian reefs, it is obvious that they are not separate species. I collected 9 specimens (nos. 41, 71, 75, 76, 101, 172, 269, 454 and 467). They represent an intergrading series of forms. No. 454 corresponds with the description and figure of Gardiner's *Orbicella heliopora* (Gardiner, 1899, p. 756, pl. 49 fig. 4), the calices being crowded and the calicular margins only very slightly exsert. No. 76 exactly resembles the specimen figured on plate 17 fig. 32 of Dr. Mayer's article. The calicular margins are exsert and distinctly apart in nos. 41 and 71 as in the specimens of *O. wakayana* figured by Gardiner (1899, plate 49 fig. 2) and Matthai (1914, plate 25 fig. 4). In no. 269 the calices have exsert margins and are crowded over the whole surface of the colony (compare Gardiner's figure of *O. rotumana* = *O. solidior*). However, nos. 75, 101, 172 and 467 are intermediate between *O. solidior* and *O. wakayana*, both types of calicular development being

present in one and the same colony. In no 172 the calicular margins are more exsert than in any of the other specimens. I am only giving a figure of part of that remarkable specimen on plate XXII fig. 3; the other types are well illustrated by Gardiner, Matthai and Vaughan as indicated above. The smaller specimens are incrusting, the larger ones are massive growths, only part of the marginal area being thin and free. In one and the same colony the diameter of the calices may range from 4 to 9 mm, not including small buds.

Orbicella versipora (Lamark)

For synonyms see Yabe c.s., 1936, p. 23 and Matthai, 1914, p. 103.

The only specimen, no. 252, incrusting *Montipora*? spec. most resembles the coral from Cocos-Keeling figured by Vaughan on his plate 28 fig. 1.

Genus **Cyphastrea** Milne Edwards et Haime

Cyphastrea microphthalma (Lamarck)

For synonyms see Yabe c.s., 1936, p. 23, Matthai, 1914, p. 43 and Umbgrove, 1939, p. 25.

The species is widely distributed on the Togian-reefs. The growth-type varies from thin crusts on dead corals (no. 431) to rather stout independent masses with a diameter of about 120 mm. These may be either irregularly rounded colonies or the growth form is raised into hillocks; also specimens strongly resembling the coral figured by Faustino are represented (nos. 180 and 230). The Togian specimens collected bear the numbers: 81, 180, 203, 230, 431, 437, 463 and 475.

All specimens are characterized by ten septa meeting the columella. The degree of projecting of the calices is varying, being up to 1 mm in some specimens (no. 81) but usually less. The columella is well developed in all specimens, not reduced as mentioned by Crossland from his Tahiti corals (1935, p. 501).

When living the species was of a pale yellowish-brown to brownish colour.

Cyphastrea chalcidicum Klunzinger

For synonyms see Yabe c.s., 1936, p. 24, Matthai 1914, p. 41, and Umbgrove, 1939, p. 26.

The species seems to occur very rarely on the Togian reefs. I collected a lone specimen, no. 163, which is a small loose ball of 50 mm diameter,

completely covered with scattered corallites. The corallites are rather widely apart, about 2 mm or less, projecting up to 1 mm. Diameter usually about 2 mm. Septa distinctly exsert. 12 septa reach the columella, primaries and secondaries equally thin. Costae prominent, of equal thinness and bearing short spines. Columella distinct, trabecular. Peritheca densely spinulate.

Genus **Leptastrea** Milne Edwards et Haime

Leptastrea purpurea (Dana)

For synonyms see Yabe c.s., 1936, p. 26 and Umbgrove, 1939, p. 26.

A specimen, no. 21, grown on a dead branch of *Acropora*, shows in the marginal parts calices of the type, figured by Vaughan (1918) in his plate 30 fig. 3a, whereas the more central parts of the growth have corallites of the normal polygonal type.

Genus **Galaxea** Oken

Galaxea fascicularis (Linné)

For synonyms see Yabe, Sugiyama and Eguchi, 1936, p. 27 and Umbgrove, 1939, p. 27.

All the specimens of *Galaxea* collected on the Togian reefs are small convex clusters belonging to this species (nos. 194, 212, 263, 280, 342, 442). The corallites show a rather great variation (1) in the amount of projection (2 to 14 mm), (2) diameter and size, sub-circular 3 to 4 mm by 8 mm in elliptical ones, (3) exsertness of the septa. The columella is a deeply set trabecular structure. When living the corallites are brown with yellow-green centra.

Family FAVIIDAE Gregory

Genus **Favia** Oken

Favia speciosa (Dana)

For synonymy see Umbgrove, 1939, p. 27.

No. 427, the single specimen I brought home, agrees with Dana's *pandanus*-type. Calices as figured by Vaughan (1918) in his plate 36 fig. 4 occur in the convex upper part of the colony, whereas calices are more distant in the marginal area, agreeing with Vaughan's plate 36 fig. 4a.

Favia pallida (Dana)

1918 *Favia pallida* (Dana), Vaughan, p. 105, pl. 16 figs. 26, 27, 29, 30; pl. 38 figs. 1—7 (with synonymy).
1925 *Favia pallida* (Dana), Hoffmeister, p. 23.
1927 *Favia pallida* (Dana), Faustino, p. 132.
1932 *Favia hululensis* Gardiner, Thiel, p. 52, pl. 6 fig. 2.
1936 *Favia pallida* (Dana), Yabe, Sugiyama and Eguchi, p. 29, pl. 19 figs. 1, 2.
1939 *Favia pallida* (Dana), Umbgrove, p. 27.

Among the Togian corals the *hululensis* type (no. 61) as well as "facies 3" of Vaughan (no. 455) are represented. Both specimens show a sexual reproduction by unequal fission, a partition growing outside the columellar area (compare Vaughan, p. 101).

Favia matthaii Vaughan

(Pl. XXII figs. 4 and 5)

1918 *Favia matthaii,* Vaughan, p. 109, pl. 39 figs. 2, 2a, 2b.

Four specimens are referred by me to this species (nos. 45, 259, 278 and 445). No. 278 most resembles the type described and figured by Vaughan; some calices are shown in plate XXII fig. 5. In one specimen (no. 445) which is grown on a *Tridacna,* many calices have partitions passing outside the columellar area (see plate XXII fig. 4) as occurs in *Favia pallida.* Vaughan already mentioned that *F. matthaii* groups with *F. pallida.* As a matter of fact in no. 445 the character of the septa too stands between these two species.

When living the dark-brown calices were surrounded by a bright-yellow peritheca.

Favia stelligera (Dana)

1918 *Favia stelligera* (Dana), Vaughan, p. 101 (with synonymy).
1936 *Favia stelligera* (Dana), Yabe, Sugiyama and Eguchi, p. 29.
1939 *Favia stelligera* (Dana), Umbgrove, p. 28.

Good representatives of the species are nos. 120, 146, 147 and 150. The arrangement of the calices most resembles Vaughan's plate 34 fig. 2, although the growth type agrees with the specimen figured by Matthai in his plate 33 fig. 1. The calices of these specimens have a diameter from 2 up to 2.5 mm. There is, however, one specimen, no. 469, which has calices of an average larger diameter 3 up to 4 mm, resembling Vaughan's plate 35 fig. 2. This specimen is from the East atoll, whereas the specimens mentioned above are from the barrier reef, S. of Batoe Daka. *Favia stelligera* var. *fanningensis* Vaughan is not present among the Togian corals.

Favia eridani nov. spec.

(Pl. XXIII figs. 1 and 2)

My collection contains one specimen, no. 433. Corallum forming a convex clump, 120 by 90 mm. Part of the margin is free and comparatively thin. The habitus of the growth reminds of *Orbicella curta* Dana. Corallites circular to elliptical, average diameter 7 mm; in larger elliptical calices 6 by 9 mm. Corallites project 4 to 10 mm above the peritheca, average 7 mm. Calices 5 mm deep. The septa drop nearly vertically to the columella. In average-sized calices 22 to 26 septa occur, 12 reaching columella, 6 to 8 being very small ones. Septal edges roughly serrate. Paliform lobes prominent in most of the calices. Septal faces granulate. Columella trabecular. Reproduction takes place by subequal to unequal fission. Costae prominent and roughly serrate.

Genus **Favites** Link

Favites abdita (Ellis et Solander)

For synonyms see Vaughan 1918, p. 109, Yabe c.s., 1936, p. 31 and Umbgrove, 1939, p. 28.

Nine specimens, nos. 43, 64, 65, 69, 84, 190, 282, 299 and 466.

Favites flexuosa (Dana)

1939 *Favites flexuosa* (Dana), Umbgrove, p. 29 (with synonyms).

I mentioned the Togian specimens (nos. 312, 332, 324, being three fragments of a large colony) in my paper on the corals from Batavia. The present specimen from Togian agrees in every detail with the coral figured by Yabe (1936, pl. 20 fig. 1).

Favites favosa (Ellis et Solander)

(Pl. XXIII fig. 3)

1936 *Favites favosa* (Ellis et Solander), Yabe, Sugiyama and Eguchi, p. 32 (with synonymy).

1939 *Favites favosa* (Ellis et Solander), Umbgrove, p. 29.

One hemispherical growth, no. 270. Plate XXIII fig. 3 shows asexual reproduction by marginal fission as is characteristic in *Favites*.

Favites virens (Dana)

For synonymy see Umbgrove, 1939, p. 29.

One large colony, no. 281 (diameter of calices 10 up to 30 mm, average

18 mm) agrees with the specimens figured in the above mentioned publication.

No coarse dentations of septa occur as mentioned in my paper on the corals from the bay of Batavia.

Favites yamanarii var. **profunda** Umbgrove

1939 *Favites yamanarii* var. *profunda*, Umbgrove, p. 31, pl. IV figs. 2—4.

Two specimens, nos. 97 and 181. Diameter of no. 181, 65 by 50 mm. No. 97 is a fragment 120 by 95 mm, broken from a large colony. I figured the Togian corals in my paper quoted above (Plate IV fig. 3 being no. 97, plate IV fig. 4 being no. 181).

Favites (?) cf. **spectabilis** (Verrill)

(Pl. XXIII fig. 5)

1918 *Favites spectabilis* (Verrill), Vaughan, p. 113, pl. 44 figs. 1, 1a.
1927 *Favites spectabilis* (Verrill), Faustino, p. 138, pl. 29 figs. 1, 2; pl. 30 figs. 1, 2.

Characters of septa and columella resemble *Goniastrea pectinata*. Dimensions of the calices, however, are as in *Favites spectabilis*. Vaughan already pointed out that a suite of corals from the Philippines, studied by him, in some respects resemble *G. pectinata*.

It seems to me probable that the Togian coral no. 250 is *F. spectabilis*. I feel, however, doubtful as I collected one specimen only, which seems intermediate between *F. spectabilis* and *G. pectinata*. The following is a description of the lone specimen from Togian.

Corallum a massive growth, arched above: horizontal diameter 85 by 70 mm, height 55 mm. Calices polygonal or elongate, average diameter 8 mm, occasionally up to 13 mm in slightly meandering calices, however, only 4 mm wide. Depth 6 mm in deepest calices on convex surface, but 3 mm only in shallow calices near lower margin of corallum. The septal ends of adjacent corallites may be opposed or they may alternate. Upper margins of septa slightly exsert, almost horizontal over a distance of about 1 to 2 mm; then they drop downward almost perpendicularly to the calicular fossa. Septal edges finely pectinate. Twelve or more septa, usually 14, reach the columella and have paliform lobes with rounded upper margins. Columella small trabecular; deep below the palar crown. Asexual reproduction by subequal and by marginal fission.

Favites halicora (Ehrenberg) → **Acanthastrea hemprichii** (Ehrenberg)

(Pl. XXIV figs. 6, 7 and 8)

1914 *Favia halicora* (Ehrenberg), Matthai, p. 106, pl. 26 figs. 3, 5—7 (with synonyms).

1914 *Favia hemprichii* (Ehrenberg), Matthai, p. 110, pl. 27 figs. 1, 2, 4, pl. 36 fig. 3 (with synonyms).
1918 *Favia halicora* (Ehrenberg), Vaughan, p. 110, pl. 41 figs. 1, 2, 3.
1925 *Favia halicora* (Ehrenberg), Hoffmeister, p. 25.
1927 *Acanthastrea hemprichii* (Ehrenberg), Faustino, p. 163, pl. 44, fig. 1.
1932 *Acanthastrea hemprichii* (Ehrenberg), Thiel, p. 51.
1936 *Acanthastrea hemprichii* (Ehrenberg), Yabe, Sugiyama and Eguchi, p. 48, pl. 57 fig. 4.

Four specimens (nos. 106, 160, 184, 185) strongly resemble *Favites halicora*. Three of the specimens have rather thick walls as in the specimen figured by Klunzinger on his pl. IV fig. 1. They also resemble the coral described and figured by Gardiner (1904, p. 786, pl. 64 fig. 45).

The colony no. 184 is a hemispherical growth with a larger diameter of 10 cm. No. 185 is of nearly the same size. It differs only by a more irregular surface of the colony. No. 106 is a hemispherical growth with a larger diameter of 155 mm, no. 160 is nearly globular (135 mm diameter). Plate XXIV fig. 6 figures the calices on the top of the coral no. 184, showing reproduction by marginal fission as is typical in *Favites*. No. 106 is different by its much thinner walls (plate XXIV fig. 7) and reminds of *Favia* (*Acanthastraea*) *hemprichii* (Ehrenberg).

As a matter of fact it seems to me hardly possible to regard *F. halicora* and *Acanthastrea hemprichii* as different species or even different genera.

In plate XXIV fig. 8 a specimen of "*Acanthastrea hemprichii*" (no. 220) is figured, showing a calicle with subequal fission next to a new calicle reproduced by marginal fission. The presence of spines on the upper part of the septal edges seems no good characteristic to separate *Acanthastrea* and *Favites* either. So it seems hardly possible to regard the two as different well defined genera. I made analogous remarks concerning *Favites virens* grade *Acanthastrea echinata* in my paper on the corals from the bay of Batavia.

Four specimens (nos. 63, 99, 170 and 220) show close resemblance to the corals identified as *Acanthastrea hemiprichii* by Faustino and Yabe c.s., judging from the illustrations published by these authors. The spines on upper part of septal edges are very rough and exsert in no. 63.

My conclusion is that the eight Togian corals discussed above form a transitional series *Favites halicora* grade *Acanthastrea hemprichii*.

Genus **Goniastrea** Milne Edwards et Haime

Goniastrea retiformis (Lamarck)

1936 *Goniastrea retiformis* (Lamarck), Yabe, Sugiyama and Eguchi, p. 34, pl. 18 figs. 5, 6 (with synonymy).

1936 *Goniastrea parvistella* (Dana), Yabe, Sugiyama and Eguchi, p. 34, pl. 57 fig. 3 (with synonymy).
1939 *Goniastrea retiformis* (Lamarck), Umbgrove, p. 32.

I agree with Hoffmeister (1925, p. 26) that *C. parvistella* should be placed among the synonyms of *G. retiformis*. Hoffmeister mentions that the Samoan specimens studied by him show walls "which are as thin as those in typical *G. retiformis* in some parts of the corallum, and in other parts are as thick as those of Dana's type of *G. parvistella*".

The same holds good for two specimens from the Togian reefs (nos. 202 and 313). On the other hand two other specimens (nos. 273 and 428) have only calices of the *retiformis*-type. They show striking resemblance to the corals illustrated by Dr. Mayor in his plate 16 fig. 25. Exactly the same calices occur in one part of the Togian specimen no. 313, whereas in another part of that colony the calices agree with those figured by Matthai (1914) in his plate 31 fig. 1.

Goniastrea pectinata (Ehrenberg)

(Pl. XXIII figs. 4 and 6)

For snynonymy see Umbgrove, 1939, p. 32.

A suite of six specimens (nos. 37, 86, 96, 337, 338, 340) from the Togian reefs agree with the description of *Goniastrea pectinata* from Murray island (Vaughan, 1918, p. 115) and from Samoa (Hoffmeister, 1925, p. 26). They strongly resemble the specimens illustrated by Dr. Mayer (1925) on his plate 15 fig. 21. The larger colony (no. 86) is a massive growth of 120 mm diameter. Asexual reproduction usually takes place by subequal fission. However, in some calices fission is rather unequal, as is illustrated by one of the calices figured in plate XXIII figs. 4 and 6, taken from no. 96.

Goniastrea planulata Milne Edwards et Haime

1918 *Goniastrea planulata* E. H., Vaughan, p. 116.
1936 *Goniastrea planulata* E. H., Yabe, Sugiyama and Eguchi, p. 35, pl. 25 fig. 3.

Three specimens, nos. 200, 336 and 382, agreeing with the specimen figured by Matthai (1914) in his plate 31 fig. 8.

Genus **Coeloria** Milne Edwards et Haime

Coeloria rustica (Dana)

(Pl. XXIV figs. 4 and 5)

1928 *Coeloria daedalea* (Ellis et Solander) Matthai, p. 24 (with synonymy), pl. 3.
1936 *Coeloria rustica* (Dana), Wells, p. 104.
1936 *Coeloria rustica* Dana), Yabe, Sugiyama and Eguchi, p. 36, pl. 21 figs. 4—10.
1939 *Coeloria rustica* (Dana), Umbgrove, p. 33.

With the exception of no. 344 the specimens show in the marginal parts calices of the type that are characteristical in *C. astreiformis,* though larger and not so deep as in that species. In a large colony, which I collected on the reef E. of the island Leiden (Pulu Njamuk) in the bay of Batavia, the *astreiformis*-type of calices occurs even on an area upwards from the margin of the corallum. For the greater part, however, the coral has calices of the *rustica*-type. I believe that the specimen figured by Yabe (1936, pl. 57 fig. 7) is not *Platygyra* but *Coeloria,* probably *C. rustica.*

Nos. 179, 344, 379 and 380 are typical *C. daedalea* auctorum and agree with the coral figured by Vaughan (1918, plate 44 figs. 3, 3a). On the other hand nos. 23, 98, 176, 211, 225 and 267 agree with *Coeloria sinensis* E. H., no elongated or maeandering calices being present. Although there are no intermediate forms in my collection I am following Matthai's usage in placing my *C. sinensis* specimens among the synonyms of *C. rustica.*

Coeloria astreiformis (M. Edwards et Haime) and **Coeloria astreiformis** (E. H.) → **C. rustica** (Dana)

(Pl. XXIV figs. 1, 2 and 3)

For synonyms see Yabe c.s. 1936, p. 37 and Hoffmeister, 1925, p. 29.

Five colonies, nos. 141, 276, 339, 346 and 470. No. 141 is a humpy growth type; no. 470 subcylindrical, the upper part forming a micro-atoll. The diameter of the calices in no. 141 is smaller (averrage 2.5 tot 3 up to 4 mm) than in the other specimens (average 3 to 4 mm), which have a hemispherical growth-shape.

In some specimens the calicular walls are comparatively high (nos. 339 and 276). These specimens seem to be intermediate forms between *Coeloria astreiformis* and the *sinensis-stricta*-type of *C. rustica.* It is hardly possible to consider them as two different species as may be seen from Pl. XXIV figs. 1—5. Moreover, when discussing *C. rustica* (Dana) I pointed out the occurrence of calices of the *astreiformis*-type in *C. daedalea* auctorum. I presume that the two "species" intergrade. In future studies on coral reefs special attention should be given to this question by studying these corals in situ.

Genus **Platygyra** Ehrenberg

Platygyra phrygia (Ellis et Solander)

For synonyms see Matthai 1928, p. 112 and Umbgrove, 1939, p. 33.

3 specimens, nos. 131, 315 and 316. The corals have a hemispherical growth-type. One, no. 316, has a hillocky mode of growth (compare Matthai,

pl. L fig. 1). 17 to 20 septa in 1 cm, of which 10 to 12 meeting columella.

The presumed differences of *Pl. phrygia* (and *tenuis*) and *Pl. gracilis* are worth of an intensive study of a large suite of corals in loco.

"*Platygyra phrygia*" as figured by Yabe, Sugiyama and Eguchi (1936, pl. 57 fig. 7) is no *Platygyra* but a *Coeloria*, probably *Coeloria rustica* (Dana).

I feel doubtful whether *Platygyra ryukyuensis* Yabe et Sugiyama is a *Platygyra*. It seems to me that the coral more resembles "*Favia hombroni* (Rousseau)" as figured by Matthai (1914, pl. 26 figs. 1 and 2, pl. 33 fig. 2).

Genus **Hydnophora** Fischer de Waldheim

Hydnophora microconos (Lamarck)

1928 *Hydnophora microconos* (Lamarck), Matthai, p. 144 (with synonymy), pls. 2, 16, 17 and 49.
1936 *Hydnophora microconos* (Lamarck), Yabe, Sugiyama and Eguchi, p. 40, pl. 32 fig. 5.
1939 *Hydnophora microconos* (Lamarck), Umbgrove, p. 34.

Typical representatives of this species were collected (nos. 169, 224, 314, 331 and 381).

Hydnophora rigida (Dana)

(Pl. XXV fig. 1)

1848 *Merulina rigida* Dana, U. S. Expl. Exp., VIII, p. 276, pl. 17 fig. 1.
1857 (?) *Hydnophora rigida* (Dana), Milne Edwards and Haime, Hist. Nat. Corall., II, p. 425.
1918 *Hydnophora rigida* (Dana), Vaughan, p. 122, pl. 48 figs. 2—3.
1927 *Hydnophora rigida* (Dana), Faustino, p. 151, pl. 37 fig. 1.
1928 *Hydnophora rigida* (Dana), Matthai, p. 156, pl. 18 fig. 4, pl. 49 fig. 8.
1936 (?) *Hydnophora rigida* (Dana), Yabe, Sugiyama and Eguchi, p. 40, pl. 30 fig. 5, pl. 34 fig. 2.
1939 *Hydnophora rigida* (Dana), Umbgrove, p. 34.

Excellent specimens were collected from the reefs South of Batoe Daka (nos. 162, 187, 242, 251, 279, 321).

The specimens are varying from slender branches up to strong massive branches having a diameter of 35 mm. I am giving a photograph of a colony, showing the habitus of the growth type.

Hydnophora tenella Quelch var. **applanata,** nov. var.

(Pl. XXV fig. 2)

1886 *Hydnophora tenella,* Quelch, p. 96, pl. V figs. 8, 8a.
1904 *Hydnophora maldivensis,* Gardiner, p. 765, pl. 60 fig. 12.
1907 *Hydnophorella exesa* (pars), Bedot, p. 199, pl. 25 figs. 127—129.
1928 *Hydnophora tenella* Quelch, Matthai, p. 153, pl. 1 fig. 7, pl. 14 figs. 1, 6.

On the free margin of the two specimens (no. 102 and no. 103) the structure and arrangement of the collines is such as figured by Gardiner, Bedot and Matthai for typical *H. tenella*, the septa sloping very obliquely backwards from the top of the elongated ridged monticules and the columella being feebly developed. However, the central part of the colony, which is much thicker (up to 17 mm), shows flattened and relatively broad monticules (Pl. XXV fig. 2). In some of these monticules the central part is concave; and up to 18 septa occur in 1 cm not sloping obliquely from the top of monticule. Moreover the columella is well developed, consisting of twisted trabeculae, formed by the septal margins. So far I can see these remarkable characteristics are absent in the specimens of *H. tenella* described up till now; they are also absent in the fossil specimens, which I found in the Upper-Neogene coral reef of Gunung Linggapadang near Prupuk, Java. However, as the structure of typical *H. tenella* occurs in the marginal parts of the Togian specimens I consider them not a different species but a variety.

Genus **Merulina** Ehrenberg

Merulina ampliata (Ellis et Solander)

For synonymy see Umbgrove, 1939, p. 35.

Two specimens from locality 332. In my collection this species is also present from Timor, the bay of Batavia, the Thousand Islands (Java Sea) and Singapore.

I discussed the whole suite in my paper on the corals from the bay of Batavia.

Merulina scabricula Dana

(Pl. XXV fig. 3 and Pl. XXVII fig. 6)

1848 *Merulina scabricula* Dana, U. S. Expl. Exped., VIII, Zooph., p. 275, pl. 16 figs. 2, 2a, 2b.
1851 *Merulina scabricula* Dana, Milne Edwards and Haime, p. 144.
1857 *Merulina scabricula* Dana, Milne Edwards and Haime, II, p. 630.
1927 *Merulina vaughani* Van der Horst, Faustino, p. 165, pl. 45 fig. 2.
1928 *Merulina scabricula* Dana, Matthai, p. 135, pl. 14 fig. 3, pl. 15 fig. 14.

Pl. XXVII fig. 6 shows a large colony of *Merulina*. The branches (Pl. XXV fig. 3) agree with Dana's and Matthai's description of *M. scabricula* Dana; the lamina have a structure as described of *M. vaughani* Van der Horst. I am convinced that Dana based his *M. scabricula* on a part only, viz., the branches, of a large colony. *Merulina ampliata* (Ellis and Solander) too has thin lamina from which crests or irregular columns arise. I believe, however, that we may distinguish these two species by the growth type of these

protuberances, *Merulina scabricula* having dendroid columns, rather rough, compressed from side to side (often coalescing) and with obtuse truncate extremities, whereas in *Merulina ampliata* (Ellis et Solander) the crests may grow out to obtain a twisted or foliate appearance which is quite different from the columns of *M. scabricula.* The lamina of my specimens have rounded collines of the type named *M. vaughani* by Van der Horst, Hoffmeister and Faustino. Van der Horst pointed out that the original species *M. ampliata* Ellis and Solander shows narrow collines and he instituted a new species, *M. vaughani,* for the specimens, which like Dana's type of *M. ampliata* have rounded collines. However, Matthai was of opinion that the material studied by him proved the existence of "an almost continuous series from the thin and very acute collines ... to the rounded collines in Dana's example of *Merulina ampliata*". My material from the East Indies, including specimens from Togian, Timor, the bay of Batavia and the Thousand Islands (Java Sea) gives support to this opinion of Matthai's because they show a gradation from extremely thin lamina with very thin and acute collines up to lamina of 8 mm thickness covered with rounded collines. Though the extremes differ widely it would be impossible to distinguish two different species in that material. So, the lamina of *Merulina scabricula* cannot be distinguished from some types of lamina of *M. ampliata* Ellis and Solander (= *M. vaughani* Van der Horst). According to my opinion the two species can be distinguished only by the different types of the protuberances. In my material no transitional forms between *M. ampliata* and *M. scabricula* are present. In case they might be found, both species should be united into one species named *Merulina ampliata* (Ellis and Solander). I believe that Faustino's example of *M. vaughani* is a young specimen of *M. scabricula.* I am not certain whether *Merulina studeri* Bedot too belongs to this species.

My specimens from Togian are nos. 348, 361, 365 and 366.

Merulina togianensis nov. spec.

(Pl. XXVI figs. 1—3)

The species (nos. 89, 91, 95, 138 and 139) shows the usual growth shape of other *Merulina* species, viz., basal and marginal lamina surrounding a central arboriform part. The coral is heavy and dense in structure. Calicinal surface of folium slightly concave, flat or even convex, up to 5 mm thick. Structure of valleys and collines on folia much resembling those of *M. ampliata* and *M. scabricula* (Pl. XXVI fig. 2). Valleys generally shallow; 15 septa in 1 cm, 10—12 septa meeting in definite centra. Septa equally exsert. No alternating row of very small septa present. Septa coarsely

toothed. Collines thick and comparatively flat. Non-calicinal surface with rough spinules along thin costae.

Arboriform part consisting of solid branches often coalescing. Younger branches rounded polygonal in diameter owing to the occurrence of valleys and rounded collines (Pl. XXVI fig. 1). Older branches, however, subcircular in diameter (6—8 mm) and of comparatively smooth appearance (Pl. XXVI fig. 3). Extremities of branches blunt or pointed (not obtuse and truncate as in the laterally compressed branches of *M. scabricula*). Branches not sharply angular and not showing the long oblique lamellae which are characteristic in *M. laxa*.

Genus **Scapophyllia** Milne Edwards et Haime

Scapophyllia cylindrica M. Edwards et Haime

1928 *Scapophyllia cylindrica* E. H., Matthai, p. 260, pl. 14 figs. 2, 4, pl. 51 fig. 2 (with synonyms).
1936 *Scapophyllia cylindrica* E. H., Yabe, Sugiyama and Eguchi, p. 42, pl. 26 figs. 1, 2.
1939 *Scapophyllia cylindrica* E. H., Umbgrove, p. 36, pl. V fig. 2.

No. 174 is the only specimen I collected on the Togian reefs. The coral is 55 mm broad and 115 mm long; its greatest height attains 50 mm. It is a rather young colony showing the origin of two cylindrical branches with sinuous collines. Between these the valleys are straight over a distance of about 2 cm. For the rest Matthai's description of Milne Edwards and Haime's type is entirely applicable to the Togian specimen.

Family MUSSIDAE Verrill

Lobophyllia corymbosa (Forskål)

1928 *Lobophyllia corymbosa* (Forskål), Matthai, p. 210, pls. 24, 25, 26, 27, 57, 58, 60, 62, 64, 68 and 71 (with synonymy).
1936 *Lobophyllia corymbosa* (Forskål), Yabe, Sugiyama and Eguchi, p. 43, pl. 33, fig. 1.
1939 *Lobophyllia corymbosa* (Forskål), Umbgrove, p. 36.

Large colonies occur on the Southern side of Batoe Daka: nos. 38, 49, 53, 54, 55, 56, 57, 66 and 68.

Lobophyllia costata (Dana)

1928 *Lobophyllia costata* (Dana), Matthai, p. 216, pls. 24, 27, 28, 29, 34, 47, 54, 57, 58, 60 and 62 (with synonymy).
1936 *Lobophyllia costata* (Dana), Yabe, Sugiyama and Eguchi, p. 43, pl. 31 fig. 3.
1939 *Lobophyllia costata* (Dana), Umbgrove, p. 37.

The larger more ore less hemispherical colonies have a diameter of 130 to 180 mm and most resemble *Mussa sinuosa* as figured by Faustino (1927,

pl. 39 fig. 1), always one or more mono- to bistomodaeal polyps being present: nos. 80, 195, 218, 228, 229, 241, 473.

Genus **Symphyllia** Milne Edwards et Haime

I am not convinced that *Symphyllia recta, S. radians, S. agaricia* and *S. valenciennesi,* as defined by Matthai (1928), are separated by specific limits. Although the suite from the Togian islands is not large enough to settle this question definitely, two of my specimens apparently are intermediate forms, one *S. recta* → *agaricia,* the other *S. recta* → *valenciennesi.* According to my opinion *S. radians* is only a growth-type of *S. recta.* To the question of the specific limits in *Symphyllia* special attention should be given in future researches by studying a large suite in situ.

Symphyllia recta (Dana)

1928 *Symphyllia recta* (Dana), Matthai, p. 227, pl. 30 figs. 1—6; pl. 31 figs. 1—2; pl. 48 figs. 4—6; Pl. 57 fig. 1 (with synonymy).
1936 *Symphyllia recta* (Dana), Yabe, Sugiyama and Eguchi, p. 46, pl. 33 fig. 4.
1939 *Symphyllia recta* (Dana), Umbgrove, p. 37.

All the specimens from Togian are massive and with a broad base of attachment. There is a great deal of variation in the septal dentations. Nos. 82 and 326 have rather small teeth (resembling Matthai, 1928, pl. 30 fig. 1); in nos. 208 and 317 the septal dentations are stronger developed (as in Matthai, pl. 30 fig. 4). A furrow at the summit of the collines is not always distinct (compare Faustino, 1927, p. 159); in some specimens it is very distinct in part of the colony, whereas it is lacking in other parts of the same colony. No. 326 is a large colony (diam. 270 mm) with the shape of a micro-atoll. The valleys of this specimen are mostly arranged perpendicular to the rim of the micro-atoll.

Symphyllia recta (Dana) → **agaricia** Milne Edwards et Haime

(Pl. XXVII fig. 1)

No. 310 shows sinuous valleys of the *recta*-type, but in most of the valleys (not in all) two rows of columellar centres are present as in *S. agaricia.* The valleys not being of the *radians*-type, this specimen is an intermediate form between *S. recta* and *S. agaricia.*

Symphyllia recta (Dana) → **valenciennesii** Milne Edwards et Haime

(Pl. XXVII fig. 3)

No. 343 is a small colony with strongly dentated septa. The collines are

broad and applanate showing a distinct median groove. In this characteristic the specimen resembles *S. valenciennesii,* though in this small coral the grooves are not so broad as in the larger specimens figured by Matthai (1928, pl. 32 fig. 1 and pl. 66 fig. 4) and Yabe (1936, pl. 58 fig. 3). The valleys are, however, not arranged as in *S. agaricia* and *S. radians,* nor is in parts of the valley more than one row of columellar centres or a ring of columellar centres surrounding a central one present. On the contrary, valleys and columellar centres are of the *S. recta*-type. The specimen is intermediate between *S. recta* and *S. valenciennesii* E. H.

Symphyllia radians Milne Edwards et Haime

1928 *Symphyllia radians* E. H., Matthai, p. 231, pl. 31 fig. 3; pl. 33 fig. 1; pl. 54 fig. 7; pl. 58 fig. 4; pl. 71 fig. 2 (with synonymy).
1936 *Symphyllia radians* E. H., Yabe, Sugiyama and Eguchi, p. 46, pl. 33 fig. 3.
1939 *Symphyllia radians,* Umbgrove, p. 37.

No. 304 is a small specimen (diam. 70 mm) corresponding in every respect to *S. radians* E. H.

Family ECHINOPORIDAE Verrill

Echinopora lamellosa (Esper)

For synonymy see Umbgrove, 1939, p. 38.

The growth types of this species range from very thin lamina without calices on the lower side to rather thick lamina having calices on either side. Nos. 115 and 119.

Echinopora cf. **gemmacea** (Lamarck)

For synonyms see Matthai, 1914, p. 54 and Umbgrove, 1939, p. 38.

I refer one specimen, no 258, to this species. It is a lamen of up to 14 mm thickness, with a very thin margin and having a branching hillock. Costae low but distinct ridges with blunt echinulations resembling those of *E. ehrenbergi* as figured by Klunzinger in his plate 6 fig 7. Calices circular, not strongly projecting, occurring on either side of the lamen.

Diameter of calices usually 3 mm. This character and the septal number agrees with *E. lamellosa* as defined by Matthai. Up to 12 septa making columella. I consider the specimen intermediate between *E. lamellosa* and *E. gemmacea.* Further comments on the different species of *Echinopora* may be found in my paper on the corals from the bay of Batavia. I feel doubtful whether the coral described by Thiel as *E. gemmacea* belongs to that species. It may be that it belongs even to a different genus.

Echinopora horrida Dana

1846 *Echinopora horrida,* Dana, p. 282, pl. 17 fig. 4.
1927 *Echinopora horrida* Dana, Faustino, p. 123, pl. 22 figs. 1 and 2.
1937 *Acanthelia horrida* (Dana), J. W. Wells, New Genera of Mesozoic and Cenozoic Corals, Journ. of Paleontology, vol. 11, p. 73.
1939 *Echinopora horrida* Dana, Umbgrove, p. 39, pl. VII figs. 1, 2; pl. VIII figs. 1, 2.

I discussed the characteristics of this species in my paper on the corals from the bay of Batavia. The specimens from Togian are nos. 178, 197, 226 and 233.

Genus **Mycedium** Oken

Mycedium elephantotus (Pallas)

(Pl. XXVIII fig. 1)

1936 *Mycedium elephantotus* (Pallas), Yabe, Sugiyama and Eguchi, p. 49, pl. 33 fig. 4; pl. 37 figs. 5, 6.

A single specimen, no. 196, is a large foliated lamen with a radius of 240 mm.

Identification is based on the specimen figured by Yabe c.s. in their plate 37 fig. 5. When living, the coral had a pale-yellow colour.

Genus **Tridacophyllia** de Blainville

Tridacophyllia lactuca (Pallas)

(Pl. XXVIII figs. 2 and 3)

For synonyms see Thiel, 1932, p. 103, Yabe c.s., 1936, p. 51 and Umbgrove, 1939, p. 41.

Although there is great confusion in the taxonomy of the various species of *Tridacophyllia* I do not hesitate in referring my specimens (nos. 272 and 297) to *T. lactuca* (Pallas) as described by Thiel (pp. 103—107, pl. 18 fig. 3). For all security I am giving an illustration of a detail from the specimen no. 272. No. 297 is a large colony, 34 cm high and 60 cm in diameter.

MADREPORARIA FUNGIDA

Family FUNGIIDAE Dana

Fungia echinata (Pallas)

1932 *Fungia echinata* (Pallas), Thiel, p. 67, pl. 10 fig. 1 (with synonymy).
1932 *Fungia brachystoma* Thiel, p. 65, pl. 8 fig. 5.
1939 *Fungia echinata* (Pallas), Umbgrove, p. 43.

Five fullgrown specimens belong without any doubt to this species (nos. 168, 309, 363, 447 and 479). The largest specimen collected attains 270 mm length. I have no hesitation in referring also no. 327, a young specimen,

75 mm long, to this species because the character of the spines and the type of teeth on the larger septa are those of *F. echinata.*

This species which has a wide distribution from the Red Sea through the Indian Ocean and the Pacific up to the Palau islands and Tahiti, is a common one on the reefs of the Togian islands and in the bay of Batavia.

A specimen collected on the island Hoorn in the bay of Batavia has a length of 390 mm.

According to my opinion *Fungia brachystoma* Thiel is a young specimen of *F. echinata.* The shortness of the axial fossa is a juvenile character. Moreover the ratio between length of the corallum and length of the axial fossa varies considerably even in adult and large specimens as may be seen from the following table. I have enumerated in the table 6 specimens from Togian, two from the bay of Batavia (B), "*F. brachystoma*" Thiel (T) and a specimen from upper Neogene strata in Java (N) to be described in another paper.

	T	N°. 327	N	B	N°. 363	N°. 168	N°. 309	N°. 479	N°. 447	B
Length of corallum	55	75	115	175	175	190	225	240	270	390
Length of axial fossa	14	30	30	140	160	160	205	130	140	250
Ratio	25.4	40	26	80	92	84.4	91	54	52	64

Thiel regards the presence of a "median septum" causing a bilateral symmetry in the septal arrangement a valuable characteristic of his species "*brachystoma*". As a matter of fact "median septa" are present in one of my specimens (no. 168); another specimen shows it on only one side of the axial fossa (no. 309), whereas in other specimens such a septum occurs over some distance, disappearing in the more distal parts of the axial fossa and giving place to an asymmetrical arrangement of septa (no. 363 and the largest specimen from the bay of Batavia). Moreover the Neogene specimen has an asymmetrical arrangement of septa and gives no support to Dr. Thiel's phylogenetic considerations.

From the statements given above is it evident that *F. brachystoma* is not a valid species. The name has to be placed among the synonyms of *F. echinata* Pallas.

Fungia scutaria Lam.

(Pl. XXIX figs. 1 and 2)

For synonyms see Thiel, 1932, p. 63 and Umbgrove, 1939, p. 44.

Two young specimens, nos. 375 and 481, undoubtedly belong to the present species. They have well-developed tentacular lobes.

When Dr. Boschma studied a collection of Fungiidae from Tahiti he stated that in many cases the species of the *scutaria*-group differ very little from each other. He suggested that *Fungia oahensis* from the Hawaiian Islands perhaps has to be united with *F. scutaria* and *F. paumotensis* in one species (Boschma, 1929, p. 44).

In my collection one specimen, no. 294, gives some evidence in the same direction. Habitus and upper surface resemble *F. scutaria* (Pl. XXIX fig. 1); the lower surface (Pl. XXIX fig. 2) reminds of some characteristics of *F. oahensis* as it shows a peripheral rim with distinct costae surrounding a central area which is crowded with small spines. It is only in a few spots of this central part that the costae can be seen over a distance of some millimeters; there again they become entirely hidden by the spines.

There are no such irregular large humps on the central part of the underside as in typical *F. oahensis*. The coral has an elongated shape (110 × 63 mm) and rounded edges. The upper surface is convex, 25 mm heigh, and shows distinct though not very prominent tentacular lobes (Pl. XXIX fig. 1). So, summa summarum, this specimen must be named *Fungia scutaria*.

Fungia paumotensis Stutchb.

For synonyms see Boschma, 1925 and 1929.

Two specimens, no. 210 and no. 330. No. 330 is a young specimen. No. 210 agrees especially in respect to the type of spines on the lower surface with the diagnosis and photographs of *F. paumotensis* var. *carcharias* Studer as described by Döderlein. The lower surface is slightly convex, the upper surface is very flat. The septa are nearly equal in height. In that respect the specimen more resembles *F. scutaria*. No tentacular lobes developed. Dimensions of the corallum 110 mm long, 65 mm broad.

Fungia concinna Verrill

For synonymy see Thiel, 1932, p. 75 and Umbgrove, 1939, p. 43.

I agree with Gardiner, Vaughan, Van der Horst, Boschma and Thiel, that *Fungia plana* must be united with *F. concinna* in one species, as transitions are present in the Togian specimens too. Nevertheless there are forms, which are typical *F. plana* (nos. 369 and 477) while most of the specimens show a septal dentation typical of *F. concinna* (nos. 204, 283,

289, 293, 370, 450, 452, 458 and 478). The transitional forms are nos. 137, 295, 449 and 468. One might be inclined to consider some specimens of the *concinna* type to Döderlein's var. *serrulata* whereas other discs agree with his *Fungia concinna typica*. However, between both types too transitions exist.

The specimens nos. 283 and 293 show branched spines. There is, however no reason to consider them a separate type, because all transitional stages between rather short granulated spines and the longer, taller and branched types occur in my material. Secondary calices are present in two specimens, nos. 204 and 293. Most of the discs are flat to slightly concave; one has a distinct concave lower surface (no. 450, a small specimen, diameter 82 mm) with coarsely dentated septa, the underside crowded with rather short granulated spines only the major costae bearing longer ones. One specimen (no. 458) has nearly equal septa; on its lower surface too the costae are nearly equal. The underside of no. 452 possesses rather many openings though restricted to a broad periphery of the centre. It may be considered a transitional form to *F. repanda*. One specimen has two mouths, separated by a few irregular septa (no. 295). *Fungia concinna* is a common species on the reefs around the Togian islands.

Fungia repanda Dana

(Pl. XXVII figs. 4 and 5).

For synonyms see Thiel, 1932 and Umbgrove, 1939, p. 44.

Vaughan (1907) pointed already out that transitional forms exist between *F. concinna* (and *F. plana*) and *F. repanda*. The same has been stated by other students of *Fungia* and the same holds good for the Fungiae from the Bay of Batavia and from the Togian islands. When describing *F. concinna* I mentioned a specimen having rather many perforations (no. 452). On account of their being restricted to the distal parts of the periphery I still named the specimen *F. concinna*. Using the degree of perforation of the theca as a characteristic, in the same manner as Boschma (1925 and 1929) did, some specimens in my collection from Togian have to be regarded as typical *F. repanda* (nos. 136, 292, 371 and 372). One specimen, no. 286, shows not so many perforations, but I am inclined to refer it to *F. repanda*, although it must be admitted that no. 452 and no. 286 are transitional forms elucidating again that *F. concinna* and *F. repanda* are no biologically valid species and better should be united into one species. No. 286 has a strongly concave underside (diameter 135 mm, height 80 mm), showing rather thin spines. The upper surface shows some secondary calices especially around a

dead part, where the growth of the septa has stopped under the influence of an unknown cause.

There are, moreover, four young *Fungias* in my collection, which I refer to *F. repanda* (nos. 112, 329, 453 and 460). The aboral surface of no. 460 is figured in Pl. XXVII fig. 5. It shows clearly that we are dealing with two young specimens. Pl. XXVII fig. 4 are the same specimens seen from the oral side. Some septa of the two specimens have fused. Apparently the two would have entirely fused in the adult stage, giving origin to a *Fungia* with irregular arrangement of the septa.

Fungia danai Milne Edwards et Haime

For synonyms see Thiel 1932, p. 69 and Umbgrove 1939, p. 44.

No. 480 is a rather young specimen (diameter 75 mm) but belongs without any doubt to *Fungia danai.* It agrees in all characteristics with the description of Döderlein's Pl. XVI figs. 5, 5a, but it has no central scar.

Fungia valida Verrill

For synonyms see Döderlein, 1902, p. 125.

Two specimens, nos. 373 and 374, correspond in every characteristic with the description by Döderlein. In the largest specimen of the two, which has a diameter of 112 mm, the central part of the under side bears no spines. The smaller one has a diameter of 95 mm.

Fungia fungites (Linné)

For synonyms see Thiel, 1932, p. 69 and Umbgrove, 1939, p. 44.

The specimens collected belong to var. *discus* Dana (no. 290) and var. *agariciformis* Verrill (nos. 111, 135 and 285).

Var. *discus* is abundant on the reefs in the bay of Batavia.

Fungia fungites (L.) → **Fungia repanda** (Dana)

In my collection are typical specimens of *Fungia fungites* and of *Fungia repanda.* I collected, however, a suite of *Fungia* specimens which combine the characteristics of the two species. Some appear closer to *F. fungites,* some other discs closer to *F. repanda.* The specimens can be arranged in such a way that they clearly illustrate an intergradation between the two species. They cannot be considered varieties of the two species, nor would special names have any significance, as a complete series of transitional forms is present. In designating the series I am following the method used by Hoffmeister (1925, pp. 6, 7).

The species are intergrading in the characters of the septa, costae, spines and perforation of the disc.

α No. 291 has subequal septa and costae. In these respects it resembles *F. fungites*. Most of the spines are smooth and acute as in typical *F. fungites*. Some spines are, however, rough and divided on their tops.

β The latter characteristic is to a larger extent true for no. 376. Many spines bear distinct small granules and are split at the top.

γ In no. 296 the spines in the centre of the disc are blunt and strongly granulated. Along the margin of the disc the spines are more elongated, with slender shafts, granulated and split only at their tops. There, moreover, smooth and acute spines occur as in typical *F. fungites*.

δ The latter are lacking in no. 288. The habitus of the septa in nos. 296 and 288 is as in *Fungia fungites*. In no. 110 the spines are of the same types as in no. 296. However, the general habitus of the oral surface resembles *F. repanda* more than *F. fungites*. When turning the disc to the light it appears rather strongly perforated, which is not the case in the specimens mentioned up to now.

ε No. 451 resembles *F. repanda* in respect to the unequal septa and costae and the many perforations of the disc. The spines are, however, not as in typical *F. repanda*; they are slender or even acute, most of them granulated in the upper parts only and ending in two or three acute ends. Only a few blunt and strongly granulated spines occur in the central part of the disc.

I collected an analogous though not so complete suite of corals in the bay of Batavia. After finishing my study of this puzzling series of corals I sent the material to Dr. H. Boschma, who was willing to restudy the suite. Dr. Boschma, whom I owe many thanks for this cooperation, came to exactly the same conclusion, though he did not know the results of my study.

I am designating the suite *Fungia fungites* grade *repanda*. Of course we could write *Fungia repanda* grade *fungites* as well.

Genus **Halomitra** Dana

Halomitra robusta (Quelch)

(Pl. XXVII fig. 2)

For synonyms see Boschma, 1925, p. 242.

All specimens of *Halomitra* collected by me belong to the species *robusta* as defined by Boschma. It is a common species on the Togian reefs. Many specimens show a very irregular shape. Sometimes it could be stated, when

collecting the specimens, that the irregular shape is due to the limited room left open by surrounding coral colonies. Thus, no. 264 has exactly the form of the little pool the coral lived in. The central calicle of some specimens has a distinctly larger size than the secondary calicles (nos. 268, 284, 368, 444) whereas in the other specimens, even in a very small one of 70 mm largest diameter (no. 182) all calicles are subequal in size. In most specimens a radial arrangement of the spines according to the costae can only be distinguished in the marginal part of the aboral surface. As to the arrangement of the septa my material proves the correctness of Boschma's uniting of *H. robusta* and *H. irregularis* and I agree with him that the genus *Döderleinia* Gardiner (= *Parahalomitra* Wells, 1937) should be placed among the synonyms of *Halomitra* Dana. I collected 10 specimens on the Togian reefs: nos. 182, 264, 268, 284, 287, 367, 368, 377, 444 and 446. Except for two elongated dome shaped specimens (nos. 268 and 377) the specimens have a very irregular shape with an undulating oral surface and their habitus corresponds to *H. irregularis* Gardiner (1898, pl. XLIII). The costal spines are rather small even in the largest specimens (reaching a largest diameter of 265 mm). On the other hand I have collected a small specimen from the Bay of Batavia (island Leiden, foliosa-facies), showing a very regular convex oral surface and a slightly concave aboral surface covered (except for the scar of atachment) with large branched spines which are distinctly radially arranged. It is figured in my paper on the Batavia corals. One specimen (no. 377) was found lying upside down. The marginal parts have strongly grown inwards. I am giving a figure of the small specimen (no. 182) as it is interesting to note the great number of calicles although the greater diameter of the disc ic only 70 mm. Boschma mentioned a sepcimen having a diameter of 64 mm and possessing 18 calicles only (l.c., p. 247). This specimen from Togian has a distinct scar of attachment on the convex central part of its lower surface. In some of the larger specimens the scar is still clearly visible, but covered with spines. In one specimen (no. 446) a false bud is in a stage of formation (compare Boschma, 1925, fig. 130).

Family AGARICIIDAE Verrill

Genus **Pavona** Lamarck

Pavona decussata Dana

(Pl. XXX fig. 5)

1925 *Pavona decussata* Dana, Hoffmeister, p. 40, pl. 4 fig. 1 (synonyms).
1927 *Pavona decussata* Dana, Faustino, p. 204, pl. 67 figs. 2 and 3.
1936 *Pavona decussata* Dana, Yabe, Sugiyama and Eguchi, p. 56, pl. 39 figs. 4—6.
1939 *Pavona decussata* Dana, Umbgrove, p. 46.

In my collection from the reefs in the bay of Batavia are typical specimens of *P. decussata* as, e.g., figured by Mayor (1925, pl. 8 fig. 23).

In the Togian reefs some specimens were found agreeing with them in every respect (no. 448) having many fronds growing at nearly right angles.

However, other specimens have a somewhat different growth type. In no. 223 (Pl. XXX fig. 5) one system of fronds growing nearly parallel to each other, has developed much stronger and higher than the laminae, which may be seen protruding perpendicular to them. It seems to form a gradation to the growth type no. 236. This specimen has very thick fronds (up to 18 mm at their bases) and these fronds are projecting from a massive basal part, which has a thickness of 40 mm, surrounded entirely by well developed calices. This growth type reminds of *P. crassa* Dana.

Pavona divaricata Lamarck

(Pl. XXIX figs. 4 and 5)

For synonymy see Hoffmeister, 1925, p. 38 and Umbgrove, 1939, p. 47.

The two specimens, which I brought home differ in respect of the growth type of the branches. In no. 435 (Pl. XXIX fig. 5) the branches are looser and more sharply triangular than in no. 231 (Pl. XXIX fig. 4) which has thicker and more crowded branches, coalescent in more places than no. 435. I believe these differences to be only two growth types of the same species and to my opinion also *P. prismatica* Brueg., resembling no. 435 in many respects, belongs to *P. divaricata* Lam.

Pavona frondifera Lamarck

(Pl. XXX figs. 2, 3 and 4)

1925 *Pavona frondifera* Dana, Hoffmeister, p. 40, pl. 3 fig. 1 (with synonymy).
1927 *Pavona frondifera* Dana, Faustino, p. 203, pl. 67 fig. 1.
1932 *Pavona frondifera* Dana, Thiel, p. 90, pl. 17 fig. 4.
1936 *Pavona frondifera* Dana, Yabe, Sugiyama and Eguchi, p. 57, pl. XL figs. 1—3.
1939 *Pavona frondifera* Dana, Umbgrove, p. 47.

Most of the specimens I collected in the bay of Batavia belong to a growth type as figured by Hoffmeister in his pl. 3 fig 1c, having rather large fronds which seen from aside show rounded nearly semicircular margins and many carinae running perpendicular to the margin of a frond. On the other hand pl. 3, fig 1e of Hoffmeister's is a specimen possessing fronds whose summits are divided into more ore less curled or even twisted lobes. On the Togian reefs I collected a *Pavona* (no. 438) which shows every gradation between these two types of fronds in one and the same specimen as is illustrated by Pl. XXX figs. 2 and 3. I am convinced that no. 456

(Pl. XXX fig. 4) too belongs to *P. frondifera,* being a type in which the fronds are divided in rather long and narrow twisted lobes. Most of the lobes have well developed carinae; the structure and arrangement of the calicles is the same in both the Togian specimens mentioned here.

Pavona varians (Verrill)

1918 *Pavona varians* (Verrill), Vaughan, 1918, p. 138, pl. 57 (older synonyms).
1921 *Pavona varians* (Verrill), Van der Horst, 1921, p. 25.
1922 *Pavona varians* (Verrill), Van der Horst, 1922, p. 419, pl. 31 fig. 3 (4?).
1936 *Pavona varians* (Verrill), Yabe, Sugiyama and Eguchi, 1936, p. 57, pl. LVIII fig. 6.
1939 *Pavona varians* (Verrill), Umbgrove, p. 47.

Typical specimens corresponding in every respect to those figured by Vaughan have a wide distribution on the Togian reefs (nos. 153, 175, 246, 357 and 476). It seems to me that Bedot's specimen of "*P. decussata*" from Amboina (1907, fig. 182, non fig. 180) belongs to this species.

Pavona (Polyastra) obtusata (Quelch)

(Pl. XXXI figs. 1 and 2)

1886 *Tichoseris obtusata* Quelch, p. 114, pl. 5 figs. 3—3c.
1936 *Agaricia* (?) *ponderosa* Gardiner, Yabe, Sugiyama and Eguchi, p. 55, pl. 27 fig. 5; pl. 38 fig. 1; pl. 52 fig. 1.
1936 *Polyastra obtusata* (Quelch), Wells, Annals and Magazine of Natural History, ser. 10, vol. 18, 1936, p. 549—552, pl. IX figs. 1—3.

Pavona (*Polyastra*) *obtusata* is a rather common species on the Togian reefs. My specimens are numbered: 199, 207, 298 and 432. The largest specimen (no. 298) is a massive colony with a greater diameter of 190 mm. Many small barnacles are growing on its surface. Where these occur in a more or less linear arrangement close to each other, they hamper the growth of the corallites and cause a mammillated aspect of the surface when the parts of the surface lying between grow up. In this specimen the corallites are as a rule individually surrounded by a wall (Pl. XXXI fig. 1). In places and especially along the edge of the same colony (no. 298) the calices may be arranged serially in small valleys. Pl. XXXI fig. 2 is from a small colony (no. 207) showing moreover many calicles on the surface of the corallum surrounded by a wall as Wells considered typical in *P. obtusata* Quelch. In my paper on the corals from the bay of Batavia I discussed at length the species and varieties of the subgenus *Polyastra.*

Genus **Psammocora** Dana

A critical revision of the many species of *Psammocora,* which have been described, would probably reduce considerably the number of valid species,

especially the non-branching forms. Such a revision is only of value if the original types can be studied.

So far as I know the following forms have been described: (1) *Ps. contigua* (Esper) = *Ps. ramosa* Quelch, = ? *Ps. plicata* Dana; (2) *Ps. digitata* E. H.; (3) *Ps. divaricata* Gardiner; (4) *Ps. exesa* Dana; (5) *Ps. explanulata* Van der Horst; (6) *Ps. folium* Umbgrove; (7) *Ps. haimiana* E. H.; (8) *Ps. nierstraszi* Van der Horst; (9) *Ps. obtusangula* Lam.; (10) *Ps. parvistella* (Verrill); (11) *Ps. planipora* E. H. = *Ps. gonagra* Klunzinger; (12) *Ps. profundacella* Gardiner; (13) *Ps. samoensis* Hoffmeister; (14) *Ps. superficialis* Gardiner; (15) *Ps. vaughani* Yabe c.s.; (16) *Ps. verrilli* Vaughan.

Psammocora columna Dana is now considered a *Coscinaraea.*

From the sixteen species enumerated above only two are of a widely branching type, viz., *Ps. digitata* E. H. and *Ps. divaricata* Gardiner. The new species described below, *Ps. togianensis,* most resembles *Ps. digitata* but it may be distinguished from it at once by its smaller much more crowded and deeper calices, which moreover show a different structure.

Psammocora contigua (Esper)

For synonyms see Umbgrove, 1939, p. 51.

One specimen (no. 274); the growth type most resembles the specimen figured by Quelch (1886, pl. VI fig. 6) and Mayor (1925, pl. 18 fig. 17 D).

The species is also a common one on the reefs in the bay of Batavia, where it belongs to the "ramosa-facies", lying on the sandy bottom in the very shallow water of the moat. Those specimens most resemble those of Faustino (1927, pl. 70) and Yabe c.s. (1936, pl. XLV fig. 2), as may be seen in Pl. XXIX of my paper on "De Koraalriffen in de Baai van Batavia" (1928).

Psammocora togianensis nov. spec.

(Pl. XXIX fig. 3, Pl. XXX fig. 1 and Pl. XXXI figs 3, 4)

The species is a common one on the Togian reefs (nos. 216, 237, 238, 260, 335 and 347). It belongs to the group of branching *Psammocoras.* The growth-type resembles *Psammocora divaricata* Gardiner and still more *P. digitata* E. H. The branches are elliptical in cross section; in full-grown specimens the diameter amounts up to 55 mm (longer axis) and 35 mm (short axis). The branching seems preferring to take place in one plane coinciding with the longer axis of the diameter of the branches but also some branches perpendicular to that plane may occur. Branches with rounded, often thickened ends. Not seldom a new branch grows downward

forking at an angle of nearly 90° (Pl. XXXI fig. 4). Irregular rounded protuberances occur on the branches. These are caused by a small crustacean which is living in it (Pl. XXIX fig. 3). Surface very rough, due to the fact that the calices are separately sunken in, moreover by the numerous petal shaped septa being bulged and very roughly-granulate. Fossa average over 0.5 mm in diameter. Short elliptical or petal-shaped septa alternating rod shaped ones, which extend up the convex ridge between the calices. The intricate arrangement of the septa and forking septo-costae is shown by Pl. XXX fig. 1 and Pl. XXXI fig. 3. Up to 12 septa reach the center of the calice. Columella well developed but situated rather deep, consisting of a few (two to four) papillae. The structure of the calices most resembles those of *Psammocora exesa* Dana as figured by Gardiner (1905, pl. XCII) and by Yabe (1936, pl. XLIV).

I obtained excellent photographs of the type specimen of *Ps. digitata* E. H. As good figures of that species are desired these are given here (Pl. XXXII figs. 1 and 2). A comparison with the Togian specimens clearly shows that they belong to different species.

Genus **Coscinaraea** Milne Edwards et Haime

I am not following Yabe c.s. in their writing "*Coscinastraea*" because Edwards and Haime (1860, III, p. 203) mentioned that it was "imprimé par erreur" in their publication of 1848. So "*Coscinastraea*" is "lapsus calami", and according to article 19 of the international rules of taxonomy we must write: *Coscinaraea.*

Most of the descriptions of *Coscinaraea* are based on one or few specimens only. Thus, we cannot yet form a good idea of the specific variability of the several characteristics, which have been used as a base to define new "species". When studying the descriptions and figures of *C. columna* Dana = *C. savigniensis* (Gardiner) and *C. monile* (Forskål) = *C. meandrina* E. H. = *C. fossata* (Dana) it seems to me impossible to consider them two different species. Hoffmeister (1925, p. 44) pointed out the same and he remarked: "*C. columna* is very similar to *C. monile* and appears to be a denser edition of it". I feel doubtful about the specific value of the two new species described by Yabe, Sugiyama and Eguchi (1936): *C. hahazimaensis* and *C. kusimotoensis.* The first resembles *C. monile* but has narrower, flat topped collines, and broader septa; the second closely resembles *C. columna* according to Yabe cum suis, but it has shallower valleys, lower collines, edged at their summits and narrower septa separated by wider interspaces.

C. donnani Gardiner (1905) seems different by its having many rounded polygonal calices, which exceptionally show a slightly gyrose arrangement. The collines are very blunt and rounded in that species. In that respect it corresponds to the species mentioned above, which have calices mostly arranged in gyrose valleys.

The species described by me below seems easily to be distinguished from all the species which have been described up to now by its rather sharp edged collines, the great number of septa, and the great length of the valleys. I am sorry to say that I collected one specimen only. To get a well founded idea of the true specific value of the different species of *Coscinaraea* a large suite of specimens should be available.

C. ostreaeformis Van der Horst (1922) is different not only by its shape of growth, but especially by the arrangement of the calices. As there seem to be no collines in that coral I doubt whether it really belongs to the genus *Coscinaraea*. I consider the figures and description of *C. andrewsi* described by Gregory from Christmas island insufficient; without revision of the original fragmentary specimen a comparison with other specimens is impossible.

Coscinaraea acuticarinata nov. spec.

(Pl. XXXIII fig. 1)

The colony (no. 113) has the appearance of a massive growth, but de facto it is encrusting and has grown over some fragments of dead coral. The rim is free, 2 mm thick; below it is a dead growth of the same species. The under surface is covered by an epitheca. The calices are only exceptionally surrounded completely by collines. Mostly they are arranged in series of from 2 to 12 centers; in some sinuous and forking valleys even up to 28 centers can be counted, locally two calices being arranged perpendicular to the axis of the valley. The distance between the calicular centers, which lie in the same valley, varies from 1.5 to 3 mm. The calicular fossa has a diameter of 0.5 mm or less. Septa varying in number. In the individual calices about 60 septa may be counted high up near the summit; about 12 reaching the fossa. Septa thicker than the space between them. The septal faces covered with minute spines; septal edges rough, finely granulated. Calices and valleys deep, nearly 4 to 5 mm. Valleys gyrose and forking, varying in width, from 2 up to 5 mm measured from top to top of the collines. In very wide places of the valleys isolated short collines are present. Collines rather sharp edged, roofshaped, slightly rounded; their summits nowhere reticular in appearance. Columella false, ending in a few papillae; situated deep, but distinct in most calices.

Genus **Coeloseris** Vaughan

Coeloseris mayeri Vaughan

For synonymy see Yabe c.s., 1936, p. 63 and Umbgrove, 1939, p. 53.

I collected from the Togian reefs seven corals (nos. 44, 83, 171, 201, 341, 378 and 429) belonging to this characteristic species. The largest (no. 429) is a massive colony (22 × 16 cm) with an undulating surface.

MADREPORARIA PERFORATA

Family ACROPORIDAE Verrill

Genus **Astreopora** de Blainville

Astreopora myriophthalma (Lamarck)

1918 *Astreopora myriophthalma* (Lam.), Vaughan, p. 146, pl. 60 figs. 5, 5a.
1939 *Astreopora myriophthalma* (Lam.), Umbgrove, p. 53.

Five specimens were collected, nos. 151, 183, 334, 345 and 362. They are all pulvinate colonies the size of which ranges from 65 mm diameter (no. 183) up to 260 mm diameter (no. 151).

Three colonies (nos. 334, 345 and 362) have a rather smooth surface, no prominent calices being present. In no. 183 a few prominent calices occur and such projecting corallites are abundant in no. 151. The structure of the corals is the same as mentioned in the description of the specimen from Batavia.

Genus **Montipora** Quoy et Gaimard

Montipora venosa (Ehrenberg)

1907 *Montipora venosa* (Ehr.), Bedot, p. 274, pl. 46 figs. 260—262; pl. 47, figs. 263-266.
1907 *Montipora venosa*(Ehr.), Von Marenzeller, p. 63, pl. 21 figs. 66—68, pl. 23 figs. 66a—68a.
1918 *Montipora venosa* (Ehr.), Vaughan, p. 153, pl. 19 fig. 46, pl. 63 fig. 3.
1925 *Montipora venosa* (Ehr.), Hoffmeister, p. 50, pl. 6 figs. 2a, 2b.

There are three specimens in my collection. They are rather heavy massive colonies (nos. 94, 132 and 133).

The growth type agrees with the specimen figured by Von Marenzeller in his plate 21 fig. 66. A description of calices and coenenchyma seems unnecessary as they correspond with Bernard's description. I will mention only that the calices are crowded with a diameter of 1—1.25 mm. Six primary septa meeting in the calicular centre alternate with weakly developed secondaries. The calices are usually enclosed by a ring of coenenchyma forming an irregular reticulum. When living the coral was sepia-brown.

Montipora informis Bernard

1897 *Montipora informis,* Bernard, p. 133, pl. 27 fig. 2, pl. 34 fig. 3.
1918 *Montipora informis* Bernard, Vaughan, p. 156, pl. 64 figs. 3—4c.
1930 *Montipora informis* Bernard, Stiasny, p. 46, pl. 4 fig. 5.

I collected seven specimens (nos. 209, 222, 227, 235, 253 and 262). *Montipora hispida* (Dana) and *M. ehrenbergii* Verrill (= *M. tuberosa* Bernard) seem closely allied, but there are no transitional forms among the Togian corals. In all specimens the densely frosted tubercles are closely connected with the septa on the calicular margins. The larger specimen no. 209, is an expanding lamen 220 mm in diameter, with several low and one long protuberances. No. 227 is a lamen of approximately the same size but it shows many high lobate protuberances above the undulate base. Structure of calices and coenenchyma agrees entirely with Vaughan's description of the corals from Cocos-Keeling and is well illustrated in his plate 64 figs. 3, 4b and 4c.

When living the coral had purple calices and a dark brown coenenchyma.

Genus **Acropora** Oken

I collected a large suite of *Acropora*'s on the Togian reefs. Dr. J. Verwey kindly studied the specimens and he will mention the Togian species in a monograph on the genus *Acropora,* which is now nearly ready for publication. 15 different species occur on the Togian reefs.

Dr. Verwey kindly sent me the following preliminary list of species for publication:

1. *Acropora muricata* (L.) = *A. formosa, A branchiata* and *A. gracilis* (Dana). See Wells, 1936, p. 99, nos. 129, 213.
2. *Acropora virgata* (Dana) = *A. pulchra* (Brook), nos. 257, 333, 355.
3. *Acropora grandis* (Brook), no. 359.
4. *Acropora aspera* (Dana) = *A. hebes, A. exigua* and *A. cribripora* (Dana), nos. 277, 320, 353, 457.
5. *Acropora millepora* (Ehrenberg) = *A. prostrata, A. convexa* and *A. subulata* (Dana) = *A. selago* (Studer) = *A. squamosa* (Brook), nos. 149, 441.
6. *Acropora hyacinthus* (Dana) = *A. tenuis* (Dana) = *A. capillaris* (Klunzinger) = *A. dilata, A. kenti, A. bifaria* and *A. patula* (Brook), nos. 219, 243.
7. *Acropora tubigera* (Horn) = *A. aculeus* (Dana) = *A. frondosa* and *A. heterocladus* (Brook), no. 256.
8. *Acropora gravida* (Dana), nos. 142, 143, 161.

9. *Acropora acervata* (Dana) = *A. gemmifera, A. fructicera* and *A. spectabilis* (Brook), nos. 26, 27, 128, 186, 191, 239, 255, 356, 358.
10. *Acropora palifera* (Lamarck), nos. 22, 88, 318, 434, 465, 471.
11. *Acropora echidnaea* (Ehrenberg) = *A. procumbens* (Brook) or *Acropora echinata* (Dana), nos. 16, 87, 90, 123.
12. *Acropora* belonging to the group of *A. polymorpha* (Brook) or *A. exilis* (Brook), nos. 58, 67, 78, 79, 114, 127, 325.
13. *Acropora haimei* (M. Edwards et Haime) ?, nos. 93, 105, 121, 192, 193, 248, 254, 299?, 382).
14. *Acropora nasuta* (Dana) = *A. variabilis* (Klunzinger), nos. 16, 17 ?, 18, 19 ?, 20 ?, 140 ?, 148, 188, 261 ?, 349, 351, 352 ?, 353, 439.
15. *Acropora* spec., no. 92.

I must emphasize the preliminary character of the list; this applies especially to the species 8 to 15.

Family PORITIDAE Dana

Genus **Goniopora** Quoy et Gaimard

Goniopora tenuidens (Quelch)

For synonyms see Umbgrove, 1939, p. 56.

Excellent types, agreeing with the description and figures of Vaughan's specimens from Murray island are labelled nos. 85, 104 and 247. When living the corals had a light yellowish green colour, exceptionally dark green.

Genus **Porites** Link

Porites viridis Gardiner

1918 *Porites viridis* Gardiner, Vaughan, p. 200, pl. 89 figs. 1, 1a, 1b (with synonymy).
1918 *Porites mayeri,* Vaughan, p. 196, plate 86 figs. 1, 1a, 1b; pl. 13, figs. 9—11 (with synonymy).

I have 8 specimens which show transitions between *Porites viridis* and *P. mayeri* (nos. 62, 70, 77, 245, 252, 360, 428, 472). In one part of a colony the radial structures of the reticulum may be greater developed than the horizontal ones, in a different part of the same coral the horizontal structures may be more conspicuous. These seem moreover always predominant in the deeper layers of the reticulum as is obvious when the surface is damaged. In some calices a membranous wall is present, usually no such wall is visible.

The structure of septa, pali, columella and reticulum, is so well described and figured by Vaughan that no new description is given here.

The shape of the specimens shows a good deal of variation from short low rounded lobes to very irregular masses with ridges and gibbosities, the dimensions varying from 50 tot 150 mm diam. All specimens have an incrusting base.

Porites nigrescens Dana

(Pl. XXXIV fig. 1)

1918 *Porites nigrescens* Dana, Vaughan, p. 205, pl. 91 figs. 3, 3a; pl. 92 figs. 1, 1a, 1b, 2, 2a (with synonyms).
1927 *Porites nigrescens* Dana, Faustino, p. 290, pl. 94 figs. 4, 5; pl. 97 fig. 1.
1930 *Porites nigrescens* Dana, Stiasny, p. 29.

No. 440 is an excellent colony belonging to this species. Part of the coral is figured on Plate XXXIV to show the growth type. The specimen has a larger diameter of 270 mm. The structure of calices agrees with Vaughan's description of Dana's type, which is entirely applicable to the present specimen.

No. 35 agrees with the variety from Cocos-Keeling described and figured by Vaughan in his plate 92 figs. 2, 2a.

Cross sections through the branches of both specimens show the concentric structural elements predominating over the radial ones. Moreover cross sections nearly allways show median partly concentric irregular openings, apparently caused by boring animals.

Porites nigrescens Dana var. **togianensis** nov. var.

(Pl. XXXIII fig. 2 and Pl. XXXIV fig. 2)

A suite of 6 specimens seem closely allied to *P. nigrescens,* but differ from it by the growth-type. It does not form such close tufts as *P. nigrescens* but the branches are thicker, wider apart and with irregularly thickened blunt knots which may be caused by the overgrowing of small barnacles. The branches have a diameter of 20 up to 40 mm at the base; the tips are usually sharp, occasionally blunt. The growth type is well illustrated by plate XXXIV fig. 2, while the structure of the calices is shown by plate XXXIII fig. 2. Distance between thecal summits 2 mm; diameter of calicular openings 1 mm or slightly more. The calices are more excavated at the top than at the base of the coral.

The specimen figured is no. 52. The other specimens bear the numbers: 36, 59, 74, 177 and 198.

Porites capricornis Rehberg

(Pl. XXXIII fig. 3 and Pl. XXXV fig. 1)

1893 *Porites capricornis,* Rehberg, Abhandl. Naturwiss. Hamburg, vol. XII, p. 46, pl. 3 fig. 7.
1905 *Porites* Pelew Islands, Bernard, p. 93.

Three specimens from Togian, nos. 164, 232 and 244, undoubtedly belong to the species *capricornis* described by Rehberg. The following is a short description of the specimens.

Corallum forms long tapering, occasionally branching and fusing branches. Not seldom the branches are curved in the shape of a "capricorn". Basal parts of branches thick, up to 50 mm in no. 164 (Rehberg mentions 60 mm). The tips are mostly blunt, exceptionally sharp. The polygonal calices are superficial. The walls are seldom formed by more than one row of vertical structures. If a reticulum is present it is formed by vertical (radial) structures. Diameter of calices 1 to 1.5 mm. Septa usually 12 in number, arranged regularly; interseptal loculi narrow; pali slender, 8—11 in number. A small axial columellar tubercle always present.

Porites eridani nov. spec.

(Pl. XXXIII fig. 4 and Pl. XXXV fig. 2)

1905 *Porites* N.W. Australia 8, Bernard, p. 157, pl. 23 fig. 9; pl. 35 fig. 5.

Bernard who described this species in detail has not given it a species name. The species is, however, very characteristic and may be easily recognized. The most salient characters are: (1) growth shape explanate and encrusting with thin sharp edges, (2) small mammillate processes and branches rising from the undulate upper surface, (3) small calices with very deep fossa, (4) short and thick septa, (5) a conspicuous ring of five principal frosted pali, (6) central columellar tubercle absent, (7) the concentrically striated lower surface of the corallum.

I collected 3 specimens, nos. 303, 306 and 364. No. 303 is a small specimen of 85 mm diameter. The other specimens are large and show not only the mammillate processes mentioned and figured by Bernard but even branches rising from the surface. I have figured no. 364 which is a non-macerated specimen, consisting of three colonies, to show the growth type. Bernard has well illustrated the calicular structure on the undulate upper surface. In plate XXXIII fig. 4 I am adding a picture of the calices from a branch. On the branches the calices are more crowded and have a slightly larger diameter.

Porites species diversae

On account of the great difficulties connected with the study of this genus I refrain from identifying a suite of *Porites* from Togian. Most of them are of the massive noduliform type (nos. 73, 100, 170, 173, 205, 234, 249, 265, 436) and there are also two branching specimens, 130 and 165, which seem close to *P. nigrescens*.

BIBLIOGRAPHY

The following list contains the titles of papers which are repeatedly referred to in the descriptions and lists of synonyms. No full list is given of all publications that were constantly used in the preparation of this publication.

BEDOT, M., 1907. Madréporaires d'Amboine. Revue Suisse de Zool., vol. 15.

BERNARD, H. M., 1897. The genus Montipora, the genus Anacropora. Catal. Madrep. corals in the British Museum, vol. 3.

——, 1905. Porites of the Indo-Pacific region. Catal. Madrep. corals in the British Museum (Nat. Hist.), vol. 5.

BOSCHMA, H., 1925. Fungiidae. Papers from Dr. Th. Mortensen's Pacific Expedition, no. 28. Vidensk. Medd. Dansk naturh. Foren., vol. 79.

——, 1929. The Fungidae collected by Mr. Cyril Crossland at Tahiti and neighbouring islands. Proc. Zool. Soc. London, 1929.

CROSSLAND, C., 1935. Coral faunas of the Red Sea and Tahiti. Proc. Zool. Soc. London.

DANA, J. D., 1846. Zoophytes. United States Exploring Expedition, vol. 7, atlas.

DÖDERLEIN, L., 1902. Die Korallengattung Fungia. Alhandl. Senckenbergische naturforsch. Gesellsch., vol. 27.

EDWARDS, H. MILNE et HAIME, J., 1848. Monographie des Astreides etc. Annal. Sci. Nat. (3), Zool., vol. 10; 1849, vol. 12; 1850, vol. 13; 1851, vol. 15.

——. 1857—1860. Histoire naturelle des coralliaires, vols. 1—3.

ELLIS, J. and SOLANDER, D., 1786. The natural history of many curious and uncommon zoophytes, etc.

FAUSTINO, L. A., 1927. Recent Madreporaria of the Philippine Islands. Monograph 22 of the Bureau of Science, Manila.

GARDINER, J. STANLEY, 1897. On some collections of corals of the family Pocilloporidae from the S.W. Pacific Ocean. Proc. Zool. Soc. London.

——, 1898. On the Fungid corals collected by the author in the South Pacific. Proc. Zool. Soc. London, 1898.

——, On the astraeid corals collected by the author in the South Pacific. Proc. Zool. Soc. London, 1899.

——, 1904. Madreporaria, Astreidae. Fauna and Geogr. Maldive and Laccadive Archipelagoes, vol. 2.

——, 1905. Madreporaria, Fungida, Turbinolida. Ibidem, vol. 2, supplement 1.

HOFFMEISTER, J. E., 1925. Some corals from American Samoa and the Fiji Islands. Papers from the department of Marine Biology of the Carnegie Institution of Washington, vol. 22.

HORST, C. J. VAN DER, 1921. The Madreporaria of the Siboga Expedition, part. 2, Madreporaria Fungida. Siboga Exp., monograph XVIb.

——, 1922. Madreporaria Agariciidae. Trans. Linn. Soc. London (2), Zoology, vol. 18.

KLUNZINGER, C. B., 1879. Die Korallenthiere des Rothen Meeres.

MARENZELLER, E. VON, 1906. Riffkorallen. Denkschr. K. K. Akad. Wissensch. Wien, Math. Naturwiss. Kl., vol. 80.

MATTHAI, G, 1914. A revision of the recent colonial Astraeidae possessing distinct corallites. Trans. Linn. Soc. London (2), Zool., vol. 17.
——, 1928. A Monograph of the recent Maeandroid Astreida. Catal. Madrep. corals in the British Museum, vol. 7.
MAYOR, A. G., 1925. Growth rate of Samoan corals. Carnegie Institution, Publication no. 240.
QUELCH, J. J., 1886. Reef Corals. Challenger Reports, Zool., vol. 16.
REHBERG, H., 1892. Neue und wenig bekannte Korallen. Abh. Naturwiss. Verein. Hamburg, vol. 12.
STIASNY, G., 1930. Die Madreporaria des Naturhistorischen Reichs-Museums in Leiden. I. Porites, Goniopora, Alveopora, Montipora. Zool. Meded., vol. 13.
THIEL, M. E., 1932. Madreporaria. Mém. Musée Royal d'Hist. Nat. Belgique, hors série, vol. 2, fasc. 12.
UMBGROVE, J. H. F., 1939. Madreporaria form the bay of Batavia. Zool. Meded., vol. 22.
VAUGHAN, T. WAYLAND, 1907. Recent Madreporaria of the Hawaiian Islands and Laysan. U. S. Nat. Mus., Bull. 59.
——, 1918. Some shoal-water corals from Murray Island, Cocos-Keeling Islands and Fanning Island. Papers from the Department of Marine Biology Carnegie Institution Washington, vol. 9.
VERRILL, A. E., 1865—1869. Corals and polyps of the N. Pacific Exploring Expedition. Proc. Essex Inst., vols. 4—6.
WELLS, J. W. 1936. Nomenclature and Type Species of Some Genera of Recent and Fossil Corals. Americ. Journ. Sci., vol. 31.
——, 1936. The Madreporarian Genus Polyastra Ehrenberg. Ann. Mag. Nat. Hist. (10), vol. 18.
——, 1937. New Genera of Mesozoic and Cenozoic Corals. Journal of Paleontology, vol. 11.
YABE, H., SUGIYAMA, I. and EGUCHI, M. 1936. Recent Reef Building Corals from Japan and the S. Sea Islands under the Japanese Mandate. Sci. Rep. Tohoku Imp. University (2), Special Volume 1.

EXPLANATION OF THE PLATES

Plate XXI

Fig. 1. *Seriatopora hystrix* Dana, no. 215, × 5/4.
Fig. 2. *Seriatopora hystrix* Dana, no. 14, × 5/4.
Fig. 3. *Pocillopora eydouxi* Milne Edwards, no. 118, × 1.
Fig. 4. *Pocillopora eydouxi* Milne Edwards, no. 152, × 1/2.
Figs. 5, 6. *Seriatopora hystrix* (Dana), no. 156, × 1.4.
Fig. 7. *Acrohelia horrescens* (Dana), no. 430, × 1.
Fig. 8. *Pocillopora eydouxi* Milne Edwards, no. 118, × 1.

Plate XXII

Figs. 1, 2. *Physogyra astraeiformis* nov. spec., no. 155, × 1.
Fig. 3. *Orbicella curta* Dana, no. 172, × 2.
Fig. 4. *Favia matthai* Vaughan, no. 445, × 2.
Fig. 5. *Favia matthai* Vaughan, no. 278, × 2.

Plate XXIII

Fig. 1. *Favia eridani* nov. spec., no. 433, × 2.
Fig. 2. *Favia eridani* nov. spec., no. 433, × 3/4.
Fig. 3. *Favia favosa* (Ellis et Solander), no. 270, × 2.
Figs. 4, 6. *Goniastrea pectinata* (Ehrenberg), no. 96; fig. 4 × 2, fig. 6 × 5.
Fig. 5. *Favites* cf. *spectabilis* (Verrill), no. 250, × 2.

Plate XXIV

Fig. 1. *Coeloria astraeiformis* (E.H.), no. 141, × 2.
Fig. 2. *Coeloria astraeiformis* (E.H.), no. 339, × 2.
Fig. 3. *Coeloria astraeiformis* (E.H.), no. 470, × 2.
Fig. 4. *Coeloria rustica* (Dana), no. 23, × 2.
Fig. 5. *Coeloria rustica* (Dana), no. 225, × 2.
Fig. 6. *Favites halicora* (Ehrenberg), no. 184, × 2.
Fig. 7. *Favites halicora* (Ehrenberg), no. 106, × 2.
Fig. 8. *Acanthastraea hemprichii* (Ehrenberg), no. 220, × 2.

Plate XXV

Fig. 1. *Hydnophora rigida* (Dana), no. 279, × 1/2.
Fig. 2. *Hydnophora tenella* Quelch var. *applanata* nov., no. 102, × 2.
Fig. 3. *Merulina scabricula* Dana, no. 365, × 3/2.

Plate XXVI

Figs. 1—3. *Merulina togianensis* nov. spec.; fig. 1, no. 138, × 1; fig. 2, no. 138, × 2; fig. 3, no. 91, × 1.

Plate XXVII

Fig. 1. *Symphyllia recta* (Dana) grade *S. agaricia* E.H., no. 310, × 3/2.
Fig. 2. *Halomitra robusta* (Quelch), no. 182, × 5/4.
Fig. 3. *Symphyllia recta* (Dana) grade *S. valenciennesii* (E.H.), no. 343, × 1.
Figs. 4, 5. *Fungia repanda* Dana, no. 460, × 5/4; fig. 4, oral surface; fig. 5, aboral surface.
Fig. 6. *Merulina scabricula* Dana, no. 366, × 1/2.

Plate XXVIII

Fig. 1. *Mycedium elephantotus* (Pallas), no. 196, × 9/10.
Figs. 2, 3. *Tridacophyllia lactuca* (Pallas), no. 272, × 3/4; fig. 2, oral surface; fig. 3, aboral surface.

Plate XXIX

Figs. 1, 2. *Fungia scutaria* Lam., no. 294, × 1; fig. 1, oral surface; fig. 2, aboral surface.

Fig. 3. *Psammocora togianensis* nov. spec., no. 238a, × 3.

Fig. 4. *Pavona divaricata* Lam., no. 231, × 1.

Fig. 5. *Pavona divaricata* Lam., no. 435, × 3/2.

Plate XXX

Fig. 1. *Psammocora togianensis* nov. spec., no. 238, × 5.

Figs. 2, 3. *Pavona frondifera* Lam., no. 438, × 1.

Fig. 4. *Pavona frondifera* Lam., no. 456, × 1.

Fig. 5. *Pavona decussata* Dana, no. 223, × 3/4.

Plate XXXI

Figs. 1, 2. *Pavona obtusata* (Quelch), × 3.5; fig. 1, no. 298; fig. 2, no. 207.

Figs. 3, 4. *Psammocora togianensis* nov. spec.; fig. 3, no. 347a, × 5; fig. 4, no. 238, × 7/8.

Plate XXXII

Figs. 1, 2. *Psammocora digitata* E.H., type in the Paris Museum; fig. 1, × 5; fig. 2, × 1.

Plate XXXIII

Fig. 1. *Coscinaraea acuticarinata* nov. spec., no. 113, × 4.

Fig. 2. *Porites nigrescens* Dana var. *togianensis* nov., no. 52, × 8.

Fig. 3. *Porites capricornis* Rehberg, no. 164, × 8.

Fig. 4. *Porites eridani* nov. spec., no. 364, × 8.

Plate XXXIV

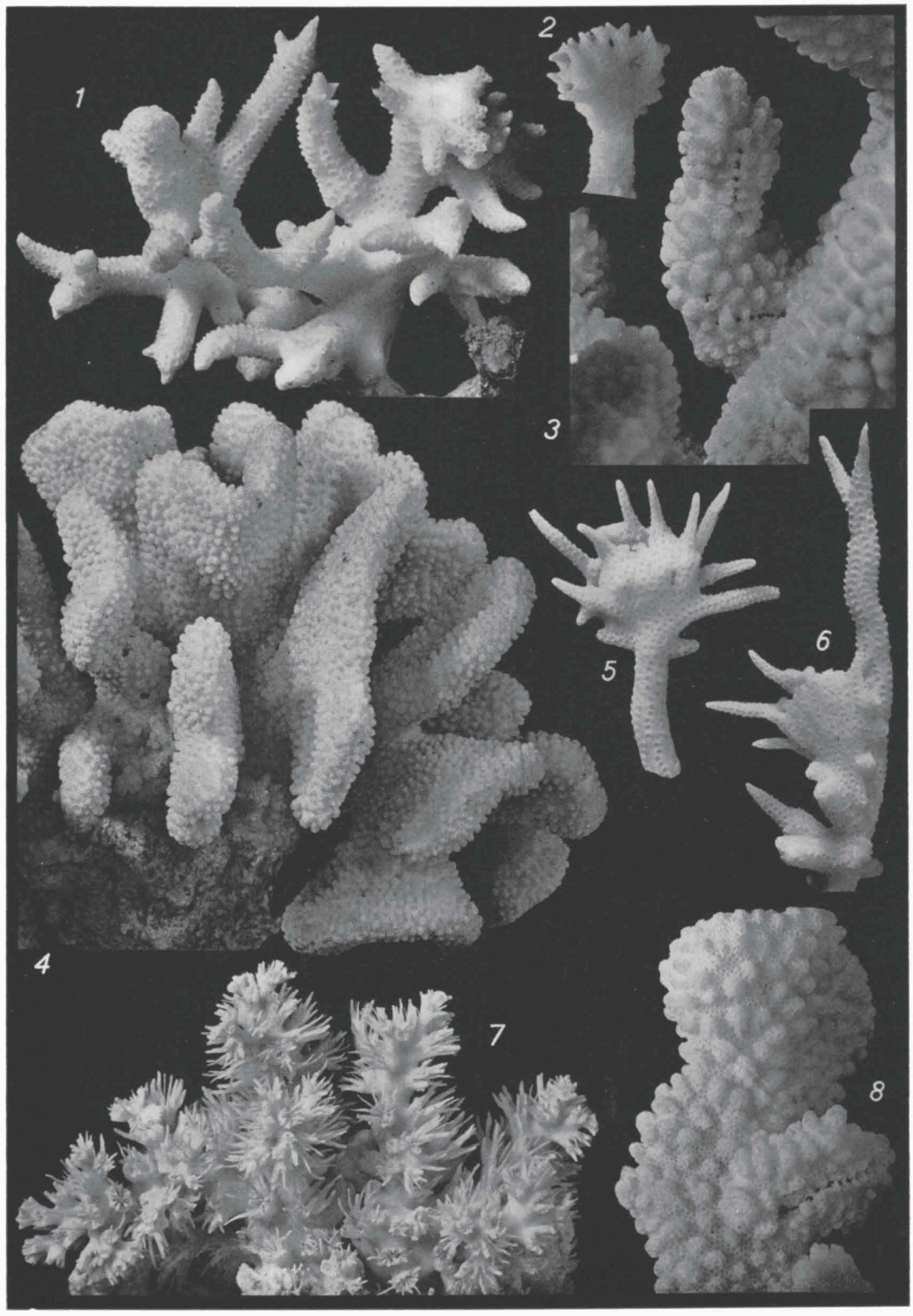
Fig. 1. *Porites nigrescens* Dana, no. 440, × 3/5.

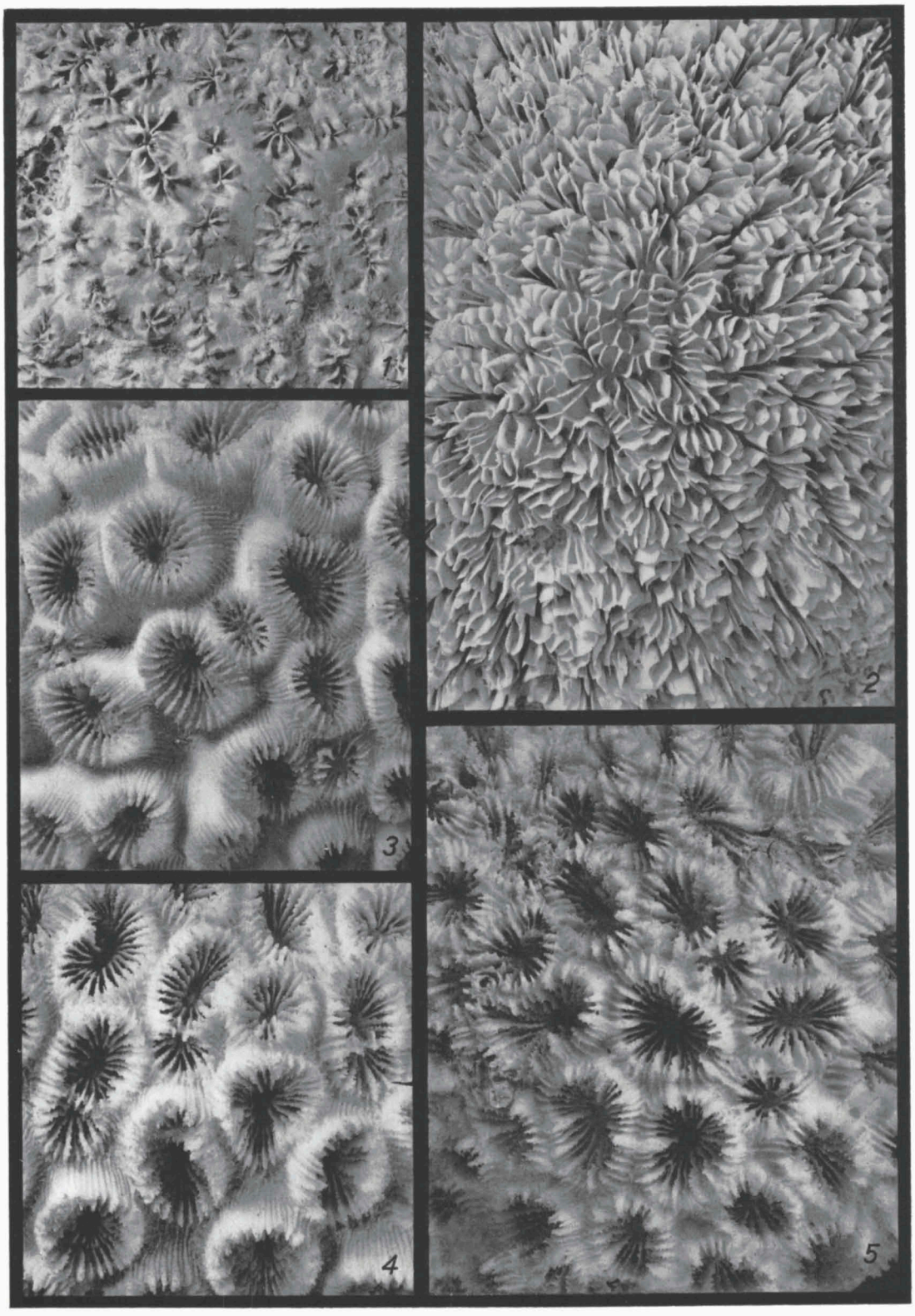
Fig. 2. *Porites nigrescens* Dana, var. *togianensis* nov., no. 52, × 2/3.

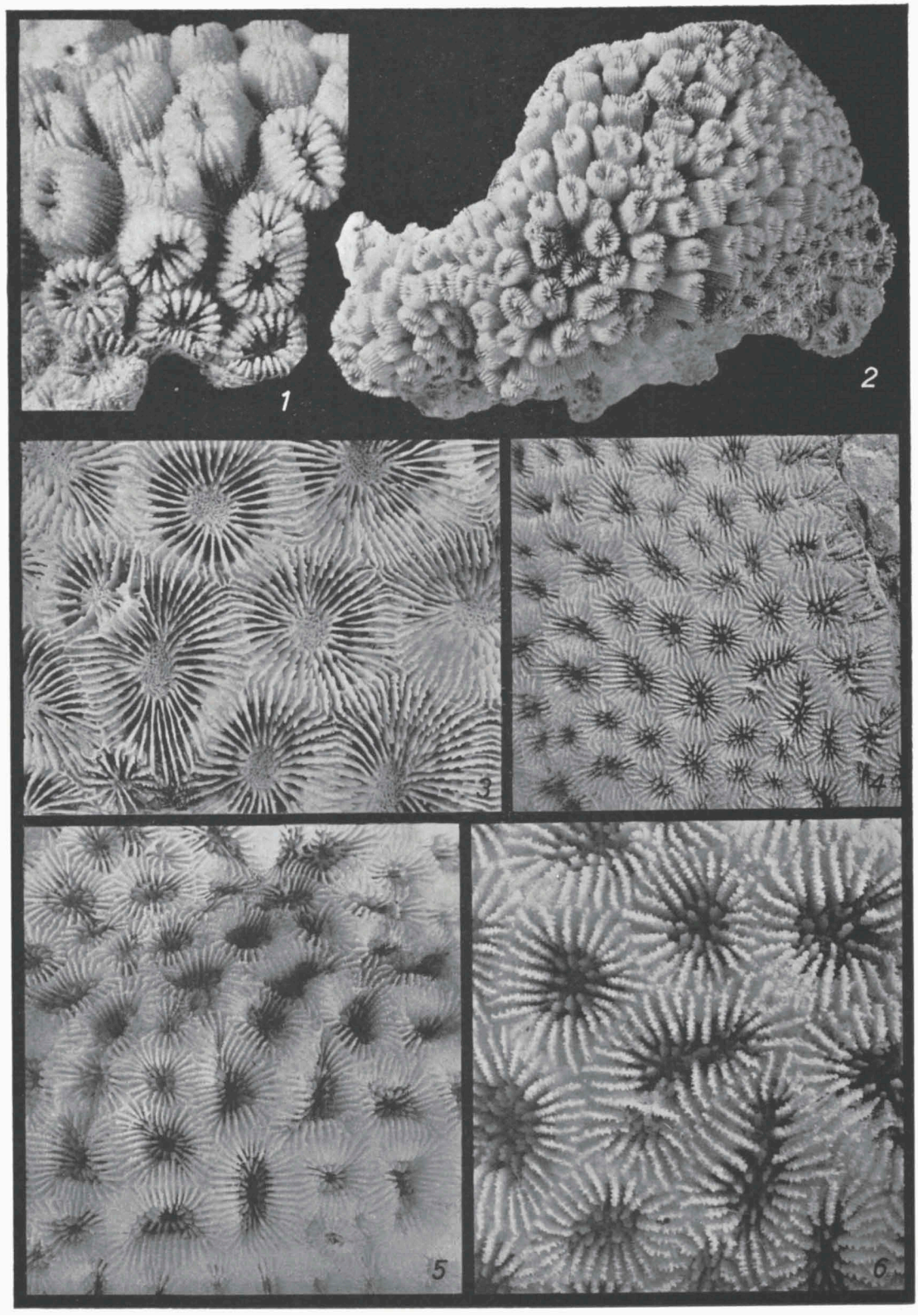
Plate XXXV

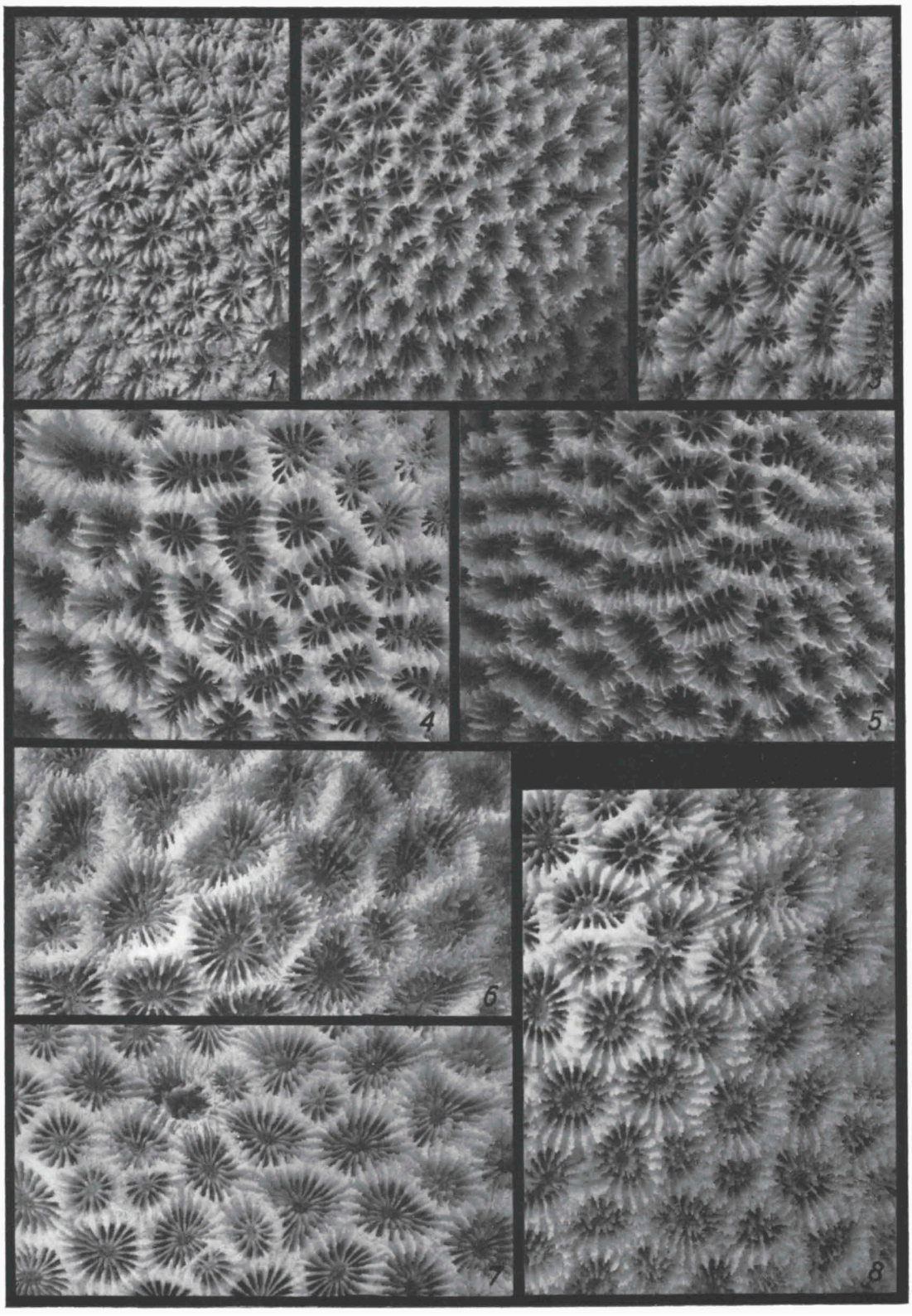
Fig. 1. *Porites capricornis* Rehberg, no. 164, × 1/2.

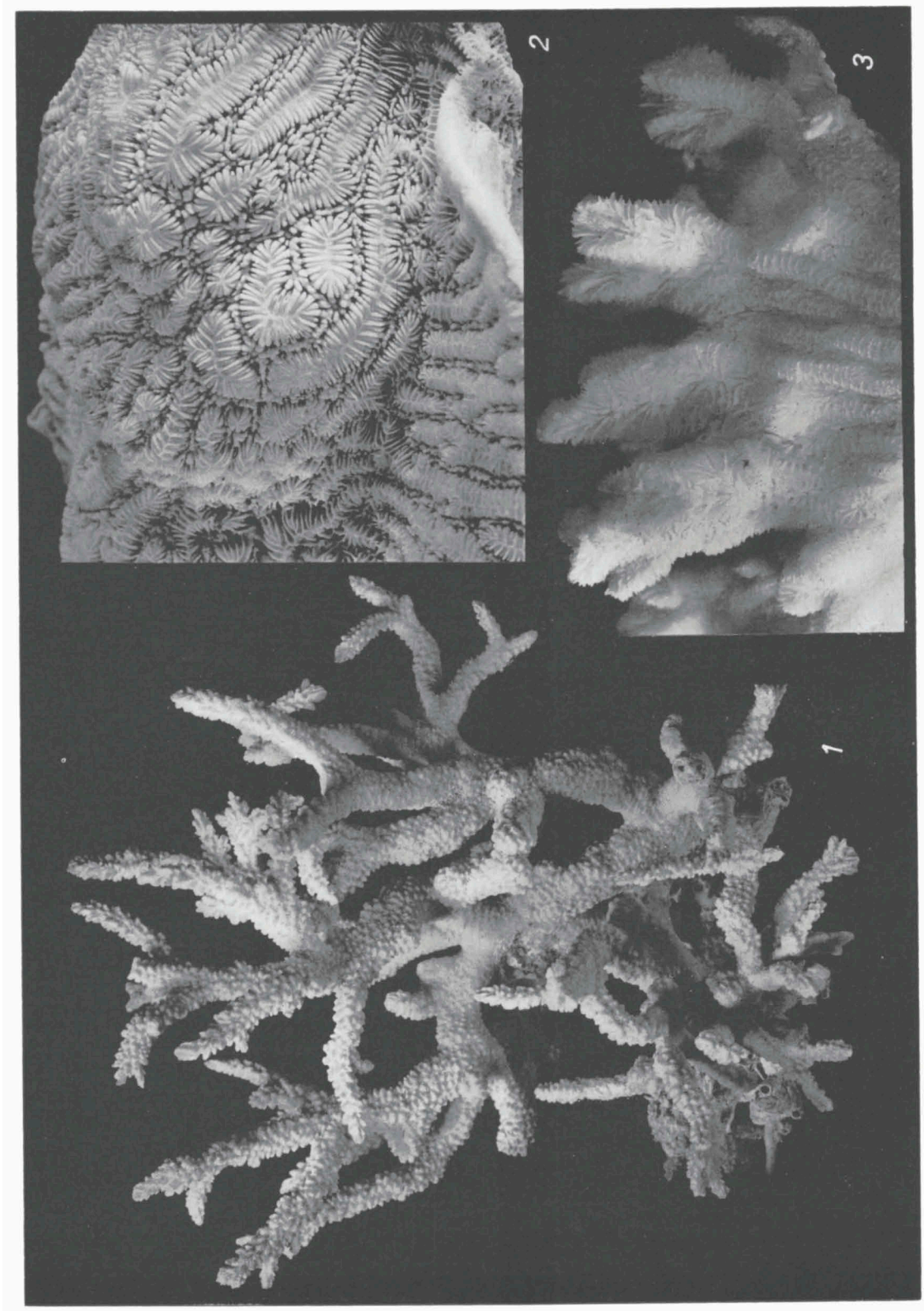
Fig. 2. *Porites eridani* nov. spec., no. 364, × 1/2.

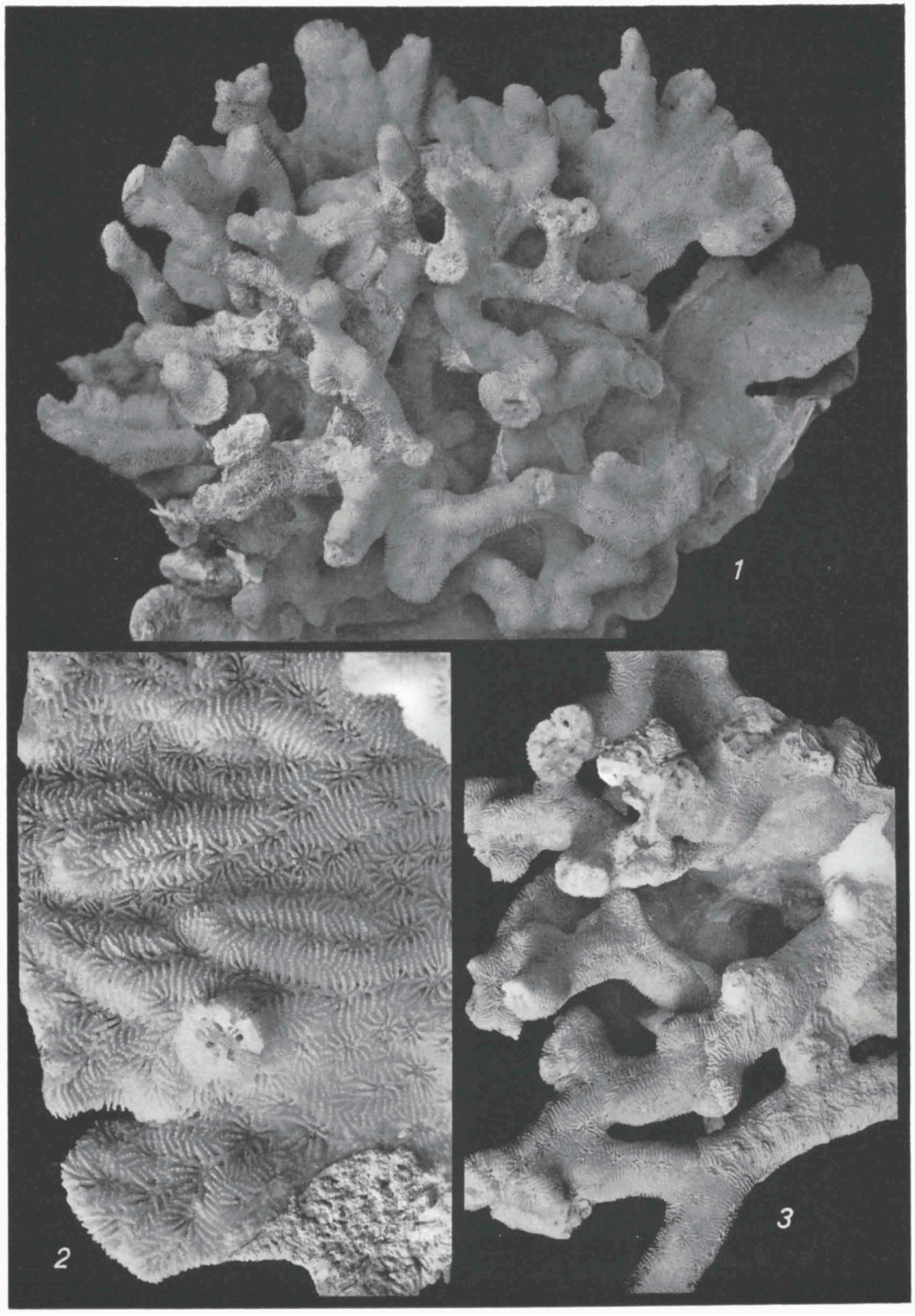

1
2
3
4
5
6
7
8

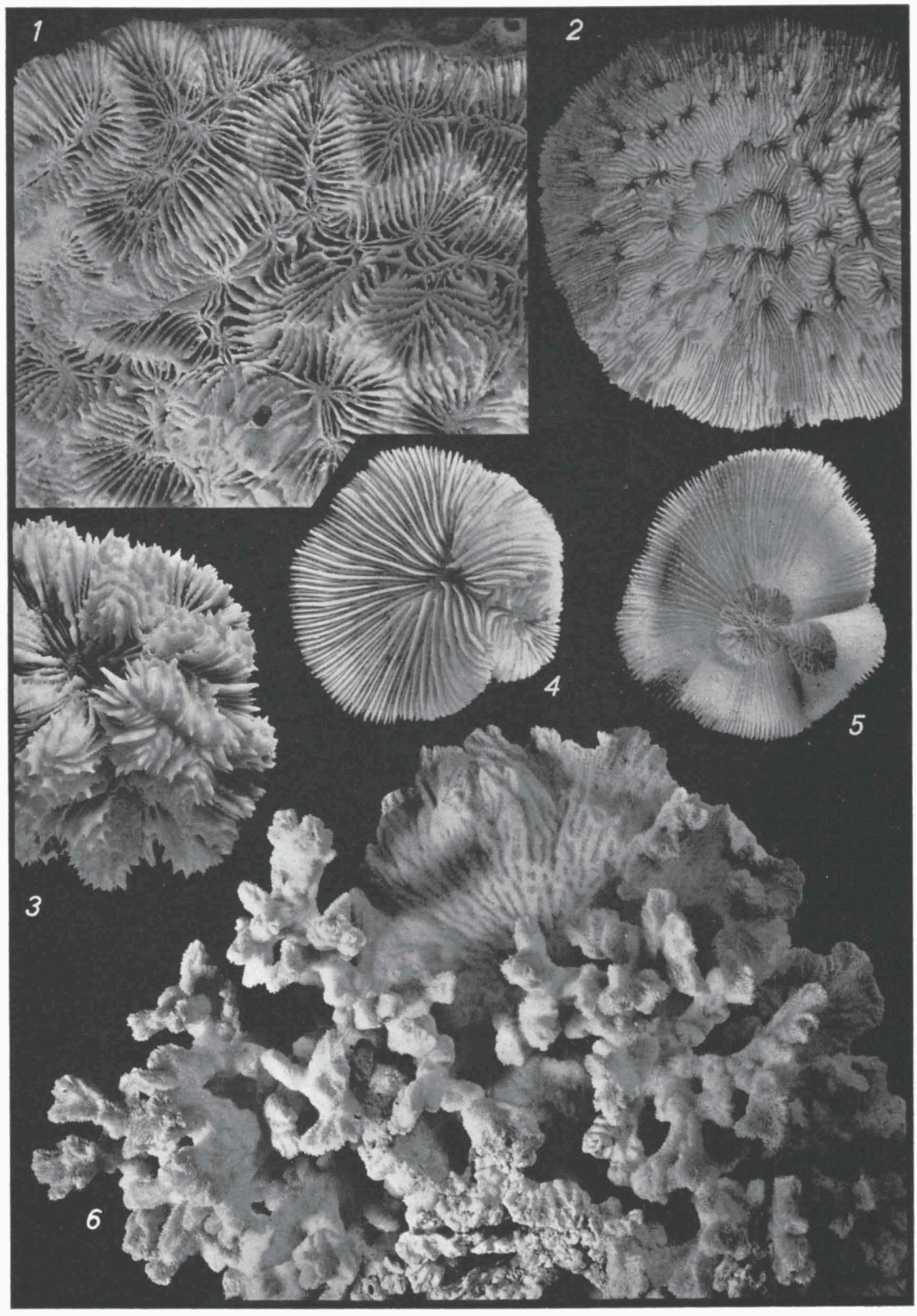

1
2
3
4
5

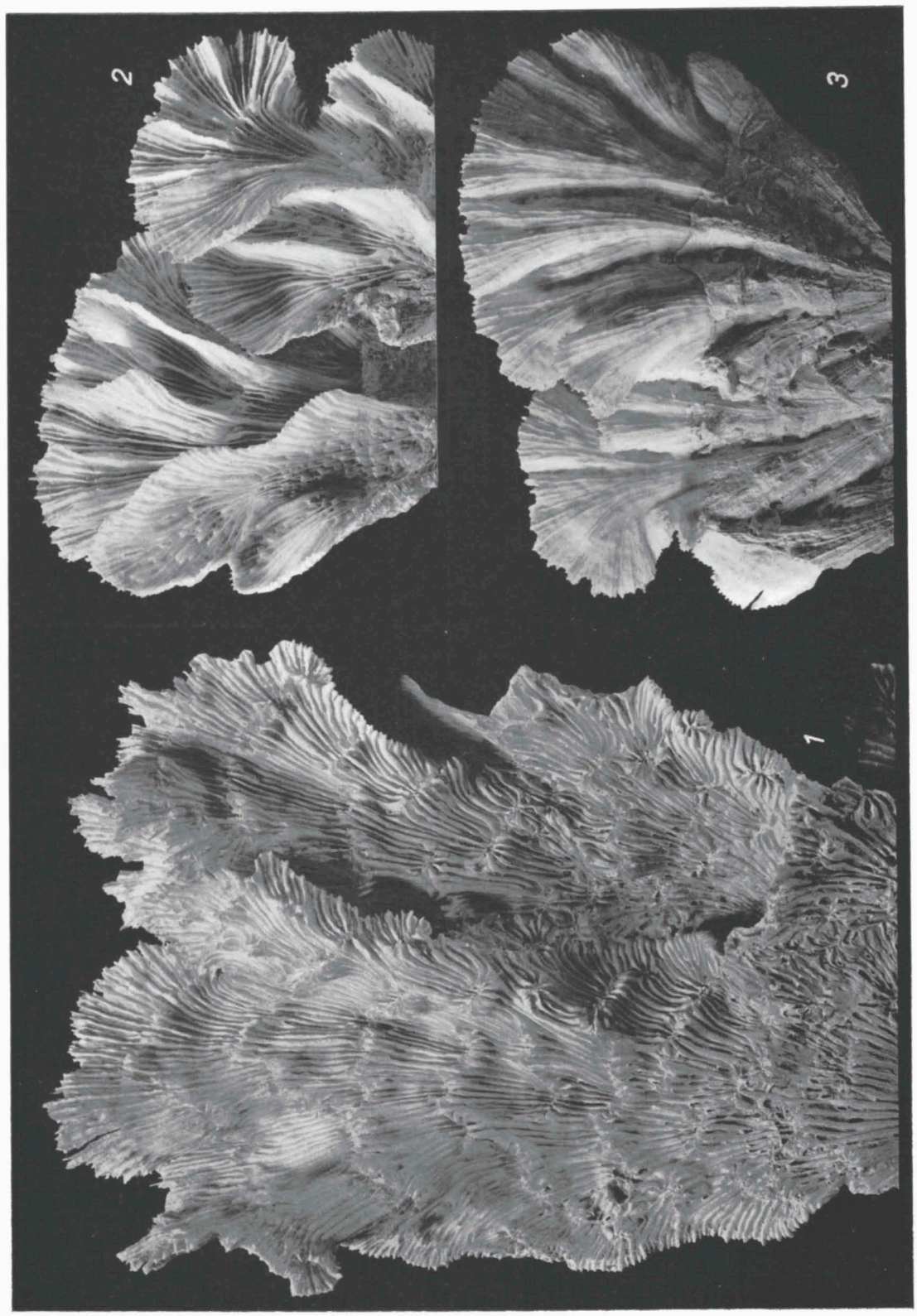

1
2
3
4
5
6

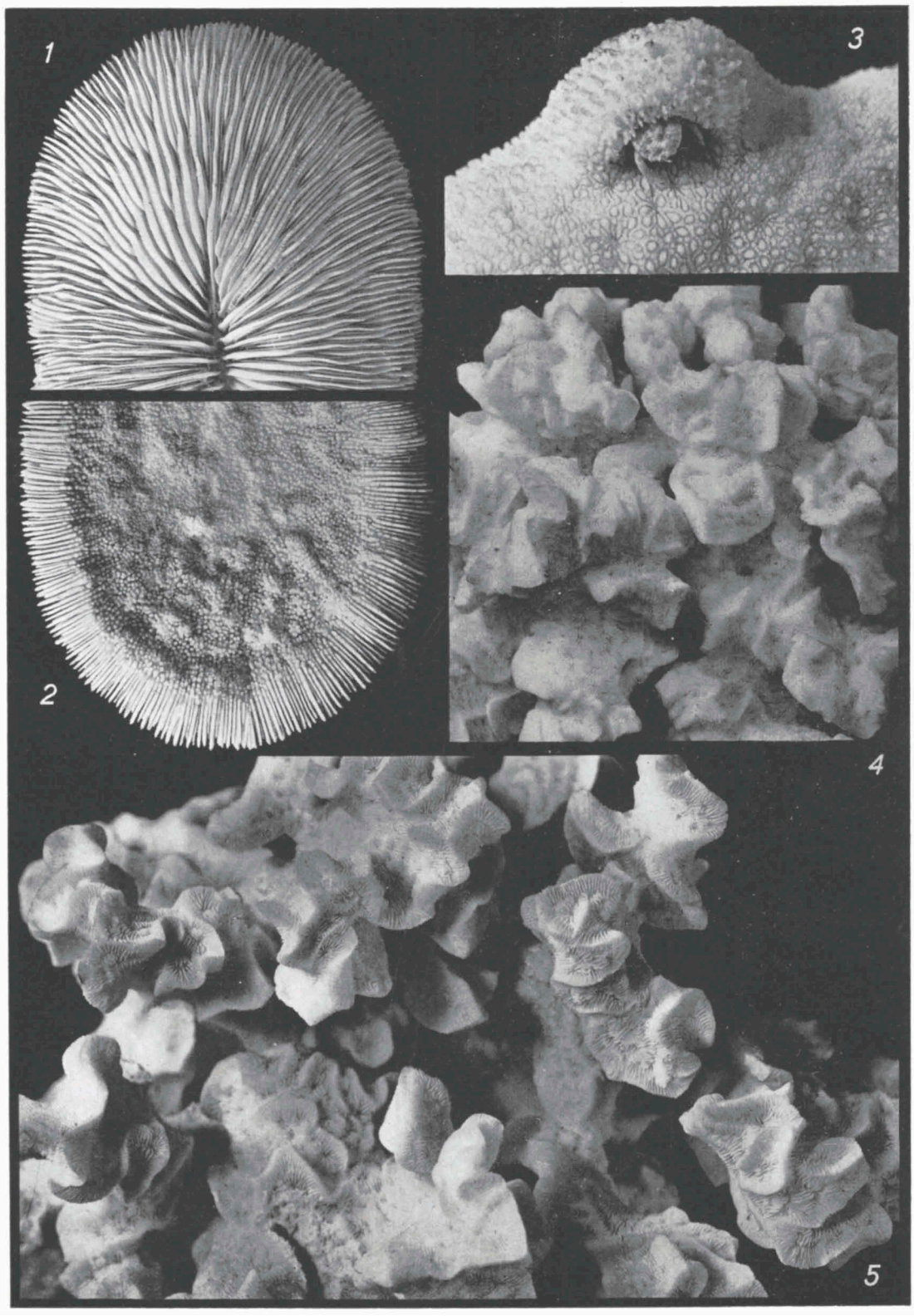

1
2
3
4
5
6
7
8

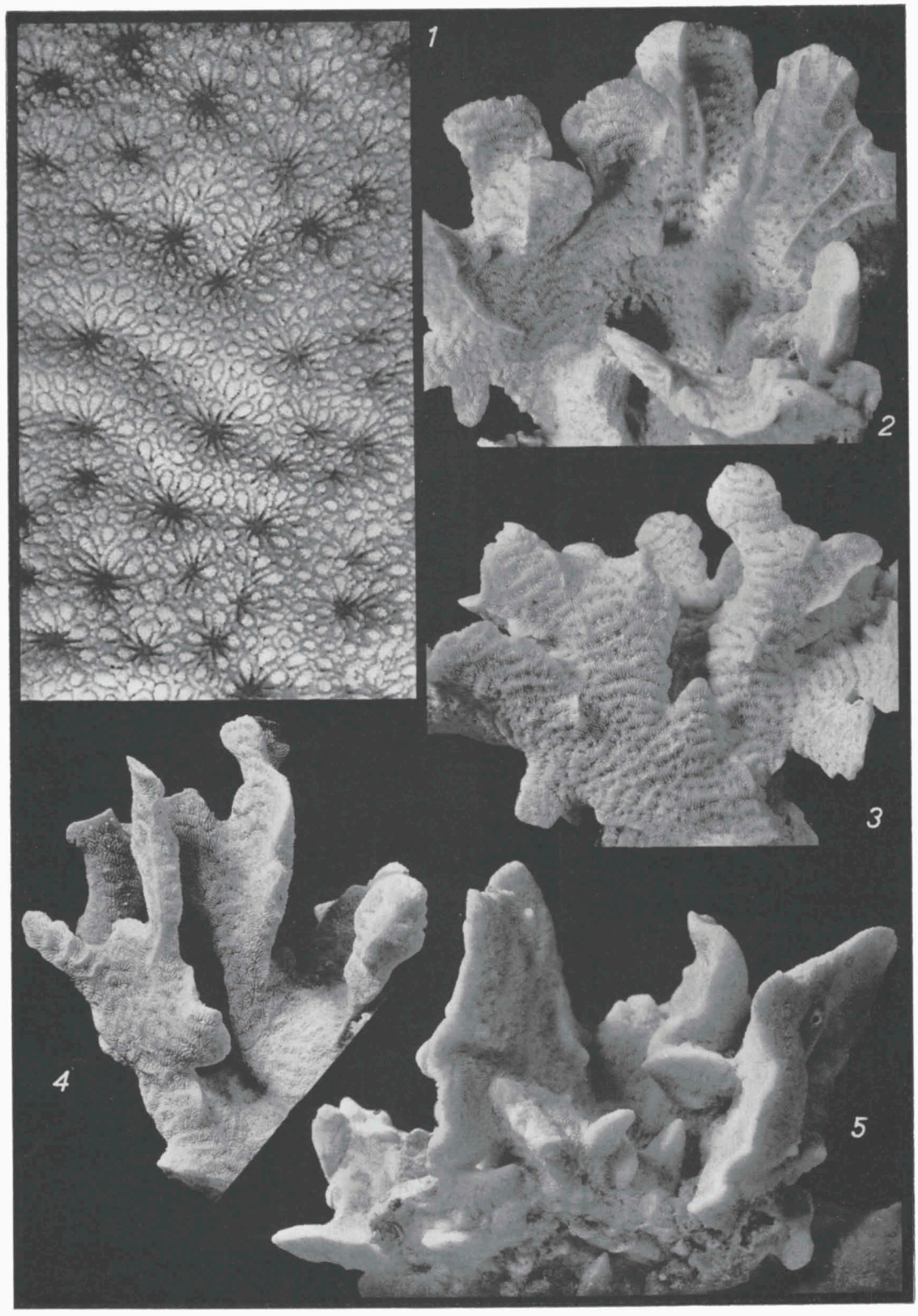

2
3
1

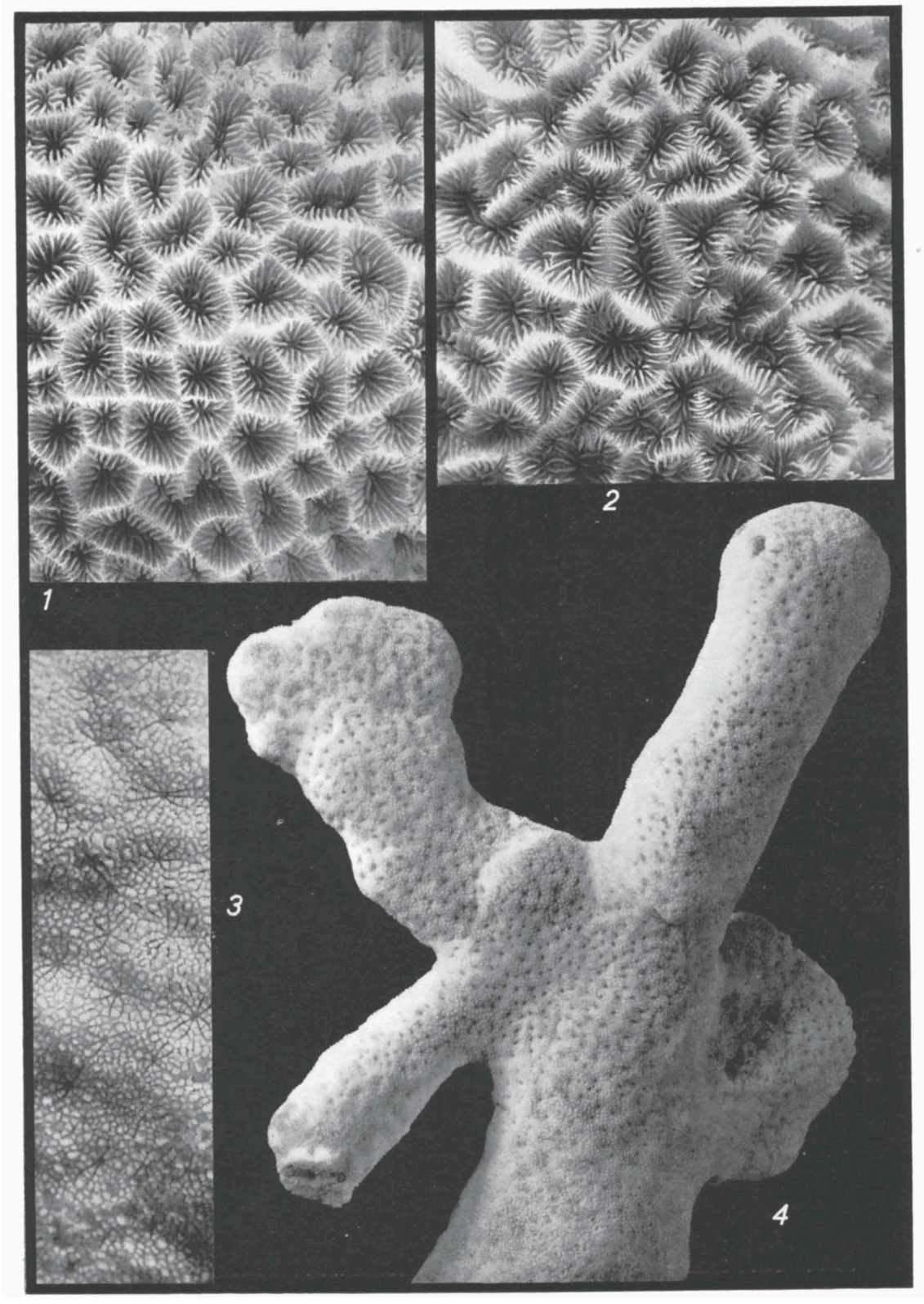

1
2
3

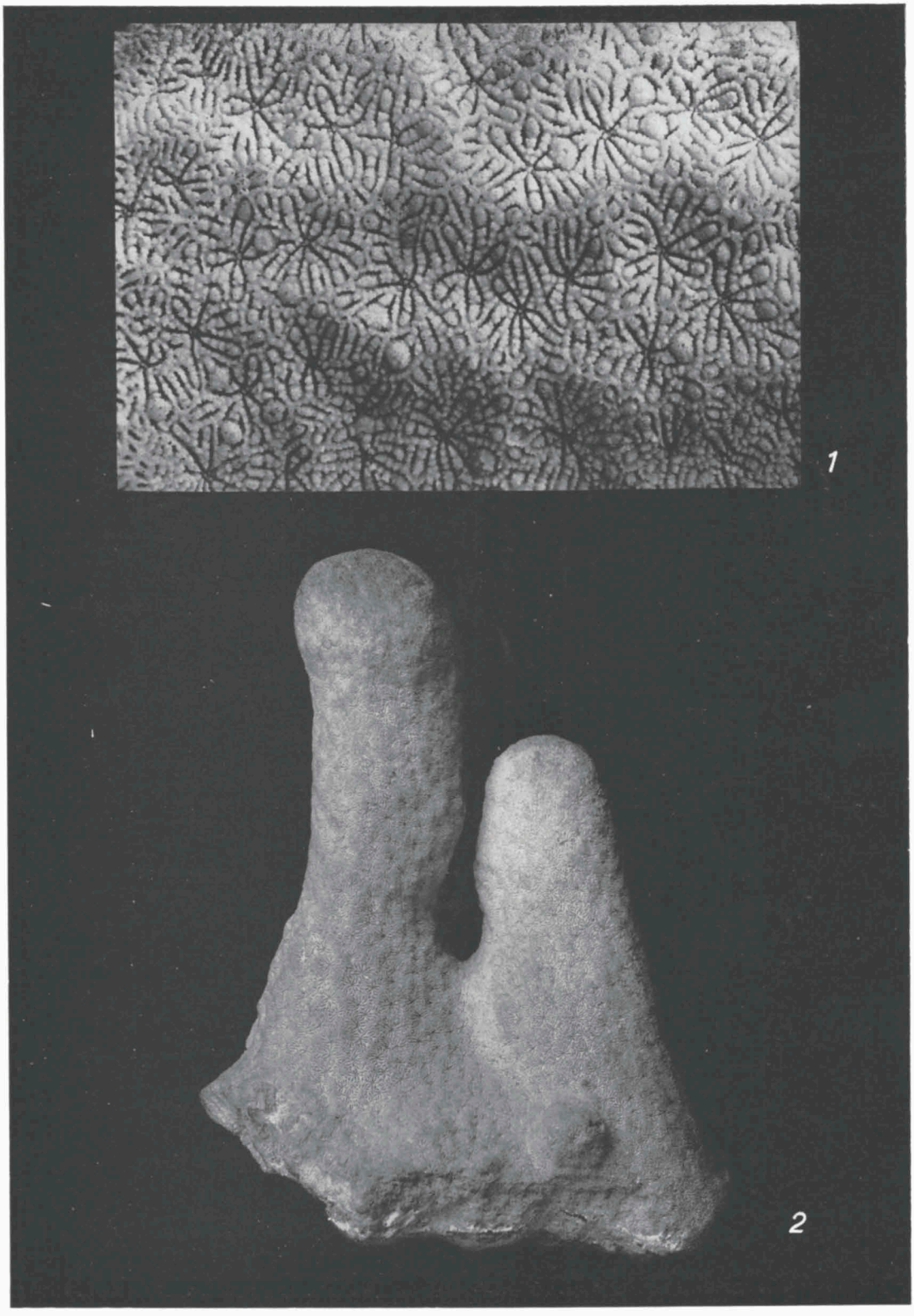

1
2
3
4
5
6

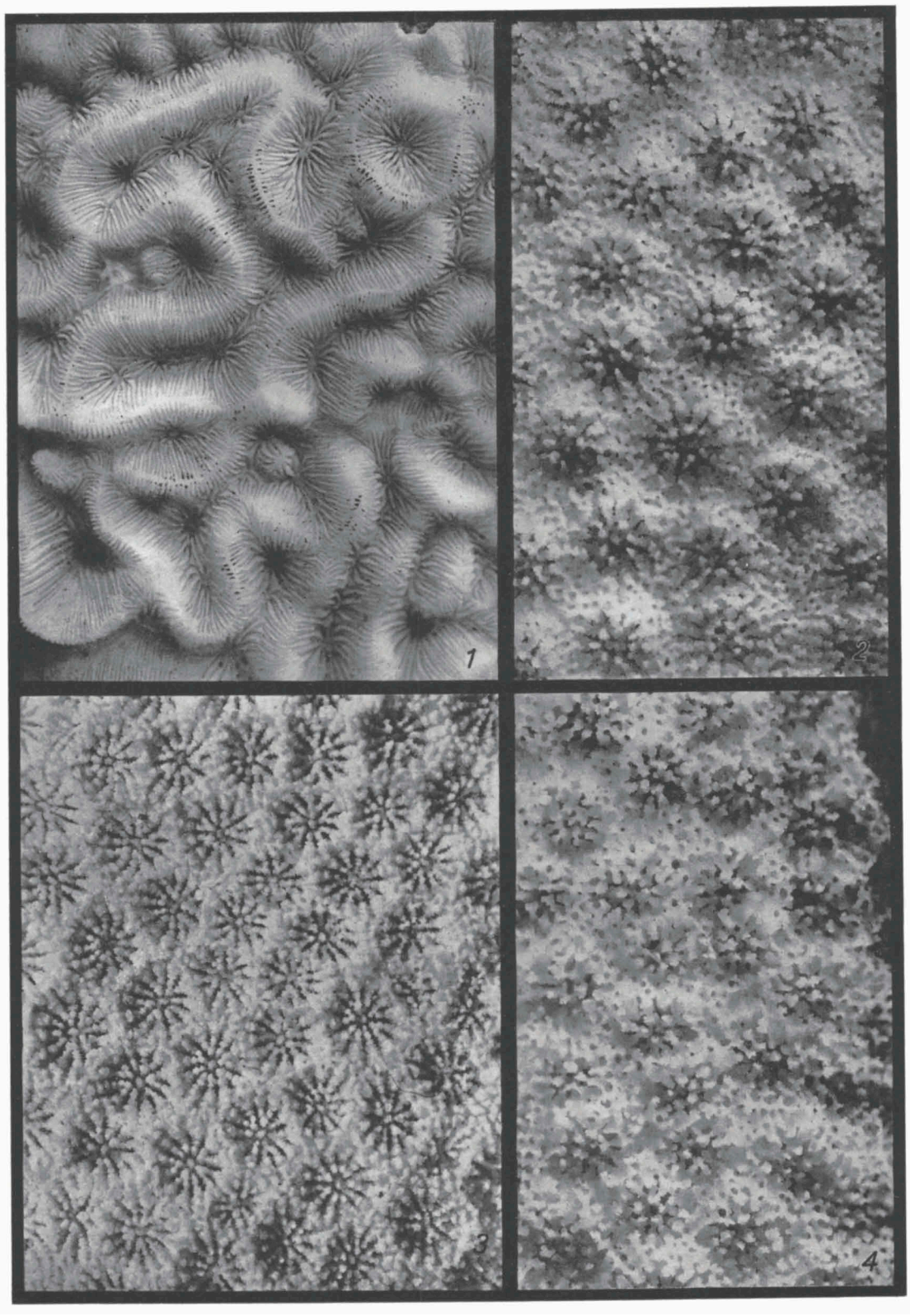

2
3
1

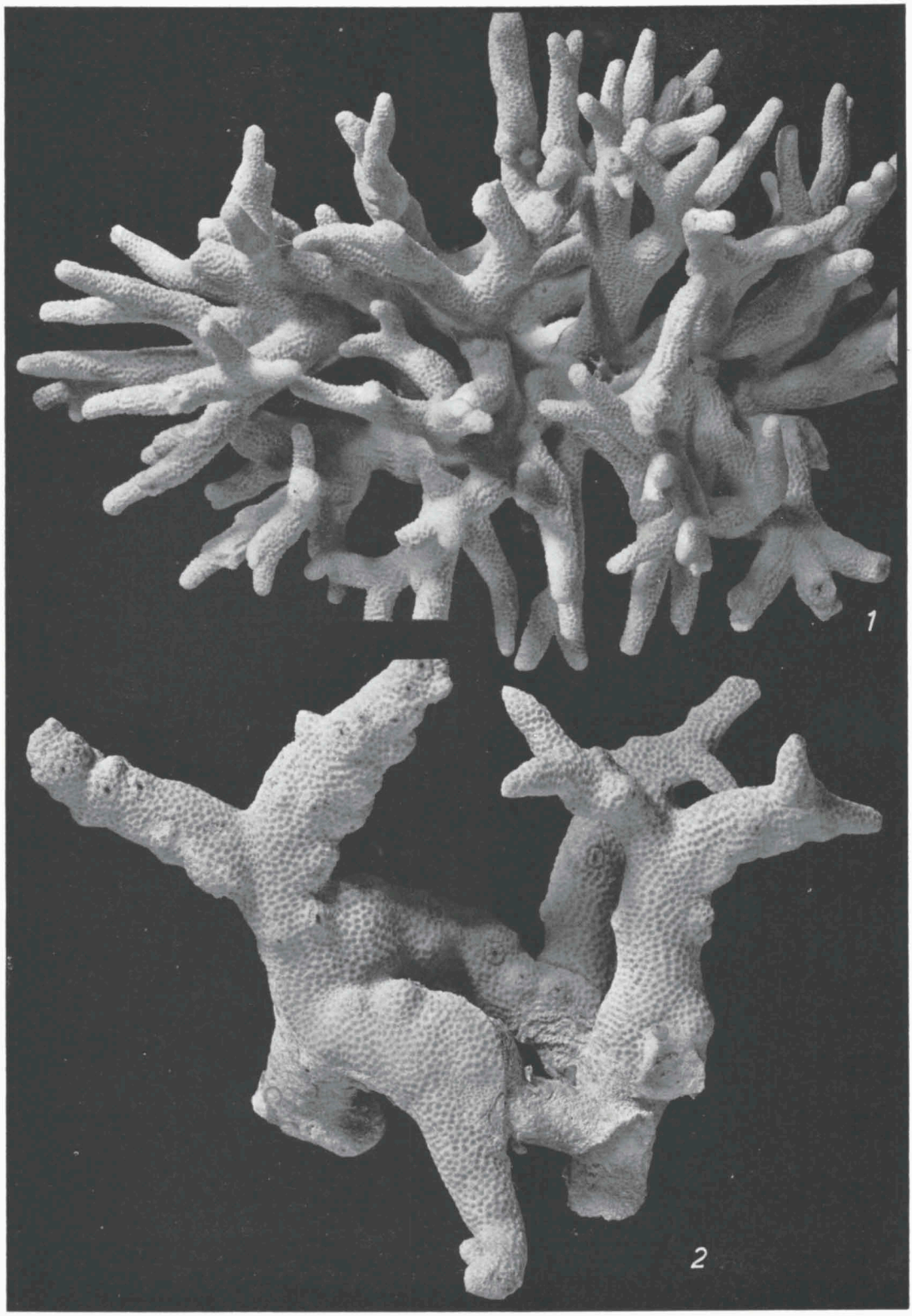

1
2
3
4
5

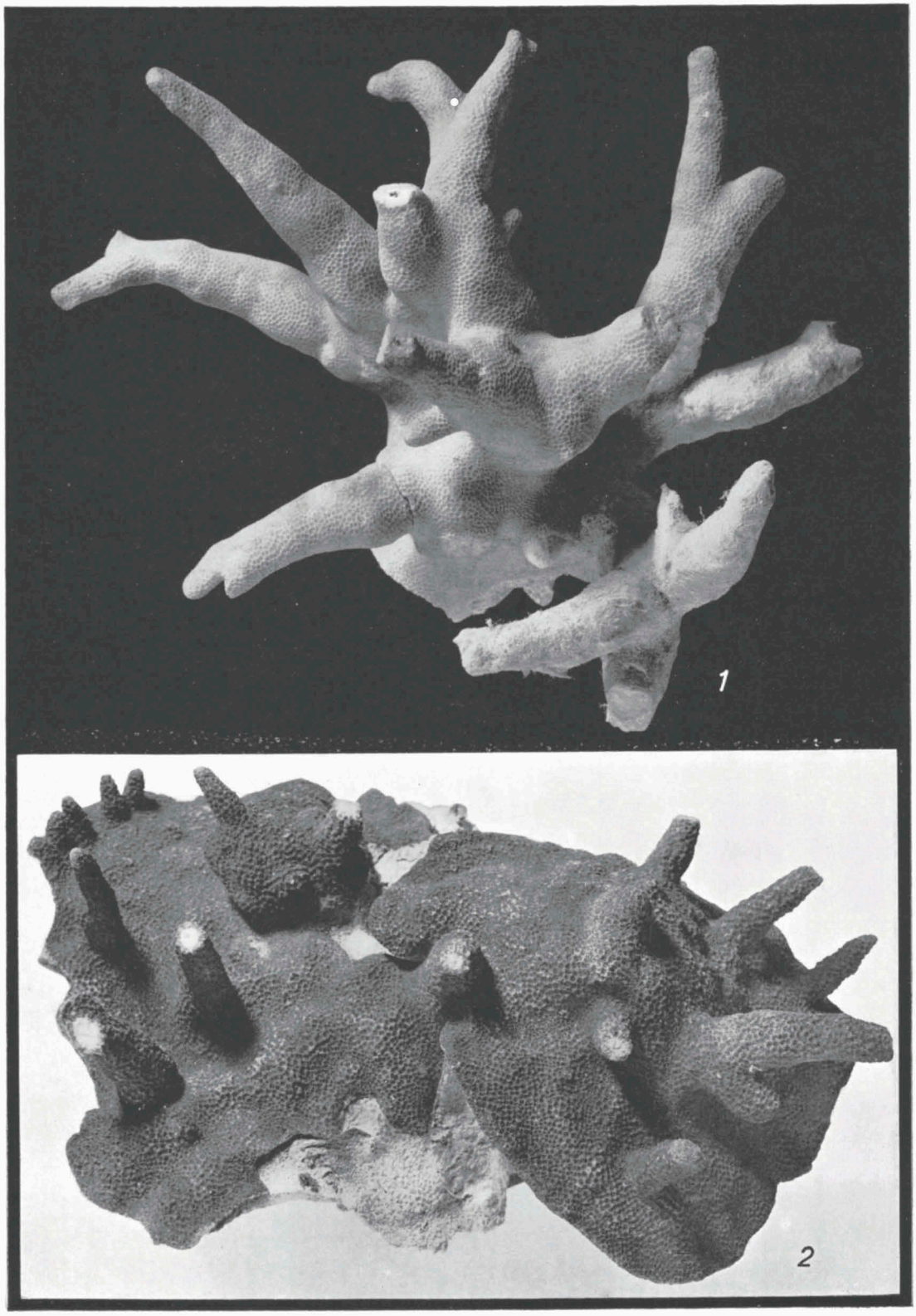

1
2
3
4
5


1
2
3
4


1
2


1
2
3
4


1
2


1
2