MADREPORARIA FROM THE BAY OF BATAVIA

by

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With 4 textfigures and 18 plates

INTRODUCTION

In the Bay of Batavia there are patch-reefs and cays in different stadia of development. Some are small reefs still rather deep below sea level, other reefs bear a small sand cay. On the larger coral sand islands vegetation has developed; moreover shingle ramparts and a moat have come into existence.

The islands and reefs considered in this paper are situated South of a line which may be thought passing from Cape Pasir towards the Island Edam, so forming a boundary between the reefs in the Bay of Batavia and the northern group of Thousand Islands („Duizend eilanden").

The author studied these reefs in some detail and the results were published as early as 1928 [1]). In that amply illustrated paper data and considerations may be found on temperature, salinity, silt, beach conglomerate, negative shift of the strandline; special attention is given to the origin and development of the reefs and islands and the mutual connection between their morphology and the prevailing winds. Moreover a preliminary list of coral species was given and the ecological aspects were considered. (The corals figured in that paper are in the Museum of the Geological Survey at Bandoeng, Java).

The two points last named are treated in a more definite form in the present publication. Since I published the 1928 paper I paid some more visits to the Bay of Batavia resulting in the finding of a greater number

1) J. H. F. Umbgrove. De koraalriffen in de Baai van Batavia (with summary in English). Wetenschappelijke Mededeelingen (Dienst van den Mijnbouw, Bandoeng) N°. 7, 1928, p. 1—68, fig. 1—17, plates 1—33.

The whole archipelago of the Thousand Islands is considered in another paper: J. H. F. Umbgrove. De Koraalriffen der Duizend Eilanden (with summary in English). Wetenschappelijke Mededeelingen N°. 12, 1929.

of species. Then a zoologist, Dr J. Verwey, stayed in Batavia a few years and made extensive studies on the fauna of the reefs [1]).

Also Boschma published some papers on corals from the Bay of Batavia [2]) and Kuenen studied the islands[3]).

I presented the specimens of my private collection to the Rijksmuseum van Natuurlijke Historie at Leiden. This collection contains specimens of the following species (numbers of the list on page 17—19) : 2, 3, 4, 7, 12, 13, 14, 15, 17, 19, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51, 52, 59, 60, 62, 64, 65, 66, 67, 69, 72, 74, 77, 78, 81, 85, 86, 87, 89, 92, 93, 95, 96.

The collections of Dr Verwey's too are now for the greater part in the same Museum. With the exception of the genus *Acropora,* I studied his material too. On the other hand Dr Verwey, now Director of the Zoological Station at Den Helder, Holland, is undertaking a monographic study of the genus *Acropora.* As his manuscript is nearly coming to an end we may look forward to his publication in a not too distant future.

Dr Verwey kindly told me that he will describe 21 *Acropora* species from the Bay of Batavia. In the present paper 96 different species of Madreporaria are described. This makes the respectable number of 117 species in total from that small reef group! [4])

Together with the collections from the Bay of Batavia I studied a large suite of reef corals, which I collected on the barrier reefs and atolls of the Togian islands (Gulf of Tomini, North Celebes). The results of my

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1) J. H. F. Umbgrove and J. Verwey. The coral reefs in the bay of Batavia, Fourth Pacific Science Congress, Java 1929. Guide to Excursion A 2.

J. Verwey. The symbiosis between damselfishes and Sea anemones in Batavia bay. Treubia, vol. 12, 1930, p. 305—366.

J. Verwey. The depth of Coral reefs in relation to their oxygen consumption and the penetration of light in the water. Treubia, vol. 13, 1931, p. 169—198 (See also Proceed. 4 Pac. Science Congress, Java 1929).

J. Verwey. Geomorphological notes on the coral reefs of Batavia bay. Treubia, vol. 13, 1931, p. 199—215.

2) H. Boschma, Knospung und verwandte Erscheinungen bei Fungia fungites and Fungia actiniformis. Treubia, vol. 3, 1923, p. 149—179.

H. Boschma and J. Verwey. The occurrence of stalked buds in the coral Echinopora lamellosa (Esper). Treubia, vol. 12, 1930, pp. 129—132.

H. Boschma. Sur la croissance de quelques coraux des récifs de l'Ile d'Edam (Baie de Batavia). Mémoires Musée Royal d'Histoire Naturelle de Belgique, sér. 2, 1936, p. 101—114.

3) Ph. H. Kuenen. Geology of Coral Reefs. The Snellius Expedition, vol. V, part 2, 1933.

4) From the Cocos-Keeling group 52 species of Madreporaria were described by Vaughan, from Murray island 66 species by the same author, from Samoa 85 species and 7 varieties by Hoffmeister and 88 species have been described from Amboina (see below).

study on the Madreporaria from the Togian reefs will probably be published next year in "Zoologische Mededeelingen". A complete list of corals from Togian appeared allready in a recent paper [1]).

The islands and reefs considered in the following pages are named after Dutch towns with the exception of three, viz., Kerkhof, Onrust and Kuiper. I give their Dutch names here as well as the native names (see fig. 1).

Leiden	—	Njamuk
Enkhuizen	—	Njamuk Ketjil
Alkmaar	—	Damar Ketjil
Edam	—	Damar Besar
Haarlem	—	Ajer Ketjil
Hoorn	—	Ajer Besar
Rotterdam	—	Ubi
Schiedam	—	Gosong
Kerkhof	—	Kelor
Purmerend	—	Sakit
Onrust	—	Kapal
Kuiper	—	Tjipir

Maps, aerial photographs and figures of interesting details of most of these islands may be found in my 1928 paper.

I will mention here that the flowers and insects of a low wooded island (viz., Leiden) are treated in a paper by Docters van Leeuwen [2]), while Verwey has published some data on the animal life of the islands [3]).

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

STRUCTURE OF REEFS AND ISLANDS

For a good understanding of the ecological distribution of the corals a short account on the structure of the reefs is given. The subject is treated at great length in my 1928 paper. I will give here only a short summary of results so far they are strictly necessary in this publication.

The crushed material of reef animals has been distributed in a remarkable way that is the same in all the islands and clearly shows the effect of

1) J. H. F. Umbgrove: Atolls and Barrier Reefs of the Togian Islands. Leidsche Geologische Mededeelingen, vol. XI, 1939, p. 132—187.

2) W. M. Docters van Leeuwen. Blumen und Insekten auf einer Kleinen Korallen-Insel. Annales Jardin Botanique de Buitenzorg, vol. 37, 1927, p. 1—31.

See also: C. G. G. J. van Steenis. Schets van de flora van het eiland Dapoer (Duizend-eilanden). De Tropische Natuur, vol. 24, 1935, p. 31—34.

3) in: Umbgrove and Verwey, op cit., 1929.

wind and surf. The beach on the South-West side is composed of loose, fine material, which for the sake of brevity we shall call coral sand. In a curve extending from the Northwest corner to the North East via North, the floor is covered with much coarser material consisting for the greater part of fragments of coral, that have been broken off or have rolled away. This material is called coral shingle and in places it has been heaped up into high ramparts (see fig. 2). These débris are piled up by the wind and the breakers. The mode of distribution of these walls shows the directions whence the influence of the winds is strongest.

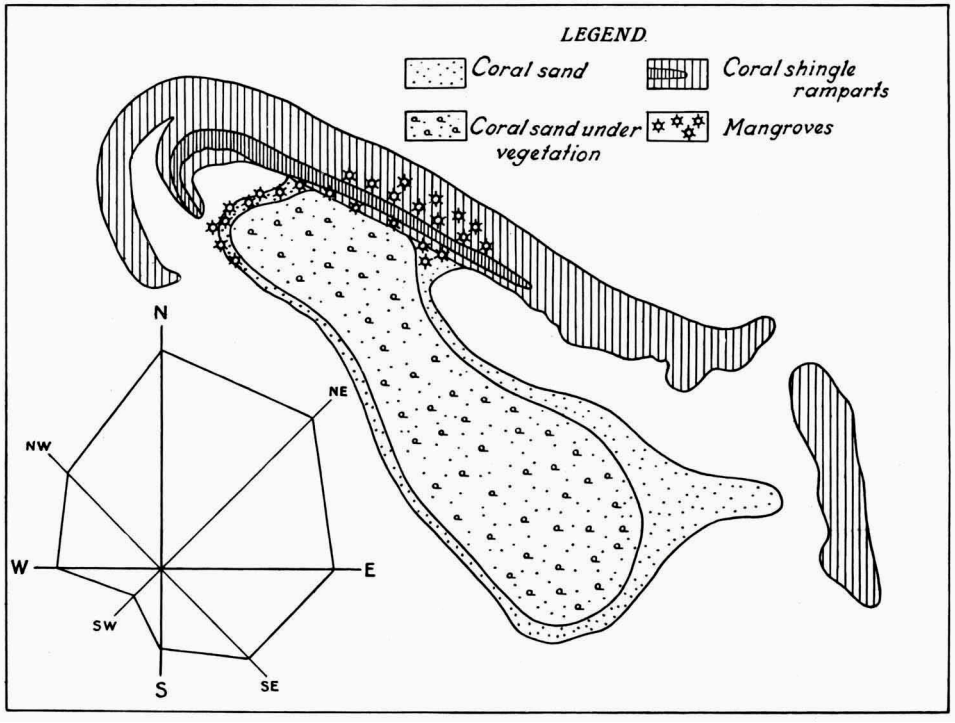

Fig. 2.

The greatest influence of the wind must be from the North, as the shingle ramparts are usually, high; the smallest influence may be expected from the South-West, such walls being absolutely wanting on this side of the islands.

The waves caused by the prevailing winds are washing around the reef and meet again on its lee side. There the finer erosion products from the reef are piled up and cause a strong sedimentation.

Data furnished by the Batavia Meteorological Observatory led to the following calculation:

a. the number of hours per annum which the wind blows from each of the eight principal directions;

b. its mean velocity in these directions.

The products of a and b gives a series of numbers the equations of which have been marked on the accompanying picture of the compass, next to the island Leiden (fig. 2).

This demonstrates very clearly that the influence of the monsoon winds and waves is just as might be expected from actual geological observations made around the islands (a × b I have named the wind-effect).

When a coral island is still in a rudimentary stage, only the sand cay emerges. This takes the shape of a semicircular dune, the convex side towards the wind, while the horns change their direction with the prevailing winds.

When the sand mass increases and the emerged part gradually becomes fixed by vegetation, the mobile part of the island tends to diminish relatively and an irregular rounded shape of the island becomes predominant.

Between the sand island and the shingle ramparts is a shallow moat. As to the origin of the moat I have suggested the same explanation as was already given by Mayor in his article: „causes which produce stable conditions in the depth of the floors of pacific fringing reef flats [1]), viz., a balance between sedimentation and excavation controlled by water-currents.

Spender has discussed the points of comparison of the Batavia reefs and islands with the cays within the Barrier reefs of Queensland [2]).

ECOLOGY OF THE REEFS; FACIES-TYPES

According to the nature of the bottom (coral sand or shingle), the depth of the water, and the movement of the waves several typical ecological units have developed. These various combinations of special kinds of bottom and conditions for life, each with a corresponding fauna adapted to it, thus constitute what are called "facies" (see textfigure 3). They will now be described separately, and a review of the Madreporaria faunas is given in the lists following below. We probably owe it to the smallness of these reefs that the distribution of the different faunas is so clearly marked. For some reefs it was possible to map them out. One of

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1) A. G. Mayor. Publ. no. 340, Carnegie Institution, Washington, 1925.

2) M. A. Spender. Islands Reefs of the Queensland Coast. Geogr. Journ., vol, 76, 1930.

See also: Sci. Rep. Great Barrier Reef Expedition, vol. 3 N°. 2, 1931; and: J. A. Steers. The Unstable Earth, 1932, p. 324—327.

these maps is reproduced as textfigure 4 [1]). As a matter of fact these maps must be taken "cum grano salis", the bounderies being not so sharply defined as shown in the sketch.

I. *Montipora ramosa* facies.

In the moat a fauna and flora occurs, which is able to live on a sandy bottom and in very shallow water of comparatively high temperature and salinity. The temperature of the water in the moat rises during the day to 32° C, even up to 36° C. Only few corals and other reef organisms stand these conditions for life, but for some of them the facies seems

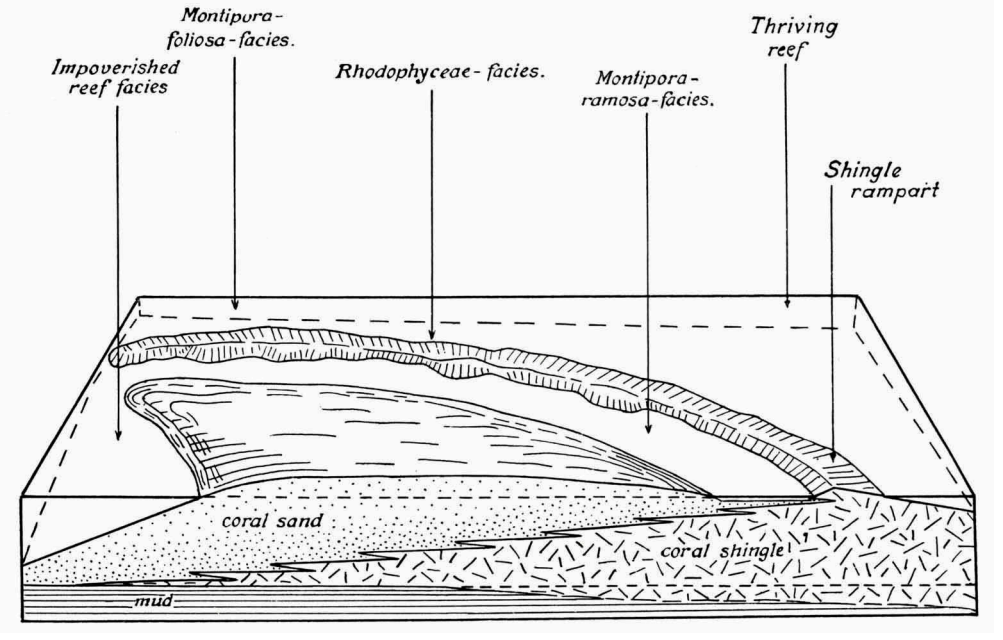

Fig. 3

favourable and such organisms may be found in great abundance. It is here that *Montipora ramosa* thrives abundantly [2]). It is the moat coral par excellence. In his account of Low Isles, West Australia, Spender too mentions *Montipora ramosa* as the typical moat coral [3]). Not seldom do *Leptastrea purpurea, Porites andrewsi, Porites lutea, Favia pallida, Favites yamanarii* var. *profunda, Pavona varians, Psammocora contigua* and

1) Analogous maps for other reefs may be found in my 1928 paper.
2) See plate 24 fig. 45 of my 1928 paper.
3) Geogr. Journal, vol. 76, 1930, p. 289.

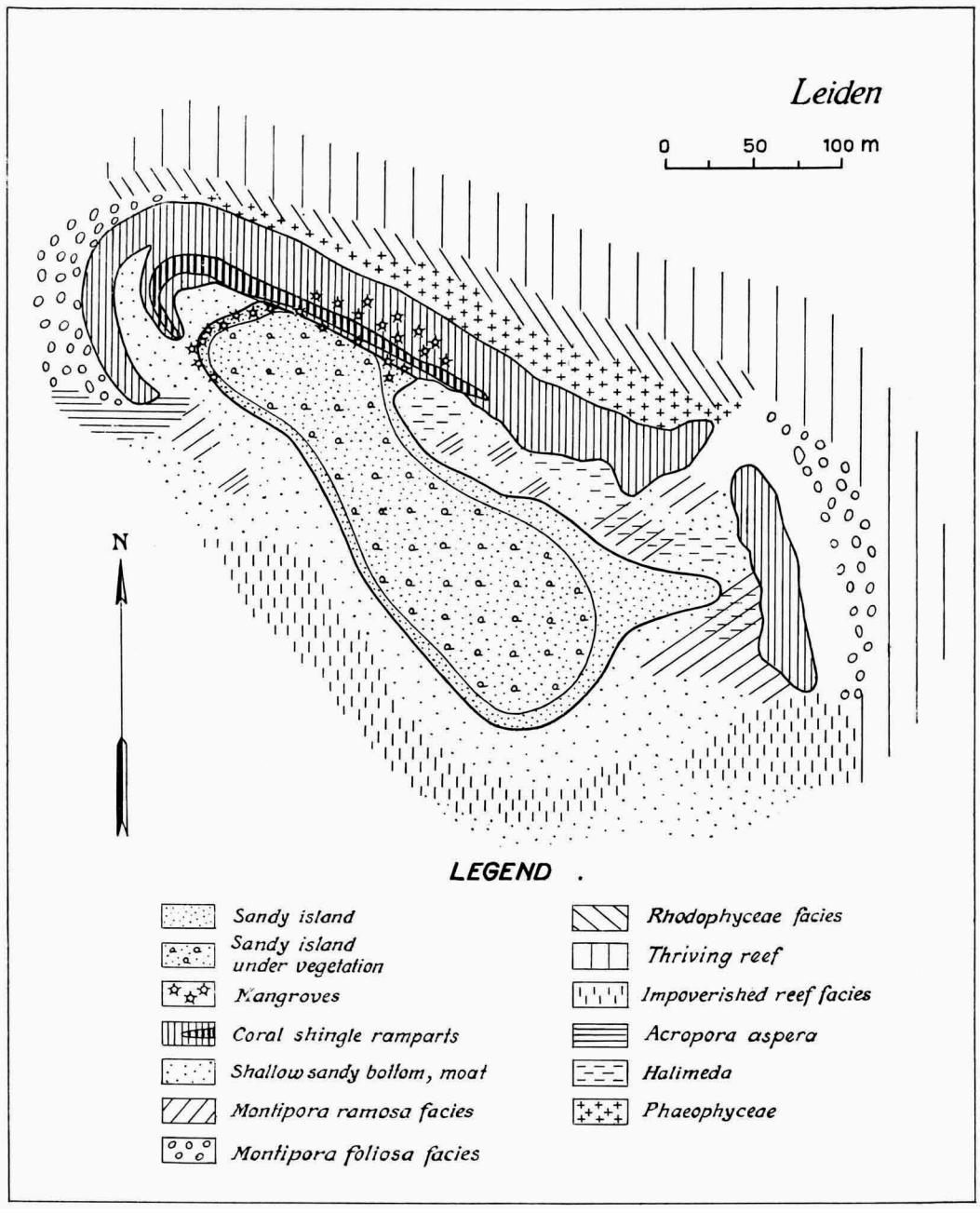
Leiden
0 50 100 m
N
LEGEND
Sandy island
Sandy island under vegetation
Mangroves
Coral shingle ramparts
Shallow sandy bottom, moat
Montipora ramosa facies
Montipora foliosa facies
Rhodophyceae facies
Thriving reef
Impoverished reef facies
Acropora aspera
Halimeda
Phaeophyceae

Fig. 4

Acropora spec. occur. Other corals that have been met with in the moat are: *Favites flexuosa, Favites yamanarii, Goniastrea pectinata, Lobophyllia corymbosa, Fungia fungites* and exceptionally also *Caulastrea tumida, Favites abdita, Symphyllia recta* (only one specimen found), *Pavona divaricata,* the *danai*-variety of *Pavona decussata, Goniopora tenuidens* and *Alveopora viridis* (only one specimen).

Apart from these Madreporaria I will mention here the frequent occurrence of the blue coral *Heliopora coerulea* (Pallas) and of patches of green calcareous algae (Chlorophyceae) belonging to the genus *Halimeda* and the Phanerogam *Thalassia.* Among the other animals that characterise the fauna of the moat I will mention the abundant occurrence of the black sea cucumber, *Holothuria,* and the less common *Synapta* and the sea urchin *Centrechinus setosus* [1]).

It is a remarkable fact that in the Western to North Western corner of the moat, where it is in open connection with the sea, a thick intertangling carpet of *Acropora aspera* Dana (syn. *A. hebes* and *A. sarmentosa*) often occurs (see textfigure 4) [2]). It is there too that an abundance of *Fungia* may be found, especially *Fungia fungites.* An interesting suite of *Fungia fungites* grade *Fungia repanda* was collected there and attached young specimens of *Fungia* may easily be found in that part of the moat.

II. Rhodophyceae facies.

The shingle ramparts represent the zone of the *Lithothamnium* ridge, well known from many a reef in the Pacific. The genus *Lithothamnium* and other Melobesiae are, however, comparatively scarce in the bay of Batavia. Indeed, they are present, some species being incrusting, others forming nodular growths of irregular shape. But they never occur in great profusion, nor do they cement the shingle components so as to transform the shingle rampart into a solid structure. Other Rhodophyceae, however, thrive abundantly on the outer slope of the rampart, e.g., *Amphiroa.* It is curious that some branched growth types are found in this zone, e.g., *Seriatopora hystrix, Hydnophora exesa, Heliopora coerulea* [3]) and *Millepora dichotoma.* On the top of the rampart patches of a rather finely branched *Acropora* species, *Acropora spicifera* (Dana), are exposed above the water at every low tide [4]). They are often much

1) See for a further enumeration of other organisms Verwey, 1929, p. 22.

2) This part of the moat is separated from the rest of the moat by the shingle rampart in the island Leiden; in other islands it is in open connection with it.

3) A fine colony in situ is figured on plate 26 fig. 48 of my 1928 paper.

4) See plate 24 fig. 46 of my 1928 paper.

mutilated by the strong surf and by the coral shingle thrown on them by the breakers. The species seems to have a strong power of repair and it is one of the corals with a comparatively fast growthrate. Except for this species of *Acropora* still a few other species were occasionally found in this zone, viz., small specimens of *Acropora* (*Isopora*) *palifera* and a species with a paleblue top calice (? *A. nobilis* Dana). By its occurrence between the *Montipora ramosa* facies and the *Montipora foliosa* facies, c.q. the thriving reef, it may be expected that some corals of the neighbouring facies zones occasionally may be met with in the Rhodophyceae facies. Among such corals I may mention a few specimens of *Montipora foliosa, Galaxea clavus, Favia pallida, Goniastrea pectinata, Porites lutea* and *Alveopora verrilliana.* And even some patches of *Montipora ramosa* were exceptionally found outside the moat in very shallow water along the seaside of the shingle ramparts. This is especially the case where lower parts of the shingle ramparts form an open connection between the moat and the sea at high tide. To the list of corals which were found in this zone I must add the following ones: *Phyllangia pallida* not seldom attached to corals or coral shingle and once I found a few living colonies of *Tubipora* (island Leiden) with vivid green polyps.

In some islands the upper part of the seaward slope of the shingle ramparts is rather poor in corals, but a zone of brown algae, Phaeophyceae, is found growing on the shingle. This is e.g. the case on the Leiden reef (compare fig. 4).

III. *Montipora foliosa* facies.

On the upper outer slopes of the shingle rampart *Montipora foliosa* abounds. This conspicuous coral and the accompanying fauna is found especially on the Northwest and South East sides of the islands, the directions from which the wind raises the surf during the longest time of the year. By the side of *Montipora foliosa* the following species are abundant: *Montipora erythraea, Seriatopora hystrix, Pocillopora damicornis, Stylophora mordax, Galaxea clavus, Favia speciosa, Favia pallida, Coeloria rustica, Platygyra phrygia, Hydnophora exesa, Symphyllia recta, Echinopora lamellosa, Fungia echinata, F. repanda, F. concinna, F. fungites, Porites lutea, Heliopora coerulea* (Pallas), *Millepora dichotoma* Forsk. and *Millepora „complanata"*. Among the other species collected in this part of the reef are: *Pocillopora verrucosa, Phyllangia pallida, Favites yamanarii, Goniastrea retiformis, G. pectinata, Hydnophora rigida, H. cf. mayori, Fungia scutaria, Halomitra robusta, Pavona venosa* var. *arbuscula, P. varians, Psammocora folium, Porites andrewsi.* Exceptio-

nally the following corals were found: *Galaxea fascicularis, Favites aspera, Goniopora arbuscula.* No Holothurians occur in this part of the reef.

The fauna of the *foliosa* facies passes gradually into the fauna of greater depths where the thriving reef occurs. Dr. Verwey mentions *Montipora foliosa* down to a depth of 8 meters and deeper. The *foliosa* facies forms the transition to the thriving luxuriant reef.

IV. Thriving reef.

Coming into deeper water, we find a luxuriance of species. Very large colonies may be seen here. This thriving reef, which is not drawn on the map, fig. 4, in its whole extent is always found developed as an arch from West over North and East to South.

The largest corals are doubtless enormous *Porites* colonies [1]) which may reach nearly up to low tide level. They form a welcome base of attachment for a dozen of other reef organisms, e.g., horizontally spread *Acroporas* and large colonies of *Millepora dichotoma.* Enormous intertangling yellow folia of *Millepora platyphylla* [2]) rise from the deepest part of the reef, their growth shape resembling that of *Pavona decussata.* Yellow and yellowish brown are widely spread colours in many corals, but amidst them there occur purple *Acroporas,* pink tinted colonies of *Pocillopora*; large semiglobular growths of *Symphyllia recta* show green patches on a brown main colour. Of a light yellowish green is *Goniopora tenuidens. Galaxea clavus* may grow as enormous structures, forming vertical pillars of a violet tint. Characteristic polygonal calices of *Favites abdita* often display a brilliant hue of yellowish orange. And between these corals are the phantastically coloured mantles of *Tridacna,* the blue five-armed starfish *Linckia,* huge sea anemones (*Discosoma*), large fans of *Isis, Plexaura* and non-calcareous Alcyonaria. Moreover a host of fishes and Crustacea display an overwhelming range of variation in shape and colour [3]).

The unrivalled splendour and wealth of forms and the delicate tints of the coral structures, the brilliant colours of fishes, clams, sea anemones, worms, crabs, star fishes and the whole rest of reef animals are so attractive and interesting that it seems impossible to give an adequate description of such a profusion of serene and fascinating beauty.

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1) According to Verwey (op. cit., 1931, p. 206) it is *Porites lobata.*

2) I believe the different growth types of *Millepora* belong to one and the same species.

3) In our excursion guide (op. cit., 1929) Dr Verwey mentions some more data about the fishes, echinodermata, etc.

I will not enumerate here the names of all the corals that were collected from the thriving reef. They may be found in the complete list, given below.

V. Corals collected in the shingle ramparts only.

In a special column of the same list I have enumerated 9 coral species that were collected as fragments in the shingle rampart only. Although up to now they were not met with living in situ, there seems no doubt that they originate from the thriving reef; they where transported by the breakers towards the shingle ramparts.

VI. Impoverished reef facies.

Almost every coral species found in the *foliosa-* and in the Rhodophyceae-facies, occurs also in deeper water of the thriving reef. So the *foliosa*-facies as well as the Rhodophyceae-facies may be considered as impoverished facies types. I have named them after their most conspicuous representatives. It would be difficult to proceed in an analogous manner regarding the fauna living on the sandy bottom along the South Western slopes of the islands. I have simply called it: impoverished reef facies.

As mentioned in the chapter on the structure of the reefs it is along the S.W. side of the islands that a strong sedimentation of fine "coral sand" takes place. Only few corals are able to live under such conditions. The sandy bottom is a point in common with the moat. And we find, indeed a few species which are thriving in the moat as well as along the upper part of the S.W. slopes: *Leptastrea purpurea, Porites andrewsi.*

The specimens of *Leptastrea purpurea* are not attached to other corals, but they lie as loose balls on the sandy bottom and all around they bear calices. The same is true for *Cyphastrea seraila* and *Cyphastrea chalcidicum.* Both species abound along the upper part of the South Western slope, whereas *Cyphastrea microphthalma* seems restricted to the deeper water of the thriving reef.

It is along the upper part of the South Western slope that large patches of the long spined sea urchin, *Centrechinus* (*Diadema*) *setosus* [1]) may frequently be found. The long snake like winding *Synapta grisea* (or *S. maculata*) is of common appearance, while *Holothuria atra,* the common species of the moat, is extremely scarce or even absent.

In deeper water irregular patches of reef corals are growing. The species are the same as in the thriving reef on the opposite side of the islands, but there are fewer species. Those which were collected are listed below in the sixth column.

1) See plate 26 fig. 49 of my 1928 paper.

COMPARISON WITH FIVE OTHER MADREPORARIA FAUNAS

In the list following below, the Madreporaria collected in the bay of Batavia are compared with five other Madreporaria faunas viz.; Cocos-Keeling, Amboina, Togian, Murray-island and Samoa. From these five reefs large collections were made and the publications are in such a form as to allow for a detailed comparison.

The corals of Cocos-Keeling and Murray island were studied by Vaughan (1918) of Samoa by Hoffmeister (1925) of Amboina by Bedot (1907) and of Togian by the present author, the manuscript of the last named fauna being ready for the press.

For the sake of convenience I am giving separate lists of those species names occurring in the publications of Vaughan's and Hoffmeister's, which for reasons of taxonomy are now regarded as synonymous to species names used in the present paper as well as in the paper on the Togian corals.

Moreover I am giving a complete list of the Madreporaria of Amboina, according to the publication of Bedot's and of later authors showing the species names as used in the original publications besides the new species names that have to be substituted.

Comparing the Madreporaria of the six coral-reefs mentioned—with the exception of the genus *Acropora!*—we come to the following result.

The Bay of Batavia and Cocos-Keeling	have in common	22 species.
The Bay of Batavia and Amboina	have in common	38 species.
The Bay of Batavia and Togian	have in common	48 species.
The Bay of Batavia and Murray island	have in common	29 species.
The Bay of Batavia and Samoa	have in common	25 species.
All six reefs	have in common	4 species.

The apparent differences of the Madreporaria faunae are due to a number of heterogenous factors.

Without any doubt there are species which occur in one or more reefs but which are looked for in vain in other reefs. Thus, e.g., not a single specimen of *Acrohelia horrescens* was found in the Bay of Batavia although this species abounds on the Togian reefs. On the other hand neither *Montipora ramosa* nor *Montipora foliosa* was found on the Togian reefs, though I eagerly searched after these species, which are so abundant on the Bay of Batavia reefs. To these examples others might be added. We are only in the very beginning of having an idea of the true distribution of species, which abound in one reef but seem absent in some other reefs.

There is, however, another factor which must not be overlooked. In the Togian reefs only the surfaces of the reefs were investigated. I did the same in the Bay of Batavia reefs, but after I left the East Indies Dr. Verwey got the disposition of a diving hood when the Snellius Expedition had finished its task. It is due to this fact that also the deeper parts of some reefs in the Bay of Batavia could be investigated by him. Thus he collected a number of species and genera living in deeper water only. These species or part of them may of course be present on the Togian reefs but they will not be found before the deeper parts of those reefs are investigated.

There may be a number of species or even genera which never will be found in the Bay of Batavia on account of its limited depth. In this connection I may point to the following genera: *Euphyllia* [1]), *Trachyphyllia, Antillophyllia, Dendrophyllia, Leptoseris, Podabacia* and some *Fungia* species belonging to the *patella* group.

When enumerating these corals I am, however, fully aware of the possibility that some of them may be found in future investigations.

That may be also the case with other genera, representatives of which are not yet known from the Bay of Batavia: *Oulophyllia, Physogyra, Plerogyra, Montastrea* (= *Orbicella*), *Palauphyllia, Boninastrea, Stylocoenia* and *Stylocoeniella.*

To mention an example. Only one specimen of *Physogyra* was found during my rather long stay on the Togian reefs and only a few specimens of *Tridacophyllia.* I saw one colony of *Pachyseris rugosa* along the steep outer reef edge, but I failed to collect it. And I know of only one specimen of *Caulastrea tumida* from the Bay of Batavia.

The list of Madreporaria of a reef will grow the longer and intenser investigations be carried out. Although the Madreporaria fauna from the Bay of Batavia is the largest one known up to now from any reef or small reef group, I am convinced that a still greater number of species will be detected if further investigations will be carried out.

And last not least there are the difficulties of "species" and taxonomy. It may be that a same species is designed by different names by different authors. In some cases the student of their descriptions and figures may feel justified in uniting the two "species", but often he may feel doubtful. The result is the appearence of different names in the faunistic lists which are compared. When the same author studies two coral faunas collected in two separate regions that factor is ipso facto eleminated. Perhaps this

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1) See the description of *Lobophyllia corymbosa.*

may in part explain why the number of species common to the Bay of Batavia and Togian is comparatively larger than from one of the other faunas that are compared here with the Bay of Batavia corals.

Here follow the lists of synonyms to which reference was already made in the considerations given above.

1. Corals from Cocos-Keeling and Murray-island, names of which have been substituted:

Vaughan (1918)	Present paper:
Pocillopora bulbosa Ehrenb.	*Pocillopora damicornis* (Linné)
Favites abdita (Ell. Sol.) pars	*Favites flexuosa* (Dana)
Goniastrea parvistella (Dana)	*Goniastrea retiformis* (Lam.)
Maeandra daedalea (Ell. Sol.)	*Coeloria rustica* (Dana)
Maeandra lamellina Ehrenb.	*Coeloria lamellina* (Ehrenb.)
Leptoria phrygia (Ell. Sol.)	*Platygyra phrygia* (Ell. Sol.)
Mussa sinuosa (Forskal)	*Lobophyllia costata* (Dana)
Symphyllia nobilis (Dana)	*Symphyllia recta* (Dana)
Herpetholitha crassa Dana	*Herpolitha limax* (Esper)
Pavona danai (E.H.)	*Pavona decussata* Dana
Pavona maldivensis (Gardiner)	*Pavona clavus* Dana
Porites haddoni Vaughan	*Porites lutea* E.H.

2. Corals from Samoa, names of which have been substituted:

Hoffmeister (1925)	Present paper:
Maeandra lamellina Ehrenb.	*Coeloria lamellina* (Ehrenb.)
Leptoria phrygia (Ell. Sol)	*Platygyra phrygia* (Ell. Sol)
Merulina vaughani v. d. Horst	*Merulina ampliata* (Ell. Sol)
Mussa sinuosa (Lam.)	*Lobophyllia costata* (Dana)
Symphyllia nobilis (Dana)	*Symphyllia recta* (Dana)

3. Complete list of corals from Amboina; the revised names are placed in the second column. To the corals, described by Bedot (1907) are added the species described by Brook, Bernard, Boschma, Doederlein, van der Horst, Quelch, Studer, Stiasny and Thiel. The latter are marked by a +

1 *Seriatopora hystrix* Dana	
2 *Pocillopora acuta* Lam	*P. damicornis* (Lin.)
3 *Pocillopora elegans* Dana	
4 *Stylophora digitata* (Pallas)	*Stylophora pistillata* (Esper)
5 *Cyathohelia axillaris* (Ell. Sol.)	
6 *Euphyllia rugosa* Dana	*Euphyllia glabrescens* (Ch. Eys.)
7 *Euphyllia fimbriata* (Spengler)	
8 *Euphyllia picteti* Bedot	
8a *Euphyllia picteti* var. *flexuosa* Bedot	
9 *Trachyphyllia amaranthus* (Müller)	
10 *Callogyra formosa* Verrill	
11 *Cyphastrea microphthalma* (Lam)	
12 *Galaxea fascicularis* (Lin.)	

Galaxea aspera Quelch	*Galaxea fascicularis* (Lin.)
13 *Galaxea fragilis* Quelch +	? = *Galaxea fascicularis* (Lin.)
14 *Galaxea tenella* Brüggem. +	? = *Galaxea fascicularis* (Lin.)
15 *Favia okeni* Edw.	*Favia speciosa* (Dana)
Favia pandanus (Dana)	*Favia speciosa* (Dana)
16 *Prionastrea robusta* (Dana)	*Favites abdita* (Ell. Sol.)
17 *Goniastrea retiformis* Lam.	
18 *Goniastrea quoyi* E.H.	
19 *Goniastrea multilobata* Quelch	
20 *Coeloria daedalea* (Ell. Sol.)	*Coeloria rustica* (Dana)
21 *Coeloria arabica* var. *triangularis* Klz.	*Coeloria lamellina* (Ehr.)
22 *Hydnophorella microcona* (Lam.)	*Hydnophora microconos* (Lam.)
23 *Hydnophorella exesa* (Pallas), pars, fig. 123—126	*Hydnophora exesa* (Pall.)
24 *Hydnophorella exesa* (Pallas), pars, fig. 127—129	*Hydnophora tenella* Quelch
25 *Merulina studeri* Bedot	*Merulina ampliata* (Ell. Sol.)
Merulina ampliata (Ell. Sol.) +	
26 *Mussa echinata* E.H.	*Lobophyllia hemprichii* (Ehr.)
27 *Mussa brueggemanni* Quelch	*Lobophyllia costata* (Dana)
28 *Symphyllia indica* E.H.	*Symphyllia radians* E.H.
29 *Symphyllia acuta* Quelch	*Symphyllia agaricia* E.H.
30 *Symphyllia sinuosa* (Quoy et Gaim.)	*Symphyllia recta* (Dana)
31 *Tridacophyllia lactuca* (Pallas)	
32 *Oxipora contorta* Quelch +	*Oxypora lacera* (Verrill)
33 *Oulastrea crispata* (Lam.) [1]	
34 *Fungia patella* Ell. et Sol. +	
35 *Fungia distorta* Mich. +	
36 *Fungia cyclolites* Lam.	
37 *Fungia actiniformis* Quoy et Gaim.	
38 *Fungia paumotensis* Stutchb.	
39 *Fungia echinata* (Pallas)	
40 *Fungia horrida* Dana +	
41 *Fungia repanda* Dana	
42 *Fungia danai* E.H.	
43 *Fungia fungites* (Linn.) +	
43a *Fungia fungites* var. *haimei* Verrill	
43b *Fungia fungites* var. *incisa* Doed.	
43c *Fungia fungites* var. *agariciformis* Lam.	
43d *Fungia fungites* var. *papillosa* Verrill	
43e *Fungia fungites* var. *confertifolia* Dana	
44 *Halomitra philippinensis* Studer +	
45 *Podabacia robusta* Quelch	*Halomitra robusta* (Quelch)
46 *Podabacia crustacea* (Pallas)	
47 *Herpetolitha limax* (Esper)	*Herpolitha limax* (Esper)
48 *Cryptabacia talpina* (Lam)	*Polyphyllia talpina* (Lam)

1) A specimen in the Rijksmuseum van Natuurlijke Historie at Leiden, identified by the author.

49 *Pavona decussata* Dana, pars, fig. 180, 181	*Pavona decussata* Dana
50 *Pavona decussata Dana,* pars, fig. 182	*Pavona varians* Verrill
51 *Pavona praetorta* Dana +	
52 *Leptoseris gardineri* v. d. Horst +	
53 *Pachyseris speciosa* Dana +	
54 *Pachyseris rugosa* Lam +	
55 *Psammocora exesa* Dana +	
56 *Balanophyllia cumingi* E.H.	
57 *Dendrophyllia ramea* L.	
58 *Turbinaria crater* (Pallas)	
59 *Turbinaria calicularis* Bernard +	? *Turbinaria crater* (Pallas)
60 *Turbinaria peltata* (Esper)	
61 *Madrepora seriata* (Ehrenb..)	
62 *Madrepora subulata* Dana	
63 *Madrepora studeri* Brook	
64 *Madrepora gracilis* Dana +	
65 *Madrepora assimilis* Brook +	*Acropora* spec. div. to be considered in Dr. Verwey's monograph on the genus *Acropora*
66 *Madrepora quelchi* Brook	
67 *Madrepora cerealis Dana* +	
68 *Acropora hyacynthus* Dana +	
69 *Acropora syringodes* Brook +	
70 *Acropora (Isopora) hispida* Brook	
71 *Montipora palmata* (Dana)	*Montipora ramosa* Bernard
Montipora ramosa Bernard +	
72 *Montipora venosa* (Ehrenb.)	
73 *Montipora spumosa* (Lam.)	
74 *Montipora verrucosa* (Lam.)	
75 *Montipora foliosa* Pallas	
76 *Montipora peltiformis* Bernard +	
77 *Montipora prolifera* Brüggem. +	
78 *Montipora incrassata* Dana +	
79 *Montipora cristagalli* (Ehrenb.) +	
80 *Montipora papillosa* (Lam.) +	
81 *Montipora informis* Bernard +	
82 *Montipora tuberosa* Bernard +	
83 *Porites conglomerata* Dana	*Porites lutea* E.H.
84 *Porites palmata* Dana	*Porites mucronata* Dana
85 *Porites saccharata* Brüggem	
86 *Goniopora stokesi* E.H.	
87 *Goniopora lobata* E.H.	? *Goniopora planulata* Ehrenb.
88 *Rhodaraea tenuidens* Quelch	*Goniopora tenuidens* (Quelch)

List of Madreporaria from the Bay of Batavia, their facies distribution and their geographic distribution on five other reefs, viz., Cocos-Keeling, Amboina, Togian reefs, Murray island and Samoa.

List of Corals from the Bay of Batavia.	Distribution according to Facies (See text)						Geographic Distribution				
	I	II	III	IV	V	VI	Cocos-Keeling	Amboina	Togian	Murray Island	Samoa
1 *Seriatopora hystrix* Dana	.	×	×	×	.	×	.	+	+	+	.
2 *Pocillopora damicornis* (Linné)	.	.	×	×	.	.	+	+	+	+	+
3 *Pocillopora verrucosa* (Ellis et Sol.)	.	.	×	.	.	.	+	.	.	.	.
4 *Pocillopora eydouxi* Milne Edwards...	.	.	.	.	×	.	+	.	+	+	+
5 *Stylophora pistillata* (Esper)	.	.	.	.	×	.	.	+	+	+	.
6 *Stylophora mordax* (Dana)	.	.	×	×	.	×	.	.	.	.	.
7 *Phyllangia pallida* Klunzinger	.	×	×	×	.	.	.	.	.	.	.
8 *Simplastrea vesicularis* nov. spec.	.	.	.	×	.	.	.	.	.	.	.
9 *Caulastrea tumida* Matthai	×	.	.	.	.	.	.	.	.	.	.
10 *Cyphastrea microphthalma* (Lam.)	.	.	.	×	.	.	+	+	+	.	+
11 *Cyphastrea chalcidicum* Klunzinger	.	.	.	.	.	×	.	.	+	.	.
12 *Cyphastrea seraila* (Forskål)	.	.	.	.	.	×	.	.	.	+	.
13 *Leptastrea purpurea* (Dana)	×	.	.	.	.	×	+	.	+	+	+
14 *Galaxea fascicularis* (Linné)	.	.	(×)	×	.	.	.	+	+	+	+
15 *Galaxea clavus* (Dana)	.	×	×	×	.	.	.	.	.	.	.
16 *Favia speciosa* (Dana)	.	.	×	×	.	.	+	+	+	+	.
17 *Favia pallida* (Dana)	×	×	×	×	.	×	.	.	+	+	+
18 *Favia stelligera* (Dana)	.	.	.	.	.	×	+	.	+	.	+
19 *Favia valenciennesii* E.H.	.	.	.	.	.	×	.	.	.	.	.
20 *Favites abdita* (Ellis et Sol.)	×	.	.	×	.	.	+	+	+	+	+
21 *Favites flexuosa* (Dana)	×	.	.	.	.	.	.	.	—	.	.
22 *Favites favosa* (Ellis et Sol.)	.	.	.	×	.	.	.	.	+	.	.
23 *Favites pentagona* (Esper)	.	.	.	×	.	.	.	.	.	.	.
24 *Favites virens* (Dana)	.	.	.	×	.	×	.	.	+	+	.
25 *Favites aspera* (Verrill)	.	.	×	.	.	.	.	.	.	.	.
26 *Favites yamanarii* Yabe et Sug.	×	.	×	×	.	.	.	.	.	.	.
27 *Favites yamanarii* var. *profunda* nov. var.	×	.	.	.	.	.	.	.	+	.	.
28 *Goniastrea retiformis* (Lam.)	.	.	×	×	.	.	.	+	+	+	+
29 *Goniastrea hombroni* (Rousseau)	.	.	.	.	×	.	.	.	.	.	.
30 *Goniastrea pectinata* (Ehrenberg)	×	×	×	×	.	.	.	.	+	+	+
31 *Coeloria rustica* (Dana)	.	.	×	×	.	.	.	+	+	+	.
32 *Coeloria lamellina* (Ehrenberg)	.	.	.	×	.	×	.	+	.	+	+
33 *Platygyra phrygia* (Ellis et Sol.)	.	.	×	×	.	.	+	.	+	.	+
34 *Hydnophora exesa* (Pallas)	.	×	×	×	.	.	+	+	.	+	.
35 *Hydnophora grandis* Gardiner	.	.	.	×	.	.	.	.	.	.	.
36 *Hydnophora microconos* (Lam.)	.	.	.	.	×	.	+	+	+	+	+
37 *Hydnophora contignatio* (Forsk.)	.	.	.	×	.	.	.	.	.	.	.
38 *Hydnophora rigida* (Dana)	.	.	×	×	.	.	.	.	+	.	+

List of Corals from the Bay of Batavia	Distribution according to Facies (See text)						Geographic Distribution				
	I	II	III	IV	V	VI	Cocos-Keeling	Amboina	Togian	Murray Island	Samoa
39 *Hydnophora* cf. *mayori* Hoffmeister...	.	.	×	.	.	.	.	.	.	.	.
40 *Merulina ampliata* (Ellis et Sol.)	.	.	.	×	.	.	.	+	+	.	+
41 *Merulina laxa* Dana	.	.	.	×	.	.	.	.	.	.	.
42 *Scapophyllia cylindrica* E.H.	.	.	.	.	×	.	.	.	+	.	.
43 *Lobophyllia corymbosa* (Forsk.)	×	.	.	×	.	.	.	.	+	.	.
44 *Lobophyllia costata* (Dana)	.	.	.	.	×	.	.	+	+	+	+
45 *Symphyllia recta* (Dana)	(×)	.	×	×	.	.	.	+	+	+	.
46 *Symphyllia radians* E.H.	.	.	.	.	×	.	.	+	+	.	.
47 *Echinopora lamellosa* (Esper)	.	.	×	×	.	×	+	.	+	.	.
48 *Echinopora gemmacea* (Lam.)	.	.	.	×	.	.	.	.	+	.	.
49 *Echinopora horrida* Dana	.	.	.	×	.	×	.	.	+	.	.
50 *Mycedium tubifex* (Dana) var. *bifrons* nov. var.	.	.	.	.	×	.	.	.	.	.	.
51 *Oxyphyllia aspera* (Ellis et Sol.)	.	.	.	×	.	×	.	.	.	.	.
52 *Tridacophyllia lactuca* (Pallas)	.	.	.	×	.	.	.	+	+	.	.
53 *Oxypora lacera* (Verrill)	.	.	.	.	.	×	.	+	.	.	.
54 *Oxypora titizimaensis* Yabe et Sug. ...	.	.	.	×	.	×	.	.	.	.	.
55 *Oulastrea crispata* (Lam.)	.	.	.	×	.	.	.	+	.	.	.
56 *Diploastrea heliopora* (Lam.)	.	.	.	×	.	.	.	.	.	.	.
57 *Fungia actiniformis* Quoy et Gaim ...	.	.	×	.	.	.	.	+	.	.	.
58 *Fungia scutaria* (Lam.)	.	.	×	.	.	.	+	.	+	.	.
59 *Fungia echinata* (Pallas)	.	.	×	×	.	.	.	+	+	.	.
60 *Fungia repanda* (Dana)	×	.	×	×	.	.	.	+	+	.	.
61 *Fungia concinna* Verrill	.	.	×	×	.	.	.	.	+	+	.
62 *Fungia subrepanda* Döderlein	.	.	.	×	.	.	.	.	.	.	.
63 *Fungia danai* E.H.	.	.	.	×	.	.	.	+	+	.	.
64 *Fungia fungites* (Linné)	×	.	×	×	.	.	+	+	+	+	+
65 *Fungia fungites* (Linné) → *repanda* (Dana)	×	.	×	×	.	.	.	.	+	.	.
66 *Halomitra robusta* (Quelch)	.	.	×	×	.	.	.	+	+	.	.
67 *Herpolitha limax* (Esper)	.	.	.	.	×	.	+	+	.	.	.
68 *Polyphyllia talpina* (Lam.)	.	.	.	×	.	.	.	+	.	+	.
69 *Pachyseris speciosa* (Dana)	.	.	.	×	.	.	.	+	.	+	+
70 *Pachyseris rugosa* (Lam.)	.	.	.	.	.	×	.	+	.	.	.
71 *Pavona cactus* (Forsk.)	.	.	.	.	.	×	.	.	.	.	.
72 *Pavona decussata* Dana	×	.	.	×	.	.	+	+	+	.	+
73 *Pavona divaricata* Lam.	×	.	.	.	.	.	.	.	+	.	+
74 *Pavona frondifera* Lam.	.	.	.	×	.	.	.	.	+	.	+
75 *Pavona varians* Verrill	×	.	×	.	.	.	+	+	+	+	.
76 *Pavona clavus* Dana	.	.	.	×?	.	.	+	.	.	.	.
77 *Pavona venosa* Ehr. var *arbuscula* nov. var.	.	.	×	.	.	.	.	.	.	.	.
78 *Psammocora contigua* (Esper)	×	.	.	.	.	.	.	.	+	.	+
79 *Psammocora exesa* Dana	.	.	.	×	.	.	.	+	.	.	.

List of Corals from the Bay of Batavia.	Distribution according to Facies (See text)						Geographic Distribution				
	I	II	III	IV	V	VI	Cocos-Keeling	Amboina	Togian	Murray Island	Samoa
80 *Psammocora haimeana* E.H.	·	·	·	·	·	×	+	·	·	·	·
81 *Psammocora folium* nov. spec.	·	·	×	·	·	·	·	·	·	·	·
82 *Coeloseris mayeri* Vaughan	·	·	·	×	·	·	·	·	+	+	·
83 *Astreopora myriophthalma* (Lam.)	·	·	·	×	·	·	+	·	+	·	·
84 *Turbinaria crater* (Pallas)	·	·	·	×	·	·	·	+	·	·	·
85 *Turbinaria peltata* (Esper)	·	·	·	×	·	·	·	+	·	·	·
86 *Montipora ramosa* Bernard	×	(×)	·	·	·	·	+	+	·	+	·
87 *Montipora foliosa* (Pallas)	·	(×)	×	×	·	·	+	+	·	·	·
88 *Montipora erythraea* von Marenzeller	·	·	×	·	·	·	·	·	·	·	·
Montipora spec. div.	·	·	·	·	·	·	·	·	·	·	·
Acropora; see monograph on this genus to be published by Dr Verwey	·	·	·	·	·	·	·	·	·	·	·
89 *Goniopora tenuidens* (Quelch)	×	·	·	×	·	·	·	+	+	+	·
90 *Goniopora columna* Dana	·	·	·	×	·	·	·	·	·	·	·
91 *Goniopora arbuscula* nov. spec.	·	·	×?	·	·	·	·	·	·	·	·
92 *Porites lutea* E.H.	×	×	×	×	·	×	·	+	·	+	+
93 *Porites andrewsi* Vaughan	×	·	×	·	·	×	·	·	·	+	+
Porites spec. div.	·	·	·	·	·	·	·	·	·	·	·
94 *Alveopora viridis* Quoy et Gaim	×	·	·	·	·	·	·	·	·	·	·
95 *Alveopora daedalea* (Forskål)	·	·	·	×	·	·	·	·	·	·	·
96 *Alveopora verrilliana* Dana	·	×	·	×	·	·	·	·	·	·	+
							22	38	48	29	25

SYSTEMATIC PART

I have followed the classification of Vaughan's (1918) which has also been used by Faustino, Hoffmeister, Yabe and other authors.

Only in a few respects I deviate from it. I am following Yabe c.s. in uniting *Mycedium* and *Oxyphyllia* with *Echinopora* in one familly Echinoporidae but I am placing *Tridacophyllia* and *Physophyllia* too in this same family as they seem closely allied to *Oxyphyllia* and *Mycedium*.

When studying two coral reef regions that are widely separate one is struck by the rather great number of identically the same forms. On the other hand it is difficult to recognize the limits between species and formae due to variability. Many authors have given their opinion on that problem. I will say only a few words about that question. It is my opinion that the number of coral „species" described up to now will steadely decrease when large suites of material will be studied, showing the variability of characters. All students on recent corals agree that Doederlein's

monographic treatise on the genus *Fungia* is an excellent and outstanding publication. However, even many of Doederlein's "species" had to be united when transitional forms were found in material studied afterwards by several authors. Thus it is now generally admitted that *Fungia concinna* and *F. repanda* are nothing but extremes in a fluctuating series. Biologically they belong to one and the same species in which still other "types" have to be united, e.g., *F. plana.*

In order to get conclusive evidence regarding the specific value of many vaguely defined "species" rearing experiments on reefs and in aquaria ought to be done on a large scale and extended over a period of many years under different conditions as to temperature, salinity, Ph, movement and silt contents of the seawater. Species which might be recommended for investigations of this kind are, e.g., *Seriatopora* spec. div., *Pocillopora verrucosa—P. elegans, Stylophora pistillata—St. mordax, Phyllangia pallida—Ph. fuscomarginata, Cyphastrea chalcidicum—C. seraila, Platygyra phrygia—P. gracilis, Symphyllia recta—S. radians—S. agaricia, Echinopora lamellosa—E. hirsutissima—E. gemmacea—E. horrida, Tridacophyllia* spec. div., *Fungia fungites—F. repanda, Fungia oahensis—F. scutaria —F. paumotensis, Halomitra robusta—H. irregularis, Pavona decussata— P. danai, Astreopora* spec. div., *Montipora foliosa—M. erythraea, Goniopora columna—G. planulata,* etc. etc.

It will be useful to any student intending to study living corals to make first "at home" a thorough systematic study of a large collection.

MADREPORARIA IMPERFORATA

Family SERIATOPORIDAE Milne Edwards et Haime

Genus **Seriatopora** Lamarck

Seriatopora hystrix Dana

1846 *Seriatopora hystrix* Dana, p. 521, pl. 19 fig. 3.
1907 *Seriatopora hystrix* Dana, Bedot, p. 154, pl. 7 fig. 18—22.
1918 *Seriatopora hystrix* Dana, Vaughan, p. 73, pl. 12 fig. 4, pl. 20 fig. 1.
1936 *Seriatopora hystrix* Dana, Yabe, Sugiyama and Eguchi, p. 12, pl. 1 fig. 1, 2.

The genus was founded by Lamarck (1816) and since that time more than twenty recent species have been described by Dana, Ehrenberg, Klunzinger, Studer, Thiel and Quelch.

A thorough monographic study of the genus with the aid of large suites of specimens and a restudy of the original type species is much desired.

I am convinced that the great number of "species" will then be reduced considerably. Many nova species has been created on one or a few specimens, even on worn-off branches only, and the type of the genus has not

even been figured or adequately described, as Vaughan pointed out already (1918, p. 73).

For the moment it is hardly possible to make a safe identification. Even when a coral corresponds exactly to an adequately described and figured species, the student has no certainty that the species name is correct.

The specimens from the Bay of Batavia correspond to the description and figures of Dana's type (cf. Vaughan, l.c.). It may be, however, that *hystrix* is a synonym of one of the older species names, of Ehrenberg's or Lamarck's. Thiel based four new species of *Seriatopora* on the shape of columella and septal arrangement and he gave as his opinion that these are different in calicular structure. I will say only that these are no good specific characters. Indeed, the calices of *S. leloupi* Thiel strongly resemble those figured by Bedot in his plate 7 fig. 22. Thiel's plate 1 fig. 3, named *S. leopoldi,* shows calices of the same type als figured by Bedot in his plate 7 fig. 21. Moreover, Bedot gives in his plate 7 fig. 20 an excellent figure of calices, which agree fairly well with Thiel's diagram (p. 16) of his *S. bandai.*

Now Bedot writes that his figures mentioned here are from one and the same colony! This shows at once that Thiel's "novae species" are no different and no valid species.

Seriatopora hystrix was found on the Bay of Batavia reefs in all different facies types with the exception of the *ramosa* facies.

Genus **Pocillopora** Lamarck

Pocillopora damicornis (Linné)

1925 *Pocillopora damicornis* (Linné); *damicornis* var. *bulbosa* (Ehr.); *damicornis* var. *cespitosa* (Dana), Hoffmeister, p. 15. pl. 1 fig. 1 (with synonyms).
1927 *Pocillopora damicornis* (Esper), Faustino, p. 102.
1928 *Pocillopora* cf. *bulbosa* Ehrenb., cf. *damicornis* (Linné), cf. *elegans* Dana, Umbgrove, p. 46, 47, 50.
1932 *Pocillopora damicornis* var. *bulbosa* (Ehr.), Thiel, p. 26, pl. 2 fig 2.
1936 *Pocillopora damicornis* Linné, *damicornis* var. *bulbosa* (Ehr.) and var. *cespitosa* (Dana), Yabe Sugiyama and Eguchi p. 12, 13 pl. 4 fig. 3—5, pl. 5 fig 3—4, pl. 7 fig 1, 2.

In my 1928 paper I mentioned the impossibility to distinguish *Pocillopora bulbosa, P. damicornis* and *P. elegans* as separate species when studying a large suite in loco. They form an intergrading series. Vaughan (1918, p. 75) was already of opinion that they might all belong to the same species. Then Hoffmeister paid attention to this question. He came to a similar opinion and distinguished *P. damicornis typica* and two varieties, var. *bulbosa* (Ehr.) and var. *cespitosa.* All the growth types to

which he refers occur in the *foliosa*-facies of the reefs in the Bay of Batavia.

Pocillopora verrucosa (Ellis et Solander)

1918 *Pocillopora verrucosa* (Ellis et Solander), Vaughan, p. 77, pl. 23 fig. 1, 2, 2a (with synonyms).
1927 *Pocillopora verrucosa* (Ellis et Solander), Faustino, p. 104, pl. 14 fig. 1.
? 1936 *Pocillopora verrucosa* (Ellis et Solander), Yabe, Sugiyama and Eguchi, p. 14, pl. 3, fig. 3, 4.

I collected an excellent specimen from the island Hoorn, North East side, a convex semiglobular growth with a diameter of 160 mm. Septa and columella are obsolete or inconspicuous. The distal parts of the branches show polygonal calices with thin walls; in the basal parts of the branches the calices are circular and more distant. Verrucae forming long thin protuberances.

It seems to me hardly possibly to consider *P. verrucosa* and *P. elegans* separate species. According to Vaughan *P. elegans* has relatively thin branches, small verrucae and the summits of adult branches are naked. At any rate they seem closely allied.

At the base of the corallum a few calices of *Phyllangia pallida* Klunzinger are attached.

Pocillopora eydouxi Milne Edwards

? 1846. *Pocillopora elongata* Dana,
1860. *Pocillopora eydouxi* Milne Edwards, p. 306, pl. F 4 fig. 1a—1c.
? 1897. *Pocillopora coronata* Gardiner, p. 949, pl. 56 fig. 4, 4a.
? 1897. *Pocillopora rugosa* Gardiner, p. 950, pl. 57 fig. 2.
1897. *Pocillopora grandis* Dana, var. Gardiner, p. 950, pl. 57 fig. 3.
1918. *Pocillopora eydouxi* M. E., Vaughan, p. 79, pl. 24 fig. 1, 2, 2a.
1925. *Pocillopora eydouxi* M. E., Hoffmeister, p. 18.
1928. *Pocillopora* cf. *eydouxi* M. E., Umbgrove, p. 47.
1932. *Pocillopora symmetrica* Thiel, p. 28, pl. 2 fig. 3.
1936. *Pocillopora* cf. *eydouxi* M. E., Yabe, Sugiyama and Eguchi, p. 13, pl. 2 fig. 5, pl. 4 fig. 2, pl. 6 fig. 4, 5, pl. 7 fig. 4, 6.
1936 *Pocillopora* cf. *modumanensis* Vaughan, Yabe, Sugiyama and Eguchi, p. 14, pl. 4 fig. 6, pl. 5 fig. 1.

I collected the species only as fragments in the shingle rampart of several islands. In some of these fragments the structure of calices and peritheca is well preserved. I compared them with an excellent suite from the Togian reefs. The specimens from both localities agree with the description of *P. grandis* Gardiner and the coral figured by Vaughan in his plate 24 fig. 2 and 2a. Thiel argued that Gardiner's and Vaughan's specimens are different from Milne Edwards' type by having directive septa which would be absent in the type of the species. I must, however, point out here the following statements: (1) in Vaughan's figure 2a and in Yabe's plate 7

fig. 4 and 5 calices with directive septa may be seen side by side of calices without directives, (2) the same is mentioned by Gardiner, (3) in the suite of Togian corals one and the same frond may show places where calices having directives are abundant, while these form the exception in other places, even both columella and septa being indistinct.

So even if the fragment figured by Milne Edwards shows no directives, there is no reason to consider it a different species.

The specimens figured by Yabe c.s. in their plate 6 fig. 4 and 5 and plate 7 fig. 4, 5 seem to belong to the present species. I am not certain that the other specimens figured by them actually belong to *P. eydouxi.*

Pocillopora woodjonesi and *P. modumanensis* seem closely allied or identical. The suite of corals studied by me is, however, not large enough to settle this question; there are no transitional forms.

Genus **Stylophora** Schweigger

Stylophora pistillata (Esper)

1907 *Stylophora digitata* (Pallas), Bedot, p. 147, pl. 5 fig. 4—7.
1918 *Stylophora pistillata* (Esper), Vaughan, p. 80, pl. 18 fig. 40, pl. 26 fig 1, 1a.
1927 *Stylophora pistillata* (Esper), Faustino, p. 87, pl. 10 fig. 1, 2 (with synonyms).
1932 *Stylophora pistillata* (Esper), Thiel, p. 32, pl. 3 fig. 2, 3.
1936 *Stylophora pistillata* (Esper), Yabe, Sugiyama and Eguchi, p. 15, pl. 3 fig. 1.

I found the species only as fragments in the shingle ramparts.

Stylophora mordax (Dana)

1846 *Sideropora mordax* Dana, p. 518, pl. 49 fig. 1, 1a—b.
1918 *Stylophora mordax* (Dana), Vaughan, p. 81, pl. 25 fig. 1—2b.
1936 *Stylophora mordax* (Dana), Yabe, Sugyiama and Eguchi, p. 15, pl. 3 fig. 2.

Specimens agreeing entirely with Vaughan's plate 25 fig. 2 were found in the *foliosa*-facies and in the luxuriant reef on the North-East-side of several islands. Moreover, I found the species on the South-Western-side of the island Edam (impoverished reef facies). A specimen is figured on plate 32 of my 1928 paper (lower row, second from the left).

Family ASTRANGIDAE Verrill

Genus **Phyllangia** Milne Edwards et Haime

Phyllangia pallida Klunzinger (Pl. I fig. 1, 2)

1879 *Phyllangia pallida* Klunzinger, p. 76, pl. 8 fig. 17, pl. 10 fig. 16

I found the species grown on corals from (1) the thriving reef (2) the *foliosa* facies (3) on coral shingle in the Rhodophyceae-facies (Pl. I fig. 1, 2). The corallites are scattered irregularly, occasionally growing next to each other, in places being separated 2 to 10 mm or more.

The corallites vary from 2 to 6 mm in heigth. Calices circular exceptionally oval with a diameter from 2 up to 4 mm and 1 to 2 mm deep. Apparently the specimens are not full-grown, as Klunzinger mentions larger dimensions. In larger calices 36 up to 44 septa occur. Septa exsert. Septal margins and faces finely granulate. The arrangement of paliform lobes and columella is illustrated by Pl. I fig. 2. Septocostae distinct and granulate.

The shape of the corallites is varying; some being cylindrical, others being narrower at the top than at the base, exceptionally a corallite being narrower at the base than at the top.

I feel doubtful whether *Ph. fuscomarginata* is a different species. My suite of specimens is, however, not large enough to settle this question. Anyhow, the 16 specimens I studied most resemble *Ph. pallida.*

Family EUSMILIIDAE

Genus **Simplastrea** nov. gen.

Corallites separated by a vesicular coenenchyma. Septa extending outside the calicular walls to meet either a septocosta of an adjacent corallite or a lamen of the choenenchyma. Corallite walls formed by vertical lamina of the coenenchyma and of a discontinuous broken appearance. Septal edges subentire. Columella trabecular. Dissepimenta present, no synapticulae.

The coral seems close to *Physogyra* from which it may be distinguished especially by the occurence of a kind of pseudo-corallite walls.

Type species: *Simplastrea vesicularis.*

Simplastrea vesicularis nov. spec. (Pl. I fig. 3—5).

The following description is based on the sole fragment (measuring 50 by 35 mm) of an apparently large colony, collected by Dr Verwey on the reef East of the Island Onrust.

Although it is not a complete colony a description of the species seems justified as the structure of the coral is very characteristical and is well established even in this fragment.

The coral is lightly built, all structural elements being very thin. Surface of corallum applanate. Corallites circular with a diameter of 3 mm or irregularly elongate with a diameter of 3 by 4 up to 5 mm separated by a vesicular coenenchyma. Corallites 1 mm distant or less, encircled by a thin wall. Calices with 12 up to 18 septa, the first two orders and most septa of the third order reaching the calicular centre and uniting to form a small trabecular pseudocolumella.

Deep in the calices an alternating cycle of very short to rudimentary septa is present.

Inside the wall the septal edges extend nearly horizontally over a distance of 1 to 1.5 mm, then they drop nearly vertically towards the pseudocolumella which is situated about 1 to 2 mm deep. The horizontal part of the septal edge is subentire, the vertical part bears delicate sharp dentations. Septal faces smooth. Dissepimenta occur at distances of 1 to 2 mm. Septa slightly exsert and extending outside the calicular walls, meeting either the septocostae of a neighbouring corallite or meeting a lamen of the coenenchyma. Coenenchyma consisting of vertical lamina and horizontal dissepimenta convex towards upper surface of corallum, thus giving origin to a kind of rather large vesiculae (see plate I fig. 3 which is a photograph of the lower broken off part of the coral). Vesicular structure open on upper surface of corallum.

Especially on the upper surface of the corallum the corallite walls have a discontinuous more or less broken appearance. As a matter of fact the corallite walls are a kind of pseudo-walls formed by vertical laminae of the coenenchyma. Some corallites are even not entirely encircled by vertical lamina, a few interseptal loculi being in open connection with a vesicle. This is well illustrated by plate I fig. 5.

Family TRACHYPHYLLIDAE Yabe, Sugiyama et Eguchi

Genus **Caulastrea** Dana

Caulastrea tumida Matthai (Pl. II fig. 1).

1928 *Caulastrea tumida* Matthai p. 275, pl. 72 fig. 5—6.
1936 *Caulastrea tumida* Matthai, Yabe, Sugiyama and Eguchi, p. 19, pl. 10 fig. 6, 7, pl. 13 fig. 1—2.

There is only one specimen, collected by Dr Verwey in the moat of the island Hoorn.

Family ORBICELLIDAE Vaughan

Genus **Cyphastrea** Milne Edwards et Haime

Cyphastrea microphthalma (Lamarck)

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

The species seems characterized by the constant occurrence of ten septa meeting the columella. It occurs rather abundant on the reefs on the East side of the islands.

Cyphastrea chalcidicum Klunzinger

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

Of frequent occurrence as loose balls on the sandy bottom, Southwest of the Islands (impoverished reef facies). Good specimens are in the Rijksmuseum van Natuurlijke Historie at Leiden.

Cyphastrea seraila (Forskål)

For synonyms see Yabe c.s., 1936, p. 24 and Matthai, 1914, p. 39.

The species was found only in undeep water on the sandy bottom of the South-Western slope of the islands (impoverished reef facies). It forms loose balls or elongated masses, with a diameter of 120 mm or so, completely covered with crowded and evenly distributed corallites. The calices have a diameter of usually 1.5 mm and are 1 mm deep. Corallites 1 to 2 mm apart sligthly projecting or walls not at all elevated. Septa slightly exsert, with short teeth. Septal faces spinulate. Septa in three cycles, twelve septa meeting the columella. Costae not prominent. Columella finely trabecular. Peritheca rather dense with thin vesicles and low scattered spines.

I found the species also on the slopes of Krakatoa and Lang Island (Strait Sunda), grown on boulders where it had to suffer constantly from rolling by the surf. It was there one of the few corals able to live in such bad circumstances.

Genus **Leptastrea** Milne Edwards et Haime

Leptastrea purpurea (Dana)

For synonyms see Yabe c.s., 1936, p. 26.

The species was found in the moat of several islands and on the shallow sandy bottom along the South-Western slope of the island Hoorn (Pulu Ajer Besar). The specimens are massive colonies of irregular rounded or elongated shape, with a larger diameter of about 100—120 mm. They seem not attached to other corals, but they are lying as loose balls on the sandy bottom and are around bearing calices. However, it may be that the coral originally started growing on a fragment of dead coral or a shell. The inner margins of the septa are perpendicular, the outer margins are slightly exsert. No degeneration of septa occurs as described by Crossland in specimens from Tahiti (Proc. Zool. Soc. London, 1931).

Genus **Galaxea** Oken

Galaxea fascicularis (Linné)

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

Large colonies are growing on the East side of the reefs. Small specimens occurring on the North-Western upper slope of the shingle ramparts (*foliosa*-facies) were exceptionally found on the island Hoorn (Pulu Ajer Besar).

Galaxea clavus (Dana)

1928 *Galaxea clavus* (Dana), Vaughan, p. 99, pl. 33 fig. 1 (with synonymy).
1927 *Galaxea clavus* (Dana), Faustino, p. 126, pl. 23 fig. 1—2.
1932 *Galaxea musicalis* (Lin.), Thiel, p. 48, pl. 2 fig. 4, 5.
1936 *Galaxea musicalis* (Lin.), Yabe, Sugiyama and Eguchi, p. 27, pl. 9 fig. 2.

Columnar branches of large colonies growing in the luxuriant reef are a common appearance on the shingle ramparts. I figured one on plate 32 of my 1928 paper. On the other hand smaller, globose growth types were collected from the Rhodophyceae-zone and from the *foliosa*-facies of several islands in the Bay.

Family FAVIIDAE Gregory

Genus **Favia** Oken

Favia speciosa (Dana)

1918 *Favia speciosa* (Dana), Vaughan, p. 103, pl. 36, 37 (with synonymy).
1927 *Favia speciosa* (Dana), Faustino, p. 130, pl. 25, 26.
1936 *Favia speciosa* (Dana), Yabe, Sugiyama and Eguchi, p. 28, pl. 20 fig. 7; pl. 23 fig. 1.

The species was found in the *foliosa*-facies and in deeper water East of the islands. It grows as convex colonies and not seldom in the shape of a micro-atol. Most specimens have calices of the *pandanus*-type.

Favia pallida (Dana)

For synonymy see Vaughan, 1918, p. 105 and Yabe c.s., 1936, p. 29.

The species has a wide distribution on the reefs in the Bay of Batavia and may be found in every part of the reef, even on the sandy bottom of the moat.

I noticed that specimens occurring in that area (*ramosa*-facies) have deep calices (up to 6 mm) and the margins of the calices are not elevated, agreeing with the type named "facies 6" by Vaughan. *F. pallida* flourishes on the North-Western parts of the shingle rampart (*foliosa*-facies). All specimens which I referred to *F. pallida* show unequal fission by a partition growing across the calice passing outside the columellar area.

Favia stelligera (Dana)

1936 *Favia stelligera* (Dana), Yabe, Sugiyama and Eguchi, p. 29 (for synonyms see also Vaughan, 1918, p. 101).

I studied a single specimen, collected by Dr Verwey on the reef along the Western shore of the island Edam, agreeing entirely with those described by previous authors.

Favia (Phymastraea) valenciennesii M. Edwards et Haime (Pl. II fig. 2)

1928 *Favia* cf. *rotulosa* Ellis et Solander, Umbgrove, p. 46, 48, pl. 33.
1936 *Phymastraea valenciennesii* E. H., Yabe, Sugiyama and Eguchi, p. 31, pl. 23 fig. 3—5, pl. 24 fig. 5.

In the Bay of Batavia many specimens of typical *Favia pallida* were collected. However, at the Western beach of the island Kerkhof (Pulu Kelor) I collected a remarkable *Favia,* grown on one of the bricks that are lying scattered around the old ruin on that island (see plate 19 and 20 of my 1928 paper). The calices are separated on the surface by deep inter-corallite grooves. I referred this specimen to Lamarck's *Favia rotulosa* (as figured by Matthai, 1914, pl. 32, fig. 4), a species that was referred by Matthai to *Favia doreyensis* E. H., which is a synonym of *Favia pallida* (Dana), according to Vaughan (1918, p. 105). The reason for doing so was especially the fact that in some of the calices marginal fission occurs by a partition passing outside the columellar area as is typical in *F. pallida* (cf. Vaughan, 1918, p. 101). This feature, shown by plate II fig. 2 occurs, however, also in a coral figured by Matthai in his plate 24 fig. 1 and called by him *Favia bertholletti* (= *F. valenciennesii*). The specimen from the Bay of Batavia almost identically resembles the coral named *F. valenciennesii* by Yabe c.s. and figured in their plate 24 fig. 5 (and plate 23 fig. 3—5). Although I am not fully convinced that the specific name is the right one, I am now referring my specimen to *F. valenciennesii.* The question whether this species is valid can be settled only on a larger suite of specimens than are at my disposal. Moreover attention should be given to it when studying the living corals in situ.

Genus **Favites** Link

Favites abdita (Ellis et Solander)

For synonyms see Vaughan, 1918 and Yabe c.s., 1936, p. 31.

I noticed the species on the thriving reef, where it is of common appearance and exceptionally in the moat. I figured a specimen in my 1928 paper on plate 32, second row, 3rd from the left.

Favites flexuosa (Dana)

1846 *Astraea flexuosa* Dana, p. 227, pl. 11 fig. 6, 6a—c.
1918 *Favites abdita* (Ellis et Solander), Vaughan p. 109, pl. 40 fig. 2 (non pl. 40 fig. 1, 3, 4, 5).
1936 *Favites flexuosa* (Dana), Yabe, Sugiyama and Eguchi, p. 32, pl. 20 fig. 1.

I agree with Yabe in not uniting *Favites flexuosa* and *Favites abdita* in one species. As a matter of fact the two species seem closely allied, but *Favites flexuosa* may be easily distinguished by its much larger and rounded calices. I collected a large colony on the Togian reefs, the diameter of the calices is from 10 up to 25 mm, average 20 mm. I am not giving new illustrations as the specimen from Togian corresponds in every detail to the specimen figured by Yabe. It seems to me that *Favites virens* is also an allied species.

Dr Verwey collected a hemispherical growth, with a diameter of 145 mm, in the moat of the island Hoorn.

Favites favosa (Ellis et Solander)

1914 *Favites favosa* (Ellis et Solander), Matthai, p. 112, pl. 28 fig. 2 (with synonymy).
1936 *Favites favosa* (Ellis et Solander), Yabe, Sugiyama and Eguchi, p. 32 (with synonymy).

One hemispherical growth with a larger diameter of 135 mm collected by Dr Verwey on the Eastern side of Onrust. Many calices show marginal fission. A detailed description and new figures seem unnecessary; the more so as I will figure a specimen in my paper on the corals of the Togian reefs.

Favites pentagona (Esper) (Pl. III fig. 1, 2)

1918 *Favites pentagona* (Esper) Vaughan, p. 112, pl. 42 fig. 1, 2 (with synonymy).
1936 *Favites pentagona* (Esper), Yabe, Sugiyama and Eguchi, p. 32, pl. 24 fig. 1, 2.

The species is well illustrated by Vaughan and by Yabe. The present specimen is remarkable for its growth type, being a vertical irregularly branched and in places coalescent growth, 250 mm high. Part of it is figured in plate III fig. 2. The coral was collected East of Onrust by Dr Verwey.

Favites virens (Dana)

1918 *Favites virens* (Dana), Vaughan, p. 111, pl. 41 fig. 4, 5 (with synonymy).
1927 *Favites virens* (Dana), Faustino, p. 137, pl. 28 fig. 2.
1936 *Favites virens* (Dana), Yabe, Sugiyama and Eguchi, p. 33, pl. 19 fig. 8, 9.
1936 *Acanthastrea* cf. *echinata* (Dana), Yabe, Sugiyama and Eguchi, p. 47, pl. 34 fig. 1.

Three good specimens, collected by Dr Verwey on the Western and Northwestern reef of Onrust.

There is also a specimen from the same locality labelled by Dr Verwey: "*Favia hirsuta* E. H.". It corresponds exactly with the coral figured by Yabe c. s. in their plate 34 fig. 1 and designed: "*Acanthastrea* cf. *echinata* (Dana)".

I believe, however, that these corals too belong to *Favites virens,* differing from the specimens mentioned above only by coarser spinulose dentations of the septa and septal edges.

The septa are not or only slightly thickened in the walls as seems characteristic in *Acanthastrea echinata,* though I must say that this feature is wanting too in some calices of the specimen figured by Matthai (1914, pl. 24 fig. 8).

In future investigations on a larger suite than is available to me, attention should be given to the possibility that *Favites virens* and *Acanthastrea echinata* are nothing but extremes in a continuous series of forms.

Favites aspera (Verrill) Pl. III fig. 3, Pl. V fig. 1)

1865 *Goniastrea aspera* Verrill, Proc. Essex Instit., vol. 4, p. 32.
1927 *Goniastrea aspera* Verrill, Faustino, p. 141, pl. 33 fig. 1 and 2.
1936 *Goniastrea aspera* Verrill, Yabe, Sugiyama and Eguchi, p. 35, pl. 24 fig. 3.

The coral described below has puzzled me for a long time. The habitus of the calices reminds *Coeloria,* but many calices exhibit unequal fission of a type which is characteristic in *Favites.*

From a careful comparison with Verrill's description of *Goniastrea aspera* I am convinced that the present specimen belongs to this species. I believe that Faustino and Yabe referred the species to *Goniastrea* because they were dealing with specimens which were not in a period of strong fissiparity. As a matter of fact that seems to me the difference from the Batavian coral.

The following is a description of the specimen from the island Kerkhof (Pulu Kelor) in the Bay of Batavia, where it was living on the Northern part of the shingle rampart (*foliosa*-facies).

Corallum massive hemispherical, grown on a dead piece of coral. Corallites deep (except those along the margin), polygonal, separated by very thin walls. Diameter of average-sized non-dividing calices 5 to 8 mm; larger elongate, dividing calices up to 11 mm. Depth of fossa in calices on convex upper part of corallum 5 to 8 mm, average 6 mm. Septa roughly and irregularly dentate; teeth mostly directed upward and with narrow paliform lobes. Septa with slightly exsert dentated edges, dipping almost perpendicularly towards calicular fossa. Septa of adjacent corallites usually opposed, exceptionally alternating. In average sized calices 10 to

14, usually 12 septa reach the columella and 6 nearly reach the columella; moreover a cycle of rudimentary septa present. Columella fully developed, trabecular. Asexual reproduction in some calices by subequal, but in most calices by unequal fission.

Favites yamanarii Yabe et Sugiyama (Pl. IV fig. 1)

1936 *Favites yamanarii* Yabe et Sugiyama, p. 33, pl. 19 fig. 10.

Pl. IV fig. 1 shows a specimen from the island Edam. In the Rijksmuseum van Natuurlijke Historie there are three specimens collected by Dr Verwey (1 in the moat of Edam, 2 Onrust North, 3 Onrust East) showing shallow calices and a rudimentary cycle of septa along the margins of the calices, but soon disappearing deeper in the calices. These corals are intermediate between the present species and the variety described below. Some rudimentary septa occur also in a few calices figured in plate IV fig. 1; they are very rare in the type specimen figured by Yabe.

Favites yamanarii Yabe et Sugiyama var. **profunda** nov. var. (Pl. IV fig. 2—4)

Corallum massive rounded or hemispherical. Corallites pentagonal or hexagonal; elongated polygonal in marginal parts. Intercalicinal walls thin with acute edges. Fullgrown single calices 6 up to 12 mm in diameter, average 10 mm. Calices deep, up to 8 mm. Calices deepest in convex part of the colony. Towards edges calices are shallower and intercorallite walls slightly thicker. Asexual reproduction by marginal fission. In average sized calices 16 to 22 septa reach the columella and 3 to 6 nearly reach the columella. Moreover 18 to 24 short to rudimentary septa occur along the upper margin of the calice. Larger septa of equal thinness; edges not continuous over intercorallite walls. Septa of adjacent calices alternating; only occasionally larger septa are opposite a rudimentary one. Septal margins falling steeply to the bottom of the fossa; they bear small but distinct acute teeth and are finely serrate. Paliform lobes feebly developed in a few calices, absent in most calices. Septal faces with very small granulations. Columella deep, consisting of twisted trabeculae. Dissepimenta, not visible in calices, appear in vertical section of coral at regular distances of about 1 mm.

The coral strongly resembles *Favites yamanarii* Yabe and Sugiyama. However, *F. yamanarii typica* is different (1) by the absence of a complete cycle of rudimentary septa, (2) by thicker intercalicular walls, (3) by shallower calices.

I collected *Favites yamanarii* var. *profunda* also on the Togian reefs, where *F. yamanarii typica* seems absent.

I am giving an illustration of a specimen from the moat of Enkhuizen, which is grown in the shape of a micro-atol. There is a good specimen in the Rijksmuseum van Natuurlijke Historie at Leiden, collected by Dr Verwey in the moat of the island Hoorn. Pl. IV fig. 3 and fig. 4 are specimens from Togian.

Genus **Goniastrea** Milne Edwards et Haime

Goniastrea retiformis (Lamarck)

For synonyms see Yabe c.s., 1936, p. 34 (*G. retiformis* and *G. parvistella*).

I agree with Hoffmeister (1925, p. 26) that *G. parvistella* should be placed among the synonyms of *G. retiformis*. I will describe transitional forms from the Togian reefs.

The species may easily be found in the shingle ramparts and occurs living on the reefs along the East and North-East sides of the islands.

Goniastrea hombroni (Rousseau)

1914 *Favia hombroni* (Rousseau), Matthai, p. 107, pl. 26 fig. 1 and 2, pl. 33 fig. 2 (with synonymy).
1918 *Goniastrea hombroni* (Rousseau), Vaughan, 1918, p. 100.

One specimen from the shingle rampart of the island Purmerend (Pulu Sakit). Dimensions of calices, irregular arrangement of septa, thickness of walls and the rudimentary columella formed of a few trabeculae from the septa agree in every respect with Matthai's description. The specimen resembles Matthai's plate 26 fig. 2 so entirely that it seems unnecessary to give a new illustration.

Goniastrea pectinata (Ehrenberg)

1918 *Goniastrea pectinata* (Ehrenberg), Vaughan, p. 114, pl. 15 fig. 21—23, pl. 42 fig. 3, 4, pl. 43.
1925 *Goniastrea pectinata* (Ehrenberg), Hoffmeister, p. 26.
1927 *Goniastrea pectinata* (Ehrenberg), Faustino, p. 140, pl. 32 fig. 1—2.
1932 *Goniastrea pectinata* (Ehrenberg), Thiel, p. 53, pl. 5 fig. 3, 4.
? 1936 *Goniastrea pectinata* (Ehrenberg), Yabe, Sugiyama and Eguchi, p. 34, pl. 23 fig. 2 (?), pl. 24 fig. 4 (?).
? 1936 *Goniastrea* cf. *planulata* E.H., Yabe, Sugiyama and Eguchi, pl. 25 fig. 1—2.

Although the species is not a common one in the Bay of Batavia, specimens were collected in all facies types, the impoverished reef facies excepted.

Genus **Coeloria** Milne Edwards et Haime

Coeloria rustica (Dana)

1928 *Maeandra daedalea* (Ellis et Solander), Umbgrove, p. 46, pl. 32.
1928 *Coeloria daedalea* (Ellis et Solander), Matthai, p. 24, pl. 3 (with synonymy).
1936 *Coeloria rustica* (Dana), Wells, p. 104.
1936 *Coeloria rustica* (Dana), Yabe, Sugiyama and Eguchi, p. 36, pl. 21 fig. 4—10.

The species occurs abundantly in the thriving reef and also in the *foliosa*-facies. Specimens which are typical *C. daedalea* auctorum grow side by side of specimens of the *C. sinensis* type in which no elongated or maeandering calices are present. In their marginal parts most colonies show calices of a type which is characteristical for *C. astreiformis,* though larger and not so deep as in that species. In a large colony, which I collected on the reef East of the island Leiden the *astreiformis* type of calices occurs even on a comparatively large area upwards from the margin of the corallum. For the greater part, however, the coral has calices of the *rustica* type.

Coeloria lamellina (Ehrenberg)

1928 *Maeandra lamellina* (Ehrenb.), Umbgrove, p. 49, pl. 32, middle of second row.
1928 *Coeloria lamellina* (Ehrenb.), Matthai, p. 37 and plates (with synonymy).
1936 *Coeloria lamellina* (Ehrenb.), Yabe, Sugiyama and Eguchi, p. 36, pl. 16 fig. 1, pl. 21 fig. 3, pl. 25 fig. 4, 5.

In deeper water East of the island Hoorn I collected a splendid semiglobular growth, showing very long sinuous valleys. It occurs also on the sandy bottom Southwest of the islands (impoverished reef-facies). Identification is based on the description and figures of Vaughan's (1918, p. 119, pl. 45 fig. 2) and Matthai's.

Genus **Platygyra** Ehrenberg

Platygyra phrygia (Ellis et Solander)

For synonyms see Matthai, 1928, p. 112.

Since, in 1928, I mentioned the species only as fragments from the shingle rampart of many islands, I found the coral living on the reef on the Northern side of the island Hoorn (Pulu Ajer Besar). A semiglobular growth of 100 mm diameter, with strongly winding collines. Collines on upper part of corallum very thin and high.

Genus **Hydnophora** Fischer de Waldheim

Hydnophora exesa (Pallas)

For synonyms see Matthai, 1928, p. 140 and Yabe c.s., 1936, p. 39.

The species is a common one on the reefs in the Bay of Batavia. It grows along the outer slopes of the shingle-ramparts (Rhodophyceae facies), in the *foliosa* facies and in deeper water of the thriving reef.

Hydnophora microconos (Lamarck)

For synonyms see Matthai, 1928, p. 144 and Yabe c.s., 1936, p. 40.

No living specimens were studied, but fragments of this characteristic species are not rare in the shingle ramparts.

Hydnophora grandis Gardiner

1904 *Hydrophora grandis* Gardiner, p. 764, pl. LX fig. 11.
1928 *Hydnophora grandis* Gardiner, Matthai p. 150 pl. 2 fig. 10—13, pl. 47 fig. 3.
1936 *Hydnophora grandis* Gardiner, Yabe, Sugiyama and Eguchi, pl. 30 fig. 3—4.

Specimens, corresponding in every respect with the original description of Gardiner's were collected from the island Leiden (Pulu Njamuk). Moreover I collected from the shingle-rampart of the island Leiden a fragment, showing a similar structure but a different growth shape. In this fragment the calicular surface rises into a pillar of irregular shape.

Hydnophora contignatio (Forskål) (Pl. V fig. 3)

1928 *Hydnophora contignatio* (Forskål), Matthai, p. 155, pl. 15 fig. 3, pl. 17 fig. 7—9, pl. 18 fig. 1—3, pl. 46 fig. 2 (with synonymy).

I refer to this species one specimen collected by Dr Verwey and labelled by him: „*Hydnophora ehrenbergi* E. H., Onrust, East, colour of coral when living a pale greyish green". I agree with his identification, but *H. ehrenbergi* is now placed among the synonyms of *H. contignatio*. A full description seems unnecessary. I will only say that the columella is very rudimentary in this specimen.

Hydnophora rigida (Dana)

For synonyms see Matthai, 1928, p. 157 and Yabe c.s., 1936, p. 40.

Dr Verwey collected good specimens on the reefs along the East side of the island Onrust and the North side of the island Hoorn. I compared them with an excellent suite from the Togian islands.

Hydnophora cf. **mayori** Hoffmeister (Pl. VI fig. 1)

1925 *Hydnophora mayori* Hoffmeister, p. 30, pl. 2 fig. 2a, 2b.

The corallum has slender branches and is ramose, divided and coalescent. Though the habitus of the colony as a whole seems rather widely branched, parts of it show the branches closely crowded (Pl. VI fig. 1). The whole cluster is 11 cm high. The branches are from 6 to 9 mm thick. The character of the septa and monticules is as described by Hoffmeister, with the exception of the serrations of the septal edges being rather unpronounced. The septa are very prominent, long and sloping obliquely on the tops of the branchlets, and comparatively short on the more proximal parts of the branches. Though conical monticules of the *H. rigida* type occur, the monticules in this specimen are mostly elongated and occur in linear arrangement, causing an angular appearance of the branches reminding *Merulina laxa* Dana. Matthai (1928, p. 140) mentioned Hoffmeister's species among the synonyms of *H. exesa* (Pallas) but he expressed his doubts in placing it there. I am, however, inclined to believe that *H. mayori* is a valid species. *Hydnophora composita* (Rehberg) seems close and may prove to be identical (compare notes and figures by Rehberg and by Matthai p. 139, 140, plate 72). In that case *H. mayori* ought to be placed among the synonyms of *H. composita*. My specimen is from the island Leiden (Pulu Njamuk) where I collected it in the *foliosa*-facies on the N. side of the reef.

Genus **Merulina** Ehrenberg

Merulina ampliata (Ellis et Solander)

1786 *Madrepora ampliata* Ellis and Solander, Nat. Hist. Zooph., p. 157, pl. 41 fig. 1 and 2.
1928 *Merulina ampliata* (Ellis et Solander) Matthai, p. 127, pl. 13 fig. 1—8, pl. 59 fig. 3—4, pl. 67 fig. 3 (with synonymy).
1932 *Merulina ampliata* (Ellis et Solander) Thiel, p. 58, pl. 7 fig. 1, 2 and 3 a-e.
1936 *Merulina ampliata* (Ellis et Solander) Yabe, Sugiyama and Eguchi, p. 41, pl. 29 fig. 3, pl. 51 fig. 6.

My material from the East Indies, including specimens from Timor (coll. Dr G. A. F. Molengraaff), the Bay of Batavia, the Thousand Islands (coll. Dr J. Verwey), Singapore and the Togian islands give support to the opinion of Matthai's, viz., that gradations exist between *Merulina vaughani* Van der Horst with rounded collines and the sharp ridged collines of *M. ampliata* as originally described by Ellis and Solander. As a matter of fact there are in my collection extremely thin lamina with very thin acute collines from Pantjalirang Ketjil (Thousand Islands, Java Sea) and the island Hoorn (Pulu Ajer Besar, Bay of Batavia). My

specimens from Togian have slightly thicker and slightly rounded collines. In a specimen, which I collected on the island Leiden (Pulu Njamuk, Bay of Batavia) the collines are still more rounded, but separated by rather broad valleys. However, the specimens from Singapore and from Timor have collines of the rounded type and narrow valleys of the *M. vaughani* type. The thin lamina are strongly perforate, the thicker ones have fewer perforations and I have one large lamen of the island Leiden, which in places is nearly 10 mm thick and is nearly imperforate. All specimens show crests of a twisted and foliate appearance, which I consider characteristic of *M. ampliata* (see my description of *M. scabricula* from the Togian islands).

Merulina laxa Dana(Pl. VI fig. 2)

1846 *Merulina laxa* Dana, U.S. Explor. Exp. VIII, p. 276, pl. 16 fig. 3.
1928 *Merulina laxa* Dana, Matthai, p. 135 (with synonymy).
1936 *Merulina laxa* Dana, Yabe, Sugiyama and Eguchi, p. 41, pl. 16 fig. 10, pl. 27 fig. 3, 4.

From the island Schiedam (Pulu Gosong) I collected two small specimens, which are typical representatives of this species. Faustino has given a good illustration of a small branch, and Yabe published an excellent photograph of a large colony, showing the remarkable growth shape of this species.

Genus **Scapophyllia** Milne Edwards et Haime

Scapophyllia cylindrica Edwards et Haime (Pl. V fig. 2)

1848 *Scapophyllia cylindrica* Milne Edwards et Haime, Ann. Sci. Nat. (3), vol. XI, p. 278, vol. X, pl. 8 fig. 8, 8a.
1928 *Scapophyllia cylindrica,* Matthai, p. 260, pl. 14 fig. 24, pl. 51 fig. 2 (with synonymy).
1936 *Scapophyllia cylindrica,* Yabe, Sugiyama and Eguchi, p. 42, pl. 26 fig. 1, 2.

On the shingle rampart of the island Kerkhof (Pulu Kelor) I found a well preserved fragment of a large colony, which apparently had the same growth type as the type specimen of Edwards and Haime and as the large colonies figured by Matthai and by Yabe. The specimen from the Bay of Batavia corresponds exactly to Matthai's description of the structure of the septa, columella and collines.

Family MUSSIDAE Verrill

Genus **Lobophyllia** de Blainville

Lobophyllia corymbosa (Forskål)

1928 *Lobophyllia corymbosa* (Forskål), Matthai, p. 210, pl. 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.

The species was found living in the moat of the island Hoorn (Pulu Ajer Besar) and Dr J. Verwey found enormous colonies on the reef East of the island Onrust.

Originally I found only strongly worn-off fragments of this species in the shingle rampart of most of the islands in the Bay of Batavia. I erroneously supposed these to be fragments of *Euphyllia glabrescens.* Under that name they are mentioned in my provisional list of the coral fauna (1928, p. 46, 48 and 54). Afterwards I found specimens with well preserved calices and by careful comparison I now am convinced that the widely distributed fragments in the shingle ramparts belong to *Lobophyllia corymbosa.*

Up to now *Euphyllia* is not yet found in the Bay of Batavia.

Lobophyllia costata (Dana)

1928 *Mussa sinuosa* (Lam.), Umbgrove, p. 46.
1928 *Lobophyllia costata* (Dana), Matthai, p. 216, pl. 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.

Some well preserved specimens were found in the shingle ramparts of the islands Leiden and Kerkhof.

Genus **Symphyllia** Milne Edwards et Haime

Symphyllia recta (Dana)

1928 *Symphyllia nobilis* (Dana), Umbgrove, p. 49, pl. 32, second row 2d from the left.
1928 *Symphyllia recta* (Dana), Matthai, p. 227, pl. 30 fig. 1—6, pl. 31 fig. 1; pl. 48 fig. 4—6 (with synonymy).
1936 *Symphyllia recta* (Dana), Yabe, Sugiyama and Eguchi, p. 46, pl. 33 fig. 4.

This conspicuous coral occurs abundantly in deeper water on the reefs East of the islands. It was also met with in the *foliosa*-facies. Once, I found even a small colony in the moat of the island Haarlem(*ramosa*-facies).

Symphyllia radians E. H.

1928 *Symphyllia radians* E. H., Matthai p. 231, pl. 31 fig. 3, pl. 33 fig. 1, pl. 54 fig. 7, pl. 55 fig. 4, pl. 71 fig. 2 (with synonymy).
1936 *Symphyllia radians* E. H., Yabe, Sugiyama and Eguchi, p. 46, pl. 33, fig. 3.

One good specimen from the shingle rampart of the island Hoorn. Diameter 65 mm.

Family ECHINOPORIDAE Verrill

Genus **Echinopora** Lamarck

Echinopora lamellosa (Esper)

1914 *Echinopora lamellosa* (Esper), Matthai p. 50, pl. 8 fig. 6, pl. 14 fig. 2—6, pl. 15 fig. 1, pl. 16 fig. 6.
1918 *Echinopora lamellosa* (Esper), Vaughan, p. 97, pl. 32 fig. 1—1a, 2, 2a, 3.
1927 *Echinopora lamellosa* (Esper), Faustino, p. 122, pl. 21 fig. 4.
1928 *Echinopora lamellosa* (Esper), Boschma, p. 1—6, pl. 1.
1930 *Echinopora lamellosa* (Esper), Boschma and Verwey, p. 129—132, fig. 1—6.
1932 *Echinopora lamellosa* (Esper), Thiel, p. 40, pl. 3, fig. 1.
1936 *Echinopora lamellosa* (Esper), Yabe, Sugiyama and Eguchi p. 48, pl. 58, fig. 1.

Echinopora lamellosa is a common species on the reefs in the Bay of Batavia. I never found it on the sandy bottom of the moat (*ramosa*-facies) but it is abundant (1) in the flourishing reef on the N.E. side of the islands, (2) along the Northern parts of the shingle rampart (*foliosa*-facies), where it is one of the most occuring species and (3) even on the sandy bottom forming the South-Western slope of the islands (impoverished reef-facies).

The species has been the subject of a special study by Boschma and Verwey. These authors paid much attention to the unusual manner of budding resulting in a secondary layer of calices on the lower surface of a horizontal lamen. I collected specimens at the N.W. side of the island Hoorn (Pulu Ajer Besar) fully confirming the statements of Boschma and Verwey. One interesting specimen from that locality shows a horizontal lamen on which a number of smaller lamina have grown in a vertical direction. The vertical ones bear calices on either side. And the horizontal one demonstrates in an excellent way the formation of a secondary layer of calices by the lateral spreading and fusing of originally isolated stalked buds.

Echinopora gemmacea (Lamarck)

For synonyms see Matthai, 1914, p. 54.

On the reef of the island Schiedam (Pulu Gosong) I collected two specimens belonging to the present species. One specimen is a rather thin lamen, very thin at the margin, the other one is thicker, up to 12 mm. In places they are strongly echinulate resembling *E. hirsutissima,* but the peritheca being vesicular in other places the specimens must be referred to *E. gemmacea.* In both specimens calices occur on either side of the lamen. Corallites circular usually projecting up to 5 mm. Diameter of

calices usually 4 mm, 12 up to 18 septa reaching columella, quaternaries distinct in larger calices. Costal ridges connecting neighbouring corallites spinulate; developed only in distal part of lamen. Columella consisting of loosely twisted trabeculae, about one-third width of calice. I am not convinced that the coral named *E. gemmacea* by Thiel really belongs to this species. It seems to me that it may be a representative of a different genus.

Echinopora horrida Dana (Plate VII fig. 1, 2, Pl. VIII fig. 1, 2)

1846 *Echinopora horrida* Dana, p. 282, pl. 17 fig. 4.
1927 *Echinopora horrida* Dana, Faustino, p. 123, pl. 22 fig. 1 and 2.
1937 *Acanthelia horrida* (Dana), Wells, p. 73.

A large suite of branched *Echinopora*'s collected in the Bay of Batavia shows a considerable amount of variation in many characters. (1) The calices vary from shallow, almost flat up to strongly projecting, vertical, oblique or even curved tubes; (2) the corallites are crowded to widely separate; (3) intercorallite areas striate and covered with scattered spines or even devoid of spines to densely echinulate; (4) peritheca usually dense but in a few specimens vesicular in places; (5) growth type ramose, tortuous; branches occasionnally coalescing to many times coalescing and even giving origin in some places to a lamellose growth from which again tortuous branchlets originate; (6) 10 to 14, usually 12 septa reach the columella, which is formed of loosely twisted trabeculae; pali absent.

The range of variation mentioned may occur in one and the same specimen. I am figuring a few specimens to illustrate the statements given above. I am not convinced that *Echinopora lamellosa, hirsutissima* and *gemmacea* as defined by Matthai (1914) may be considered different and true separate species, but if they are it seems to me that the branched type described here is closely allied to *E. gemmacea.*

It may be that it is nothing but a variety or a growth form of that species. Since I have no convincing proof for this opinion I maintain the name *E. horrida* Dana. As a matter of fact Milne Edwards and Haime supposed *E. horrida* to be a dendroid variety of *E. hirsutissima;* and Matthai considered it a variety of *E. lamellosa.* The question can be settled only by growth experiments on the living reef. I collected no specimens resembling *Echinopora fructiculosa* Ehrb. as figured by Klunzinger in his plate 6 fig. 4 and by Crossland (Proc. Zool. Soc. London, 1935, pl. III); all the specimens from the Bay of Batavia having branchlets with a laciniate and alate apex.

From the facts mentioned here it is evident that there is no reason to follow Wells in his instituting a new generic name for *E. horrida.*

I collected the species on several islands in the Bay of Batavia, where it may be found along the S. W. side of the island on a sandy bottom (impoverished reef facies); Dr Verwey collected the species on the reef of Pulu Belanda (Thousand Islands, Java Sea) and it is also a common species; on the Togian reefs (Northern Celebes); it was mentioned moreover from the Central Philippines and from the Fiji Islands.

Genus **Mycedium** Oken

Mycedium tubifex (Dana) var. **bifrons** nov. var. (Pl. IX fig. 1, 2)

I collected only one fragment of a large folium from the shingle-rampart of the island Leiden (Pulu Njamuk). Although the specimen is rather worn-off, there are still sufficient details left to give a full description.

The lamen, being a distant part of a large corallum, has a thickness of about 20 mm at the proximal end gradually becoming thinner, to 1 mm at the outer margin. Calices inclined, shallow, not surrounded by a distinct wall, irregularly scattered on either side of the lamen. Proximal parts of calicular margin slightly elevated. In full grown calices 12 prominent septo-costae radiate from the calicular centre. Septo-costae almost smooth, only in places slightly denticulate. Septo-costae alternately strong and thin or subequal. The worn-off parts of the corallum show the strongly dissepimental structure of the lamen. Columella small, trabecular.

The structure of this coral agrees very well with *Mycedium tubifex* (Dana). The occurence of calices on either side of the folium induces me to consider it a variety of this species.

Genus **Oxyphyllia** Yabe et Eguchi

Oxyphyllia aspera (Ellis et Solander) (Pl. X fig. 1, 2)

1936 *Oxyphyllia aspera* (Ellis et Solander), Yabe, Sugiyama and Eguchi, p. 50; pl. 36 fig. 1—4 (with synonyms).
1936 *Oxyphyllia aspera tosaensis* Yabe et Eguchi, p. 51, pl. 36 fig. 6.
1936 *Oxyphyllia aspera sugiyamai* Yabe et Eguchi, p. 51, pl. 38 fig. 5, 6.

This species shows a great deal of variation. In the Rijksmuseum van Natuurlijke Historie at Leiden is a specimen collected by Dr Verwey on the Northern reef of Onrust. On the label Dr Verwey wrote: "from a large horizontally expanded plate, two meters deep at lowest tide. The coral grows amidst *Porites*". This specimen has rather small calices, 7 to 10 mm in diameter, reminding var. *tosaensis* but differing from it by the calices not being inclined and not being circumscribed by walls.

A second specimen collected by Dr Verwey along the Southern side of Hoorn, has calices of the *"aspera typica"* type. Besides, however, some calices show a remarkable crown of septal lobes steeply dipping towards the axial fossa (Plate X fig. 2).

The following is a description of a specimen which I collected on the shingle rampart of the island Leiden (Pulu Njamuk), N.E.-side (see Plate X fig. 1).

Lamen undulating, in places thin, 1 to 2 mm, but in other places up to 20 mm thick and showing a dissepimental structure. Lower surface with thin subequal longitudinal costae, 9—12 in one cm. Calices on upper surface arranged irregularly. Some calices strongly prominent, vertical or oblique, up to 15 mm and with a diameter of 10—14 mm. Other calices only slightly prominent and not surrounded by distinct pseudo-walls, the diameter of these corallites being only 6—8 mm. Among the larger calices some are destitute of walls, while others are surrounded by distinct pseudo-walls. In the smaller type of calices 18—24 septa are present, 12 meeting columella, some of the higher cycles fusing with primary ones. The columella is a rather dense spongy structure, consisting of twisted trabeculae. Septa and septo-costae with strong dentations, very prominent around the calicular margin.

In this specimen the characters of *O. aspera typica, O. aspera* var. *tosaensis* and *O. aspera* var. *sugiyamai* are combined.

Genus **Tridacophyllia** de Blainville

Tridacophyllia lactuca (Pallas)

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

The species resembles those collected by me from North Celebes and figured in my paper on the corals from the Togian islands. It was collected by Dr J. Verwey on the East side of the island Onrust.

Family OXYPORIDAE Yabe et Eguchi

Genus **Oxypora** S. Kent

Oxypora lacera (Verrill) (Pl. XII fig. 1)

1936 *Oxypora lacera* (Verrill), Yabe, Sugiyama and Eguchi, p. 53, pl. 29 fig. 6, 7, pl. 37 fig. 1, 2 (with synonyms).

There is one excellent semi-cupshaped specimen, collected by Dr Verwey. It is labelled: "Island Hoorn, Southwest corner".

Oxypora titizimaensis Yabe et Sugiyama (Pl. XI fig. 1, 2)

1936 *Oxypora titizimaensis,* Yabe et Sugiyama, p. 53, pl. 29 fig. 4, 5, pl. 34 fig. 5, pl. 59 fig. 7.

Two specimens, belonging to the present species were both collected by Dr Verwey, one labelled: "Island Hoorn, Southwest corner", the other: "Onrust, East". Part of the latter specimen is figured on plate XI fig. 1 and 2.

Family OULASTREIDAE Vaughan

Genus **Oulastrea** Milne Edwards et Haime

Oulastrea crispata (Lamarck)

1936 *Oulastrea crispata* (Lam.), Yabe, Sugiyama and Eguchi, p. 54, pl. 42 fig. 1—4 with synonyms).

There is an excellent specimen from the reef on the East side of the island Onrust, collected by Dr Verwey. The coral which is grown on a brick is stained black with the exception of the septa that are of the usual white colour. It agrees entirely with the specimen figured by Faustino in his plate 73 fig. 3 and 4. In the Rijksmuseum van Natuurlijke Historie at Leiden there is also a specimen from Amboina.

Genus **Diploastrea** Matthai

Diploastrea heliopora (Lamarck)

For synonyms see Yabe c.s., 1936, p. 54.

I never collected a specimen on the Batavia reefs, not even a fragment in the shingle ramparts, but I saw it in the boats of native fishermen, who obtained it from the deeper parts of the reef. Together with large colonies of *Porites* they bring it to Batavia, where the material is used for hardening the roads. Fragments of that material are in the Rijksmuseum van Natuurlijke Historie at Leiden (collection Dr Verwey).

Enormous boulders of *Diploastrea heliopora* were thrown on the shores of Strait Sunda by the devastating tidal waves caused by the eruption of Krakatoa in the year 1883. I mentioned them from Java's S. W. Point (Proc. Royal Acad. Sci. Amsterdam, vol. 34, 1931, p. 487).

MADREPORARIA FUNGIDA

Family FUNGIIDAE Dana

Genus **Fungia** Lamarck

Fungia actiniformis Quoy et Gaimard

For synonyms see Thiel, 1932, p. 62 and Doederlein, 1902, p. 82.

A detailed study of this species was made by Boschma (1923). He collected his material on the Edam reef. Dr Boschma told me that the species was abundant on the N. W. side, about ½ to 1 m deep (low tide).

Fungia scutaria Lamarck

For synonyms see Thiel, 1932, p. 63 and Doederlein, 1902, p. 91.

I collected a specimen in the *foliosa*-facies of Alkmaar, showing the characteristic tentacular lobes. The coral strongly resembles the specimen figured by Doederlein in his plate 4 fig. 8. I figured the specimen in my 1928 paper on plate 30, lower row fig. 4 from the left side.

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.

The species is abundant in the *foliosa*-facies. It occurs also in the deeper part of the thriving reef, attaining large dimensions. A specimen with a larger diameter of 390 mm from the Hoorn reef is figured on plate 32 of my 1928 paper.

Fungia brachystoma Thiel is a young specimen of *Fungia echinata.* The shortness of the axial fossa is a juvenile character. The ratio between length of corallum and length of axial fossa may vary considerably even in adult specimens. I will treat this species at greater length in my paper on the Togian reefs and I will point out that the presence or absence of a "median septum" causing bilaterally symmetry in the septal arrangement is a variable character of no use to define a separate species as Thiel did.

Fungia concinna Verrill

For synonyms see Thiel, 1932, p. 75 and Doederlein, 1902, p. 113.

On the Bay of Batavia reefs both *F. concinna* and *F. plana* occur, but they are connected by transitional forms. I will describe transitions between *F. concinna* and *F. repanda* in my paper on the Togian reefs.

I collected this species and *F. repanda* in the *foliosa*-facies and in deeper water of the thriving reef.

Fungia repanda Dana (Pl. XII fig. 2)

For synonyms see Thiel, 1932, p. 73 and Doederlein, 1902, p. 115.

I am figuring the aboral surface of a rather young specimen (greater diameter of the disc 60 mm) from the *foliosa*-facies of the island Leiden.

Pl. XII, fig. 2 shows the remarkable fact that the scar of attachment is grown out into a new disc.

Pl. XII, fig. 3 are young specifically not identified *Fungia*'s from the island Hoorn. After the older specimen died three new Fungiae grow out apparently from the last remnants of its living tissue.

Fungia subrepanda Doederlein

1902 *Fungia subrepanda* Doederlein, p. 126, pl. 17 fig. 1—7.

A specimen, agreeing with Doederlein's plate 17 fig. 2 and 2a was collected from the island Schiedam. Dr Boschma kindly checked the identification.

Fungia danai Milne Edwards et Haime

For synonyms see Thiel, 1932, p. 78 and Doederlein, 1902, p. 129.

An excellent specimen most resembling the coral figured by Doederlein in his plate 28 fig. 3 and 3a, was collected by Dr Verwey and is now in the Rijksmuseum van Natuurlijke Historie at Leiden. It was labelled by Dr Verwey as follows: "*Fungia danai* E. H., Onrust, East, 2 meters below low tide."

Fungia fungites (Linné)

For synonyms see Thiel, 1932, p. 69 and Doederlein, 1902, p. 136.

Fungia fungites is the most common *Fungia* species in the Bay of Batavia, especially var. *discus* is abundant. The species was the subject of a detailed study by Dr Boschma (1923), who paid special attention to different types of buds.

Fungia fungites (Linné) grade **Fungia repanda** (Dana)

(Pl. XIII fig. 1, 2)

A suite of specimens intergrading in characters between *F. fungites* and *F. repanda* will be described by me from the Togian islands. I collected

an analogous series of intergradations in the Bay of Batavia; the types described in that paper as α, β and δ being present among the corals from the island Hoorn (Pulu Ajer Besar). As the suite from the Togian islands is more complete I will give a full description in the publication on the Togian corals.

Pl. XIII fig. 1 and 2 show a magnificent cluster of young specimens of *Fungia,* belonging to *F. fungites* grade *repanda,* still attached to a dead branch of *Acropora.* I collected it on the N.W. side of the island Leiden (Pulu Njamuk) near the entrance of the moat.

Genus **Halomitra** Dana

Halomitra robusta Quelch (Pl. XIV fig. 1, 2)

For synonyms see Thiel, 1932, p. 84.

Small specimens up to 100 mm diameter were collected in the *foliosa*-facies, large adult ones 200 to 300 mm in diameter occur in the deeper water of the thriving reef. I am figuring a small specimen (diameter 85 mm) from the island Leiden, showing a very regular convex oral surface and a slightly concave aboral surface covered with large branched spines which are distinctly radially arranged. I never found specimens agreeing with *H. irregularis* Gardiner, a form which is abundant on the Togian reefs.

Genus **Herpolitha** Eschscholz

Herpolita limax (Esper)

For synonyms see Thiel, 1932, p. 87.

The only specimen, which I found, is from the shingle rampart of the island Leiden. Although rather worn off, it shows the characters of the species *H. limax* as defined by Boschma (1925, p. 227) and Van der Horst (1921, p. 15).

Genus **Polyphyllia** Quoy et Gaimard

Polyphyllia talpina (Lamarck)

For synonyms see Thiel, 1932, p. 89.

The species was found in the Bay of Batavia by Dr Verwey on the island Onrust and by myself in the shingle rampart of the island Hoorn.

Family AGARICIIDAE Verrill

Genus **Pachyseris** Milne Edwards et Haime

Pachyseris speciosa (Dana)

For synonyms see Yabe, Sugiyama and Eguchi, 1936, p. 63.

Specimens agreeing with the coral from Murray Island described and

figured by Vaughan (1918, p. 131, pl. 54 fig. 4, 4a) were collected along the Northern and Eastern sides of Leiden in deeper water of the thriving reef. Worn fragments are not rare in the shingle ramparts.

Pachyseris rugosa (Lamarck)

For synonyms see Thiel, 1932, p. 93 and Yabe c.s., 1936, p. 63.

There is one excellent specimen, collected by Dr Verwey and labelled "Edam SW. side". The coral agrees with the growth type illustrated by Yabe c.s. in their plate 43 fig. 1.

Genus **Pavona** Lamarck

Pavona cactus (Forskål)

For synonyms see Yabe c.s., 1936, p. 56 and Van der Horst, 1921, p. 23.

Dr Verwey collected a specimen which is labelled: "*Pavona cactus* (Forsk.), Hoorn, South-side." I agree with his identification. The coral most resembles *P. formosa* Dana, photographs of which are figured by Vaughan (1918, p. 136, pl. 56 fig. 1, 1a) who places Dana's species among the synonyms of *P. cactus*.

Pavona decussata Dana

For synonyms see Yabe c.s., 1936, p. 56.

The corals referred by me to *P. decussata* possess bifacial angular and intersecting fronds, well illustrated by Yabe c.s. in their plate 39 fig. 4—6 and by Mayor (1925, Growth-rate of Samoan corals) in his plate 8 fig. 23 and in my 1928 paper on plate 32 fig. 1: The specimens are from the thriving reefs East of the islands. I feel doubtful whether the specimen figured by Bedot in his plate 35 fig. 182 is correctly identified. Perhaps it belongs to *P. varians*, while his fig. 180, 181 is *P. decussata*.

In the Rijksmuseum van Natuurlijke Historie there is a specimen labelled by Dr Verwey as follows: "*Pavona danai* E. H., Edam, moat, S.W. and West." His identification seems to me correct, but according to Hoffmeister *P. danai* is only a variety of *P. decussata*. As Verwey's specimen is the only one from the moat attention should be given in future investigations whether the *danai* growth type is bounded to special conditions of bottom, salinity and temperature as are met with in the moat.

Pavona divaricata Lamarck

For synonyms see Hoffmeister, 1925, p. 38.

I agree with Dr Verwey's identification of a specimen now in the Leiden Museum. The coral is almost a duplicate of the Samoan coral figured by Hoffmeister in his plate 2 fig. 3b. Dr Verwey collected the specimen in the moat of Hoorn.

Pavona frondifera Lamarck

For synonyms see Yabe c.s., 1936, p. 57, and Hoffmeister, 1925, p. 40.

Most of the specimens in the Bay of Batavia belong to a growth type which is well illustrated by Hoffmeister in his plate 3 fig. 1c. The corals have rather large fronds, which seen from aside show rounded nearly semicircular margins. Many carinae are running perpendicular to the margin of a frond.

Pavona varians Verrill

For synonyms see Yabe c.s., 1936, p. 57, and Vaughan, 1918, p. 138.

I found several large colonies in the *foliosa*-facies (N. and N.W. of the islands). According to Vaughan (see 1918, p. 139) the species occurs, however, also in deeper water, to 40 fathoms. It seems to me that Bedot's specimen from Amboina (fig. 182, non 180) belongs to this species and not to *P. decussata* as identified by Bedot.

Pavona clavus Dana

For synonyms see Van der Horst, 1922, p. 420.

The single specimen is labelled by Dr Verwey as follows: "*Pavona clavus* Dana, Batavia, from material used for hardening the road". I agree with Dr. Verwey's identification. The coral is a fragment of a clavate colony 300 mm high and with a larger diameter of 140 mm. Identification is based on a careful comparison with the description and figures of Gardiner's *Siderastrea maldivensis* (1905, p. 935). As the structure of the calices is in perfect agreement with Gardiner's description no new description and figures seem needed. Van der Horst (1922, p. 421, 423) pointed out that *Siderastraea savignyana* E. H. = *S. lilacea* Klunzinger is the only Indo-Pacific species of *Siderastrea* previously known. It seems to me that the specimens figured by Yabe c.s. (1936, p. 58) in their plate 46 fig. 3—6 and named "*Pavona lilacea* (Klunzinger)" are indeed *Pavona* but belong to *P. clavus* Dana. Also their *Pavona maldivensis* (p. 57, pl. 58 fig. 4, 5) should be placed among the synonyms of *P. clavus*.

Pavona (Polyastra) venosa Ehrenberg var. **arbuscula** nov. var. (Pl. XV fig. 1—5)

When Gardiner described *Agaricia ponderosa* he felt very doubtful about referring his specimens to the genus *Agaricia* Lamarck. His opinion was shared by Vaughan (1918) but he followed Gardiner's usage. In the same way Faustino (1927) and Yabe c.s. (1936) expressed their doubt although they too placed Gardiner's species provisionally in the genus *Agaricia.*

Agaricia Lamarck (type species *Madrepora undata* Ellis et Solander 1786) has calicles arranged in transversal or concentrical series, separated by unequal "collines", and the calices have a tubercular columella. On the contrary *A. ponderosa* shows always an irregular arrangement of calicles, which are separated by walls of subequal height and the columella is, when present, a pseudo-columella formed by trabecular extensions from the septa.

For these reasons it cannot be maintained in the genus *Agaricia.* Gardiner allready pointed out that *A. ponderosa* is allied to the genera *Psammocora* and *Pavona.*

A. ponderosa is especially allied to *Pavona,* although differing from it by the general occurrence of distinct walls around the calicles. Indeed, when comparing the definition of the genus *Pavona* (see, e.g., Faustino, 1927, p. 202) with Gardiner's excellent description of *A. ponderosa,* this seems the principal character in which it differs from *Pavona.*

Quelch instituted a new genus, *Tichoseris,* for a *Pavona*-like coral having the calicles arranged in subsinuous groups with elevated walls. The type species is *Tichoseris obtusata* Quelch. Felix described *Tichoseris delicatula* from the Pliocene of Java [1]) and Timor [2]). In 1924 I pointed out that *"Agaricia" ponderosa* Gardiner belongs to the genus *Tichoseris* and I described a new species *Tichoseris wahaiensis* from Ceram [3]). I summarized the characteristics of the four closely allied *Tichoseris* species in a synoptic table (1924, p. 14). I studied a good photograph of Quelch's type specimen and compared it with my suite of Togian specimens. Moreover good figures of *T. obtusata* Quelch have been published by Wells (1936).

Quelch already mentioned the fact that elevated and solid walls may occur in some parts of *Pavona* colonies showing that the genus *Tichoseris*

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1) J. Felix. Die fossile Anthozoa aus der Umgegend von Triml. Palaeontographica, vol. 60, 1913.

2) J. Felix. Jungtertiaire und Quartaire Anthozoa von Timor und Obi II. Paläontologie von Timor VIII, No. 13, 1920.

3) J. H. F. Umbgrove. Report on Plistocene Corals from Ceram. Geol. Results of Explorations in the island of Ceram by L. Rutten, Sec. ser., no. 1, 1924.

is close to *Pavona*. Such a *Pavona* is, e.g., *P. calicifera* Gardiner (1898, p. 532).

Gardiner (1905, p. 946) united *Pavona repens* and *P. intermedia*, the latter being an intermediate form between *P. repens* and *P. calicifera*. Vaughan considered them all as synonymous to *Pavona varians* (Verrill). Moreover Vaughan figured a specimen of *P. varians* (1918, pl. 57 fig. 1), showing calicles surrounded by a distinct wall, and he mentioned: "the Murray island specimens show individual non-serial corallites and serial corallites in the same colony". I found similar specimens in the Bay of Batavia.

Even in *Pavona divaricata* Lam. some individual calices surrounded by a distinct wall may occur.

In a recent paper Wells has given a synopsis of species belonging to the subgenus *Polyastra* (Ann. Magaz. Nat. Hist., vol. 28, 1936, p. 551). He distinguished the following three species: *P. venosa* Ehrenberg, *P. planulata* (Dana) = *"Agaricia" ponderosa* Gardiner and *"Tichoseris" obtusata* Quelch. I studied (1) an excellent suite of *Tichoseris obtusata* from the Togian Islands (2) an excellent photograph of *Tichoseris obtusata* Quelch, kindly provided by the Director of the British Museum (Natural History) (3) the type of *Tichoseris wahaiensis* (4) syntypes of *Tichoseris delicatula*, (5) the present suite from the Bay of Batavia. Wells published good figures of Ehrenberg's type of *Polyastra venosa* and of Quelch's type of *Tichoseris obtusata*.

Wells is of opinion that *Agaricia planulata* Dana is identical with *Agaricia ponderosa* Gardiner. Indeed they seem very close or identical. Perhaps the only difference between the two is the general occurence of a small papillar columella in *P. planulata* which is absent in *P. ponderosa*.

Tichoseris delicatula Felix is identical with *Agaricia ponderosa* Gardiner. This may be clear even from a comparison of descriptions and figures. I studied, moreover, a specimen of *P. delicatula* from the Pleistocene of Timor, identified by Professor Felix and now in the Institute of Mining at Delft. It is without any doubt identical with *P. ponderosa*.

Tichoseris wahaiensis is of the same massive growth type as *P. planulata* and *P. ponderosa*. It is a rounded semiglobular coral of about 100 mm diameter, with polygonal calices. The structure of the corallum is, however, much denser, the calices being crowded with many very thin septa, up to 90 in single non-dividing calices. I am giving here a supplementary figure of a few calices (Plate XIV fig. 4, see also Umbgrove, 1924, pl. 1 fig. 6 and 7).

According to Wells *P. planulata* (= *P. ponderosa*) and *P. obtusata* may be separated as follows:

a. calices not in series, usually single or in small clusters *P. planulata*
b. calices usually in short series or clusters, rarely single *P. obtusata.*

In my paper on the corals from the Togian reefs I will point out, that both types of calicular arrangement occur in one and the same species, *P. obtusata,* and are connected by transitional forms.

It seems to me, however, that *P. planulata* and *P. obtusata* may be easily distinguished in another way.

P. planulata, P. ponderosa and *P. wahaiensis* have in common the occurrence of crowded septa and very narrow interseptal loculi. The calices of these species are polygonal, often pentagonal, with straight, rarely sinuous walls.

In *P. obtusata,* on the other hand, the septa are comparatively distant with rather wide interseptal loculi, and the corallite walls are usually sinuous or maeandrine.

So I believe that the specimens figured by Yabe, Sugiyama and Eguchi in their plates 27 fig. 5, 38 fig. 1 and 52 fig. 1 are not *P. ponderosa* but *P. obtusata.* The specimen figured by Faustino in his plate 65 fig. 1 and 2 is a true *P. ponderosa.*

Below, I am giving a synopsis of the different species and varieties of the subgenus *Polyastra.*

In the following I am giving a description of an interesting coral, which I collected on the reef N. of the island Enkhuizen (*foliosa*-facies). There is, moreover, a good suite in the Rijksmuseum van Natuurlijke Historie at Leiden, collected by Dr Boschma on the Edam reefs.

Colony in crowdedly branched tufts, about 100 mm high, branchlets proliferous and sometimes coalescent, lobed or in convex masses, the terminal divisions being rather thick and obtuse. Calices often with proliferations. Some calices are of the *venosa* type (Pl. XV fig. 4), others occur in short series or clusters between sharp collines as in *P. obtusata* (Pl. XV fig. 5), rarely single calices occur surrounded by an elevated wall. Locally even calices not separated by elevated walls as in *Pavona typica* may be noticed (Pl. XV fig. 1). Calices averaging 2 mm in diameter or less, with 24 or more septa, usually 12 reaching the calicular centre. Septa not dentate, confluent over walls. Interseptal loculi comparatively wide. Columella absent or a rudimentary pseudo-columella formed by trabecular extensions from the septa.

Diameter of calices, the occurrence of calices of the *venosa*-type and a strong development of proliferations show that the coral is closely allied

to *P. venosa.* It differs, however, from Ehrenberg's type by (1) the typical *venosa*-calices being comparatively rare (2) by a different growth type. For those reasons I am describing it as a new variety, var. *arbuscula.*

Synopsis of the subgenus *Polyastra.*

A. Septa crowded, interseptal loculi very narrow.
Calices averaging 4 mm in diameter polygonal often pentagonal; walls usually straight, rarely sinuous; surface regular, lacking proliferations
1. In single, non-dividing calices 48 septa, 12 reaching calicular centre. Septal edges and sides roughly granular.
a. Columella usually present, a small papilla. *P. planulata* (Ehrenberg).
b. Columella absent, if present rudimentary and trabecular. *P. ponderosa* (Gardiner) (synonym: *P. delicatula* Felix).
2. In single, non dividing calices about 90 septa. Septa and interseptal loculi extremely thin; septal edges and sides delicately granular. *P. wahaiensis* (Umbgrove).

B. Septa comparatively distant, interseptal loculi comparatively wide. Calicular walls usually sinuous or maeandrine;
1. Surface regular, lacking proliferations. Calices averaging 4 mm in diameter, up to 48 septa in single not dividing calices, up to 12 reaching calicular centre. Septal edges and sides finely granular. *P. obtusata* (Quelch).
2. Surface with proliferations, calices averaging 2,5 mm in diameter or less, with 24 to 30 septa.
a. Groups of very small calices usually encircled by collines, other calices in short series or clusters between collines, growth type of corallum irregular noduliform. *P. venosa* (Ehrenberg).
b. Calices usually in short series or clusters between collines, rarely single and circumscribed by well developed corallite walls or exceptionally even Pavonid, i.e., without elevated walls; growth type of corallum: crowdedly branched tufts. *P. venosa* Ehr. var. *arbuscula* nov. var.

Genus **Psammocora** Dana

Psammocora contigua (Esper)

1921 *Psammocora contigua* (Esper), Van der Horst, p. 33 (with synonymy).
1922 *Psammocora contigua* (Esper), Van der Horst, p. 425.
1925 *Psammocora contigua* (Esper), Mayor, pl. 28.
1925 *Psammocora contigua* (Esper), Hoffmeister, p. 45, pl. 5 fig. 1.
1927 *Psammocora contigua* (Esper), Faustino, p. 211, pl. 70 fig. 1 and 2.
1936 *Psammocora contigua* (Esper), Yabe, Sugiyama and Eguchi, p. 59, pl. 44 fig 5, 6—8, pl. 45 fig. 2, 3, 6.

The species is a common one on the reefs in the Bay of Batavia, where it may be found in the moat. The specimens resemble most Faustino, pl. 70 and Yabe c.s., pl. 45 fig. 2, as may be seen by comparing Plate 29 of my 1928 paper.

Psammocora exesa Dana

For synonyms see Van der Horst, 1921, p. 34 and Yabe c.s., 1936, p. 59.

The only specimens from the Bay of Batavia known to me were collected by Dr Verwey an labelled "Onrust, North side, from a colony with broad rounded ridges and pillars, very massive; length 1.2 meter, breadth 0.8 meter and height 0.5 meter; of a yellowish brown colour".

The fragments which Dr Verwey collected undoubtedly belong to the present species. They resemble Dana's specimens and are almost duplicates of the specimen figured by Yabe c.s.

Psammocora haimeana Milne Edwards et Haime (Pl. X fig. 3)

For synonyms see Vaughan, 1918, p. 141.

One specimen collected by Dr Verwey, Onrust S.W. side. Coral explanate incrusting with a flat surface attached to a brick. Diameter of calices to 2.5 mm, shallow; fossa up to 1 mm deep. Calices subpolygonal immediately adjacent and fairly distinct or not distinct and surrounded by coenenchyma. Usually 12 septa reach the columella; up to six of these (usually less) bifurcate or trifurcate towards the periphery of the calice. Along the calicular margins usually 24 septa may be counted in full grown calices. The outer ends are thicker than the inner ends. Interseptal loculi narrow. Septa finely granulate and usually showing paliform denticles. The outer septal ends continuous with the coenenchyma, which is a finely reticular structure, rough at the surface.

Columella a distinct small granulate tubercle, surrounded by 6 or more small rods in front of the septa.

The coral resembles *Psammocora haimeana* as described by Gardiner from Minikoi. It is, however, different by the shallowness of the calices.

Psammocora folium nov. spec. (Pl. XIV fig. 3, Pl. XVI fig. 1, 2)

The coral has the form of a semi-circular folium growing horizontally. Larger diameter 160 mm, lesser diameter 85 mm; average thickness 7—10 mm.

The lower surface is covered with an epitheca, showing concentric rings parallel to the margin of the corallum. The upper surface is irregularly undulate, slightly convex at the margin, which partly is folded downward in a sharp angle overgrowing the aboral surface. The oral surface is crowded with small calices, not arranged in rows; no fossae. Mostly eight septa reach the calicular center, two or three of these septa are the ends of two

fused septa of the forking type distally being separate. Septa thick rod-like, seldom petal-shaped, smaller septa extend beyond the calice forming an irregular network. The septa are granulose. In some calices the columella is well developed, consisting of a small irregular rod; in other calices it is very indistinct. In places, where the calices are regularly developed (Pl. XIV fig. 3a) their distances are 2 to 4 mm measured from columella to columella. Locally the development of the calices is very irregular. By the presence of an epitheca and by its growth-shape the species differs from all other *Psammocora* species.

I collected one specimen in a very shallow pool on the N. side of the island Leiden. Foraminifera belonging to the genera *Carpenteria* and *Polytrema* are attached to the epitheca.

Genus **Coeloseris** Vaughan

Coeloseris mayeri Vaughan

For synonyms and distribution see Yabe c.s., 1936, p. 63.

Dr Verwey collected excellent specimens on the reef along the North-Eastern side of the island Onrust.

MADREPORARIA PERFORATA

Family ACROPORIDAE Verrill

Genus **Astreopora** De Blainville

Astreopora myriophthalma (Lamarck)

1918 *Astreopora myriophthalma* (Lam.), Vaughan, p. 146, pl. 60 fig. 5, 5a.

In the Rijksmuseum van Natuurlijke Historie at Leiden is a specimen, collected by Dr Verwey, on the reef East of the island Onrust. Identification is based on the description and figures published by Vaughan.

Corallum pulvinate; larger diameter 130 mm. Diameter of calices 1.5 to 2 mm. Calices 2 mm apart, usually less owing to the many small calices occuring between the larger more prominent ones. The walls of many adult calices are swollen and the corallites are projecting, but not in such an irregular manner as seems characteristic in *A. ocellata*. The six primary septa are narrow above, but deeper in the calices they reach the calicular centre, where they fuse by thin processes. No true columella present. Secondaries narrow. Coenenchyma as described and figured by Vaughan.

Genus **Turbinaria** Oken

Turbinaria crater (Pallas)

1907 *Turbinaria crater* (Pallas), Bedot, p. 240, pl. 37 fig. 192—196.

Dr Verwey collected two specimens in deeper water on the reef of Onrust.

A large slightly undulating folium, with a radius of at least 200 mm was collected on the Northwest side. The figures of Bedot's specimen C from Amboina and his description of calices and coenenchyma are entirely applicable to the coral from the Bay of Batavia.

The second specimen from Onrust was collected on the East side. The lower part of the corallum is a fragment apparently broken off from a large colony. Part of its surface has grown out to cover the dead surface for the greater part with a newly formed folium of irregular shape. All corallites are of the projecting type and have a very deep seated columella. Structure of calices and coenenchyma is again as described by Bedot. This specimen reminds *Turbinaria mesenterica* auctorum, especially Edwards and Haime's specimen, which is figured, however, under the name of *Turbinaria cinerascens* (1857, pl. E 1 fig. 1a and 1b). Indeed many of the *Turbinaria* described especially by Bernard are only different growth types of the same species. A restudy of Bernard's material is much desired. Moreover, growth experiments should be made.

Turbinaria peltata (Esper)

1896 *Turbinaria peltata* (Esper), Bernard, p. 38, pl. 6—8 and 31 fig. 15 (with synonymy).
1907 *Turbinaria peltata* (Esper), Bedot, p. 242, pl. 37 fig. 197, 198.
1927 *Turbinaria peltata* (Esper), Faustino, p. 247, pl. 78, fig. 1, 2.

In the year 1929 Dr Verwey presented me with a fragment of *Turbinaria* broken off from a large colony which was growing on the reef along the Eastern side of the island Onrust. It is a flattened branch s-shaped when seen from above, a fold of the *bifrons* type, and without doubt a fragment of a colony agreeing with the specimen figured by Bernard in his plate VII. Average diameter of calices 4 mm, projecting 2 up to 4 mm.

Dr Verwey collected another branch of a large *Turbinaria* colony, which is now in the Rijksmuseum van Natuurlijke Historie at Leiden. The fragment has a subcircular diameter, 45 mm at the base and gradually diminishing towards the top. The diameter of the calices varies from 5 up to 11 mm; they project up to 15 mm. The growth type is well illustrated by Faustino in his plate 78 fig. 1.

I am convinced that at least *T. patula* (Dana) and *T. maxima* Ortmann should be placed among the synonyms of *T. peltata* (Esper).

Genus **Montipora** Quoy et Gaimard

Montipora ramosa Bernard

1897 *Montipora ramosa* Bernard, p. 49, pl. 5 fig. 1—3, pl. 32 fig. 3.
1907 *Montipora palmata* (Dana), Bedot, p. 272, pl. 46 fig. 255—259.
1918 *Montipora ramosa* Bernard, Vaughan, p. 150, pl. 19 fig. 45, pl. 62 fig. 1—3.
1927 *Montipora compressa* (Esper), Faustino, p. 250, pl. 79 fig. 1 and 2.
1928 *Montipora ramosa* Bernard, Umbgrove, p. 39, 46, 65, pl. 24 fig. 45, pl. 29 fig. 1—2.
1930 *Montipora ramosa* Bernard, Stiasny, p. 40.
1932 *Montipora ramosa* Bernard, Thiel, p. 114, pl. 17 fig. 2, 3.

On the sandy bottom of the moat *Montipora ramosa* thrives abundantly (see pl. 24 fig. 45 of my 1928 paper). I have published a good photograph of a separate specimen in another paper (in „De Tropische Natuur", 1928, p. 127, fig. 5). Spender mentions the same species as characteristic for the moat of the low wooded islands of the Great Barrier Reef (The Geographical Journal, vol. 76, 1930, pag. 289).

Dr. Mayor too collected the species from Murray Island only in shallow water and on sandy bottom. And again Wood-Jones mentions the species from Cocos-Keeling "where it grows in great luxuriance in shallow water in the lagoon, opposite the eastern end of Pulu Tikus" (Vaughan, p. 150, 151).

Montipora foliosa (Pallas)

For synonyms see Thiel, 1932, p. 115.

The species is characteristic for Northwest, North- and South-east side of the reefs where it occurs abundantly on the outer slope of the shingle ramparts. Typical specimens are figured in my 1928 paper on plate 30 fig. 2 (non plate 28 fig. 51 and plate 30 fig. 1) and an excellent type in another paper (in: „De Tropische Natuur", 1928, p. 128, fig. 9). *Montipora foliosa* occurs, however, also in deeper water on the thriving reef. Dr Verwey saw finely developed specimens to a depth of 8 meters and perhaps deeper (Fourth Pacific Sci. Congress, Java 1929, Excursion A. 2, pag. 20).

Montipora erythraea Von Marenzeller

1917 *Montipora erythraea* Von Marenzeller, p. 58, pl. 22 fig. 73, 74, pl. 23 fig. 73a, 74a.
1928 *Montipora erythraea* Von Marenzeller, Umbgrove, p. 47, 51, pl. 30 fig. 5, 6.
1930 *Montipora erythraea* Von Marenzeller, Stiasny, p. 50.

Von Marenzeller begins his description as follows: „Diese *Montipora* steht der *M. foliosa* (Pallas) Bernard's nahe und ist vielleicht nur eine

lokale Form derselben". Indeed there occur specimens, which seem intermediate. Typical *M. erythraea* may, however, easily be distinghuished by its more horizontal spreading of the lamina and by the occurrence of many protuberances. I collected the species in the *foliosa*-facies of several reefs.

Montipora spec div.

Many more species of *Montipora* occur on the reefs in the Bay of Batavia. As Professor Boschma has the intention to make an extensive study of the genus I hope that he will study also the specimens from the Bay of Batavia.

Genus **Acropora** Oken

A large collection of corals belonging to the genus *Acropora* from the Bay of Batavia form the nucleus for a monographic study of the genus by Dr Verwey. The publication probably will appear in the near future. In total 21 *Acropora* species will be described from the Bay of Batavia.

Family PORITIDAE Dana

Genus **Goniopora** Quoy et Gaimard

Goniopora tenuidens (Quelch)

1886 *Rhodaraea tenuidens* Quelch, p. 188, pl. 7, 7a, 7b.
1903 *Goniopora moluccas* 1 Bernard, p. 65, pl. 4 fig. 7.
1907 *Rhodaraea tenuidens* Quelch, Bedot, p. 270, pl. 45 fig. 253, 254.
1918 *Goniopora tenuidens* (Quelch), Vaughan, p. 186, pl. 14 fig. 17, pl. 84 fig. 1, 2.
1927 *Goniopora tenuidens* (Quelch), Faustino, p. 285, pl. 95 fig. 5–7.
1928 *Goniopora tenuidens* (Quelch), Umbgrove, p. 51, pl. 32 fig. 9.
1930 *Goniopora tenuidens* (Quelch), Stiasny, p. 34.

When living the coral is of a conspicuous light yellow-green colour. It is a common species of the thriving reef. Identification is based especially on the description and figures of Vaughan's. In the marginal parts the calices have thick and prominent pali, as in Vaughan's fig. 2; in the upper part of the pulvinate corallum the structure of the calices is usually of the type figured in Vaughan's fig. 1.

Goniopora columna Dana (Pl. XVIII fig. 1).

1846 *Goniopora columna* Dana, p. 570, pl. 56 fig. 5, 5a, 5b.
1878 *Goniopora columna* Dana, Studer, p. 537.
1903 *Goniopora columna* Dana, Bernard, p. 43.

On the reef East of Onrust Dr Verwey collected the coral described

below. On the label Dr Verwey wrote: "compare *Goniopora planulata* in Klunzinger's publication". Indeed, *Goniopora planulata* resembles the present specimen and Klunzinger placed *G. columna* among the synonyms of *G. planulata*. It seems to me, however, that G. columna is different (1) by its smaller calices (not over 3 mm), (2) by the irregular shape and angular outline of the calices, (3) by the absence of a conspicuous crown of palar lobes. The specimen is a tall compressed columnar growth 300 mm long, forked above over a distance of 80 mm. The upper part alone (20 mm) was living. Calices angular; diameter of full-grown calices usually 2 mm, exceptionally up to 3 mm. Lateral calices very shallow; no distinct septa visible apparently due to a very thin epithecal pellicle. The septa are, however, distinct in the parts which are free from an epitheca. Pl. XVIII fig. 1 illustrates some calices on the lateral part of the top. I believe Bernard was right in suggesting that "the obscuration of the septa", mentioned by Dana, was due to the skeleton being "melted down into a granular reticulum in which the radial symmetry had become obscured" (Bernard, op. cit., p. 43).

I collected another smaller cylindrical growth, belonging to the same species on the reef of Schiedam.

Goniopora arbuscula nov. spec. (Pl. XVII fig. 1—3)

The single specimen was collected by Dr. Verwey on the reef of the island Edam.

Judging from the coral shingle (with coverings of *Lithotamnium* and with many *Polytrema* attached to it) on which the coral is grown it seems to me probable that the coral was collected on the outer slope of the shingle rampart (*foliosa*-facies).

Corallum primary incrusting but soon growing up as a delicately ramose growth, attached to dead branches of *Acropora* and forming a dense convex tuft, about 90 mm high. Branches with a diameter of 15 mm at the base, 5 to 8 mm at the top. Branches crowded, often coalescing and with obtuse tops. Diameter of calices 1 to 2.5, usually 2 mm. Calices very shallow. The walls are simple and narrow, in places forming some reticulum. In full-grown calices 12 septa, exceptionally some tertiaries occur. Septa distinct only along the calicular margin, and forming a reticulum without distinct radial symmetry in the centre of the calice. In places small palar lobes may be seen, usually they seem, however, absent or rudimentary.

Genus **Porites** Link

Porites lutea Milne Edwards et Haime

? 1907 *Porites conglomerata* Dana, Bedot, p. 271, pl. 45 fig. 250—252.
1918 *Porites lutea* E.H., Vaughan, p. 198, pl. 88 fig. 1, 1a, 1b (with synonymy).
1918 *Porites haddoni* Vaughan, p. 197, pl. 87 fig. 1, 1a, 1b (with synonymy).
1927 *Porites lutea* E.H., Hoffmeister, p. 73, pl. 21 fig. 2a, 2c, 3.
1930 *Porites lutea* E.H., Stiasny, p. 31.

Bedot already pointed out that *P. lutea* E. H. and *P. conglomerata* Dana (non Esper) ought to be considered as synonyms. Indeed they were united by Vaughan and by Hoffmeister. Von Marenzeller and Bedot thought it probable that *P. solida* too should belong in its synonymy. According to Vaughan (1918, p. 192) *P. solida* is, however, different.

The specimens from the Bay of Batavia show the wide variation of structure described in detail by Hoffmeister. I have before me small colonies from the shingle rampart of Purmerend (which are grown on Gastropods) showing calices of the type figured by Bernard in his plate 3 fig. 1. Other irregularly noduliform growths from the moat of the island Enkhuizen correspond with Bernard's plate 3 fig. 2. The species occurs moreover in deeper water of the thriving reef and on the sandy bottom SW of the islands (impoverished reef facies).

Porites andrewsi Vaughan

1932 *Porites andrewsi* Vaughan, Thiel, p. 135, pl. 13 fig. 3 (with synonymy).

There is no doubt about the occurrence of this species in the moat of several islands. I collected it moreover on the sandy bottom SW. of the islands, c. q. grown on bricks near the ruin of the island Kerkhof and exceptionally in the *foliosa*-facies.

I figured two growths on plate 29 fig. 4 and plate 33 fig. 2 of my 1928 paper. I restudied a few specimens and found the structure of the calices in exact agreement with the specimen described and figured by Vaughan.

Porites spec. div.

There are many more different species of *Porites* in the Bay of Batavia and there is a large suite in the Rijksmuseum van Natuurlijke Historie at Leiden, waiting for a detailed study and identification. The growth types vary from plate like forms of the *P. lichen* type to the enormous massive coral heads with a diameter of two meters and more, occuring in the deeper water of the thriving reef and found also in a subfossil state on the sand islands as the result of a negative shifting of sea level (see Umb-

grove, 1928, plate 10 fig. 27, plate 12 fig. 31). In his paper „Sur la croissance de quelques coraux des récifs de l'île d'Edam" Boschma mentions: *Porites rus* (Forsk.), *Porites lutea* M. Edw., *P. Haddoni* Vaughan, *Porites compressa* Dana and *Porites lobata* Dana.

Family FAVOSITIDAE Dana

Genus **Alveopora** Quoy et Gaimard

Alveopora viridis Quoy et Gaimard (Pl. XVIII fig. 4, 5)

1860 *Alveopora viridis* Q. et G., Edwards et Haime, vol. III, p. 194.

The only specimen was collected by Dr Verwey in the Northwestern part of the moat of the island Hoorn. It is a small branching colony 50 mm high. Branches compressed blunt and broadened above. At the base of the colony is a narrow finely striated epitheca. Calices sub-polygonal usually elongated in the direction of the branches. The oblong calices may have a greater diameter of 2 mm, usually less, and a lesser diameter of 1 to 1.5 mm. On the summits of the branches the calices are not or only slightly elongate and their diameter only seldom depasses 1 mm; usually it is less. Walls comparatively thick. Mural openings large and scattered irregularly.

Margins of the walls beset with sharp spines, which are 1 mm long on the sides and tops of the branches. There are six or less septal spines which are short and wide apart, exceptionally reaching the corallite axis.

Alveopora daedalea (Forskål)

1848 *Pocillopora fenestrata* Edwards et Haime, Ann. Sci. Nat., vol. IX, pl. 5 fig. 3.
1860 *Alveopora daedalea* (Forskål), Edwards et Haime, vol. III, p. 194 (synonymy).
1877 *Alveopora daedalea* (Forskål), Klunzinger, p. 47, pl. 5 fig. 25, 26.
1907 *Alveopora daedalea* (Forskål), Von Marenzeller, p. 67.

A specimen from the thriving reef of the island Leiden agrees with the description of Klunzinger's specimens. The colony is, however, comparatively large (50 mm high).

Alveopora verrilliana Dana (Pl. V fig. 4, Pl. XVIII fig. 2, 3)

1907 *Alveopora verrilliana* Dana, Vaughan p. 217, pl. 91 fig. 3, 3a (with synonyms).
1925 *Alveopora verrilliana* Dana, Hoffmeister, p. 81.

I am referring to *A. verrilliana* a species, which is rather common on the Bay of Batavia reefs. Vaughan's description of the structure of the coral is applicable to the present specimens. There seems to be a great deal of variation in growth type. I collected a small subpyriform growth in the

Rhodophyceae-facies of the island Hoorn. In deeper water of the thriving reef a larger "massive" growth type occurs. Colonies with an undulate convex surface 160 mm in diameter are not rare, and I collected also a lobate growth. The variation of the calices is shown by fig. 2 and fig. 3 on plate XVIII, both figures being made from the same specimen. I collected the species also at "Java's 4e punt", Anjer Kidul, Sunda Straits.

LIST OF PUBLICATIONS CITED

I am not giving a full list of all the publications that were constantly used in the preparation of this publication.

The following list contains the titles of papers which are repeatedly referred to in the descriptions and lists of synonyms.

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

BERNARD, H. M., 1896. The genus Turbinaria, the genus Astraeopora. Catal. Madrep. corals in the British Museum, vol. 2.

——, 1897. The genus Montipora, the genus Anacropora. Ibidem, vol. 3.

——, 1903. The genus Goniopora. Ibidem, vol. 4.

BOSCHMA, H., 1923. Knospung und verwandte Erscheinungen bei Fungia fungites und Fungia actiniformis, Treubia, vol. 3.

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

——, 1928. An unusual manner of budding in Echinopora lamellosa (Esper). Ibidem, no. 41, vol. 85.

—— and VERWEY, J., 1930. The occurrence of stalked buds in the coral Echinopora lamellosa (Esper). Treubia, vol. 12.

——, 1936. Sur la croissance de quelques coraux des récifs de l'île d'Edam (Baie de Batavia). Mémoires du Musée Royal d'Histoire Naturelle de Belgique, 2me série, fasc. 3.

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.

DOEDERLEIN, L., 1902. Die Korallengattung Fungia. Abhandl. 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.

—— et ——, 1857—1860. Histoire naturelle des coraillaires, vol. 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 Phillippine 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.

——, 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 XVI b.

——, 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.

STIASNY, G., 1930. Die Madreporaria des Naturhistorischen Reichs-Museums in Leiden. I. Porites, Goniopora, Alveopora, Montipora. Zoologische Mededeelingen, vol. 13.

STUDER, TH., 1878. Übersicht der Steinkorallen etc. Kgl. preuss. Akad. Wissensch. Berlin. Monatsber. für 1877.

THIEL, M. S. 1932. Madreporaria. Mém. Musée Royal d'Hist. Nat. Belgique, hors série, vol. 2, fasc. 12.

UMBGROVE, J. H. F., 1928. De Koraalriffen in de baai van Batavia (with summary in English). Wetenschappelijke Mededeelingen Nr. 7. Dienst van den Mijnbouw, Bandoeng, Java.

VAUGHAN, T., WAYLAND, 1907. Recent Madreporaria of the Hawaiian Islands and Laysan. U.S. Nation. Museum, Bull. Nr. 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., vol. 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 I

Fig. 1, 2. *Phyllangia pallida* Klunzinger, island Leiden, Rhodophyceae-facies; fig. 1, × 3; fig. 2, × 10.

Fig. 3—5. *Simplastrea vesicularis* nov. spec., island Onrust, East side, × 2; fig. 3, lower surface, fig. 4, transverse section, fig. 5, upper surface.

PLATE II

Fig. 1. *Caulastrea tumida* Matthai, island Hoorn, *ramosa*-facies, × 3/2.

Fig. 2. *Favia valenciennesii* E. H., island Kerkhof, West side, × 2.

PLATE III

Fig. 1, 2. *Favites pentagona* (Esper), island Onrust, East side; fig. 1, × 1, fig. 2, × 5/2

Fig. 3. *Favites aspera* (Verrill), island Kerkhof, *foliosa*-facies, × 2.

PLATE IV

Fig. 1. *Favites yamanarii* Yabe et Sugiyama, island Edam, × 2.

Fig. 2—4. *Favites yamanarii* var. *profunda* nov. var.; fig. 2, island Enkhuizen, *ramosa* facies, × 2, fig. 3, Togian no. 97, × 2, fig. 4, Togian no. 181, × 7/8.

PLATE V

Fig. 1. *Favites aspera* (Verrill), island Kerkhof, *foliosa*-facies, × 7/8.

Fig. 2. *Scapophyllia cylindrica* E. H., island Kerkhof, × 1.

Fig. 3. *Hydnophora contignatio* (Forskål), island Onrust, East side, × 1.

Fig. 4. *Alveopora verrilliana* Dana, island Hoorn, Rhodophyceae-facies, × 2.

PLATE VI

Fig. 1. *Hydnophora* cf. *mayori* Hoffmeister, island Leiden, *foliosa*-facies, × 2.

Fig. 2. *Merulina laxa* Dana, island Schiedam, × 2.

PLATE VII

Fig. 1—2. *Echinopora horrida* Dana, island Hoorn S. W., impoverished reef facies, fig. 1, upper side, fig. 2, lower side, × 1.

PLATE VIII

Fig. 1—2. *Echinopora horrida* Dana; fig. 1, island Schiedam, × $^{9}/_{10}$, fig. 2, island Belanda, × $^{6}/_{10}$.

PLATE IX

Fig. 1—2. *Mycedium tubifex* (Dana) var. *bifrons* nov. var., island Leiden, × $^{9}/_{10}$.

PLATE X

Fig. 1—2. *Oxyphyllia aspera* (Ellis et Sol.), × 1; fig. 1, island Leiden, fig. 2, island Hoorn, Southern side.

Fig. 3. *Psammocora haimeana* E. H., island Onrust, South Western side, × 5.

PLATE XI

Fig. 1—2. *Oxypora titizimaensis* Yabe et Sugiyama, island Hoorn, Southwest corner, × 1; fig. 1, upper surface, fig. 2, lower surface.

PLATE XII

Fig. 1. *Oxypora lacera* (Verrill), island Hoorn, Southwest corner, × 1.

Fig. 2. *Fungia repanda* Dana, island Leiden, *foliosa*-facies, × $^{5}/_{4}$.

Fig. 3. *Fungia* spec., island Hoorn, × $^{5}/_{4}$.

PLATE XIII

Fig. 1. *Fungia fungites* grade *repanda,* island Leiden, Northwest side, entrance of the moat, × 1.

Fig. 2. Same specimen seen from opposite side.

PLATE XIV

Fig. 1—2. *Halomitra robusta* Quelch, island Leiden, *foliosa*-facies, × 1; fig. 1, lower surface, fig. 2, upper surface.

Fig. 3a, 3b. *Psammocora folium* nov. spec., island Leiden, Northern side, *foliosa*-facies, × 7.

Fig. 4. *Tichoseris wahaiensis* Umbgrove from the Pleistocene of Ceram, × 3½.

PLATE XV

Fig. 1—5. *Pavona* (*Polyastra*) *venosa* Ehrenberg var. *arbuscula* nov. var., island Enkhuizen, *foliosa*-facies. Fig. 2. lateral view, × 1; fig. 3

upper view, × 1; fig. 1, calices of the *Pavona*-type, × 3½; fig. 4, calices of the *venosa*-type, × 3½; fig. 5, calices of the *obtusata*-type, × 3½.

PLATE XVI

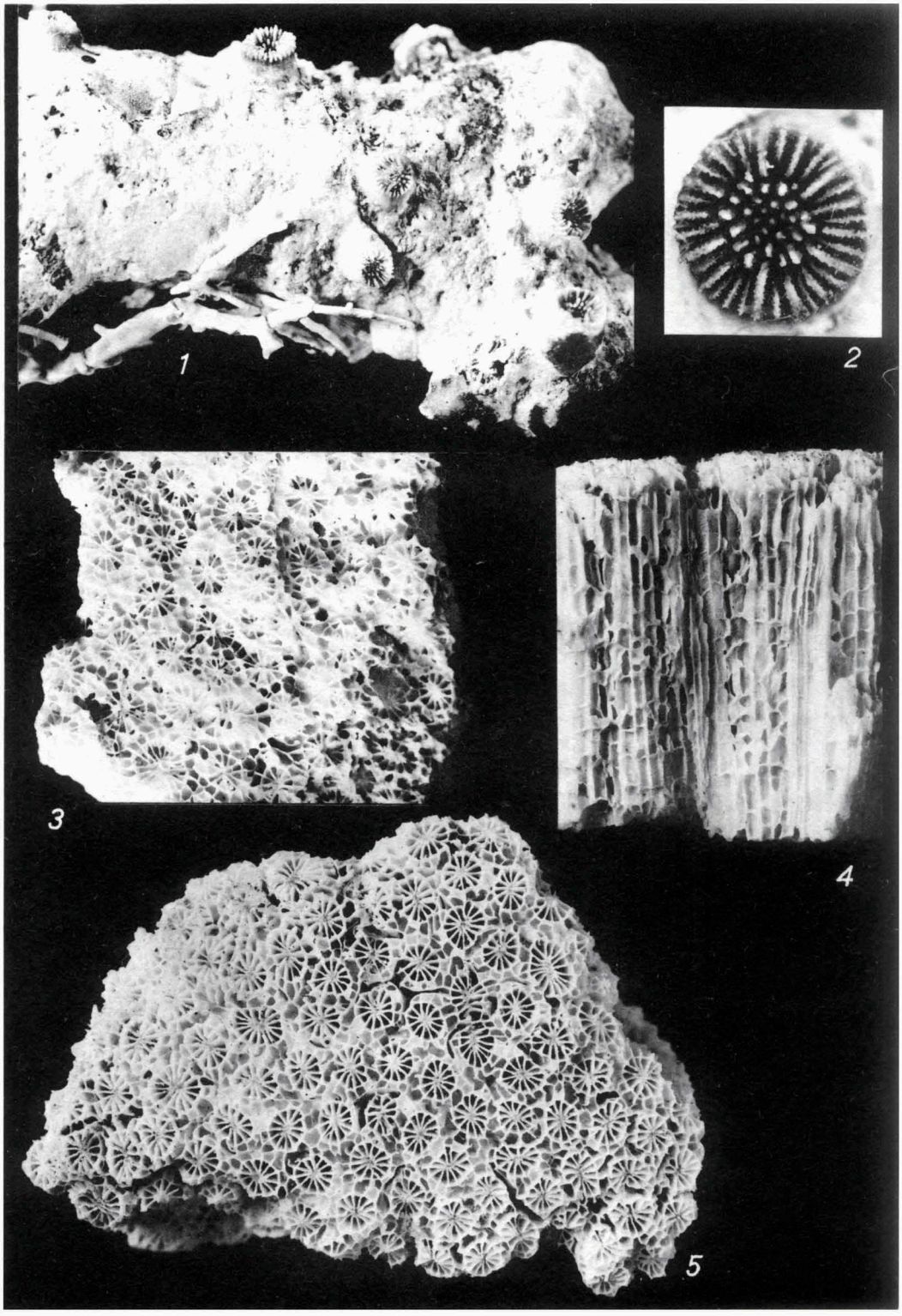
Fig. 1—2. *Psammocora folium* nov. spec., island Leiden, Northern side, × 1; fig. 1, upper surface, fig. 2, lower surface.

PLATE XVII

Fig. 1—3. *Goniopora arbuscula* nov. spec., island Edam. Fig. 1, × 7½; fig. 2, upper view, × 1; fig. 3, lateral view, × 1.

PLATE XVIII

Fig. 1. *Goniopora columna* Dana, island Onrust, East side, × 5.
Fig. 2—3. *Alveopora verrilliana* Dana, island Hoorn, thriving reef, × 4½.
Fig. 4—5. *Alveopora viridis* Quoy et Gaimard, island Hoorn, *ramosa*-facies; fig. 4, × 6, fig. 5, × 1.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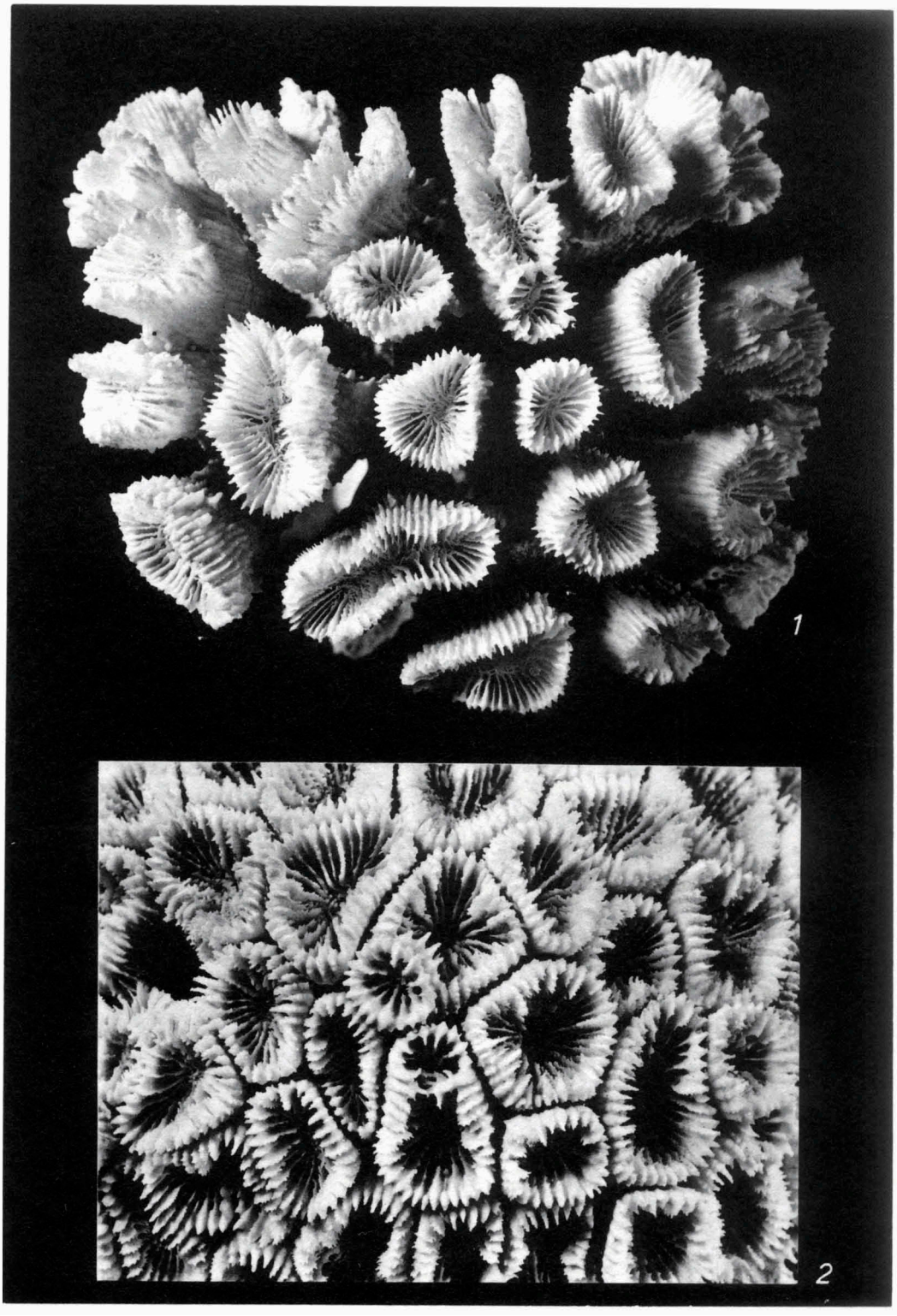
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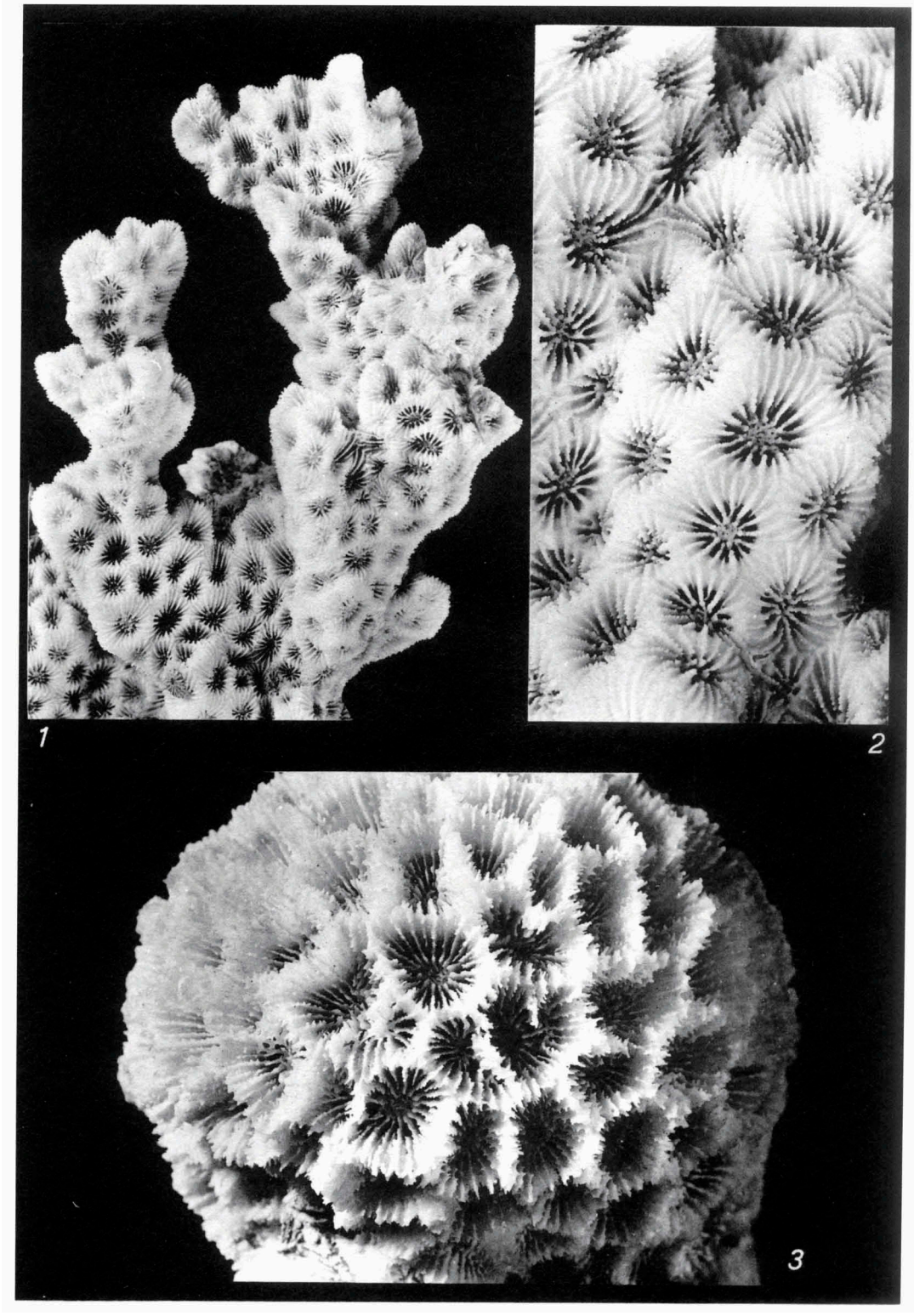
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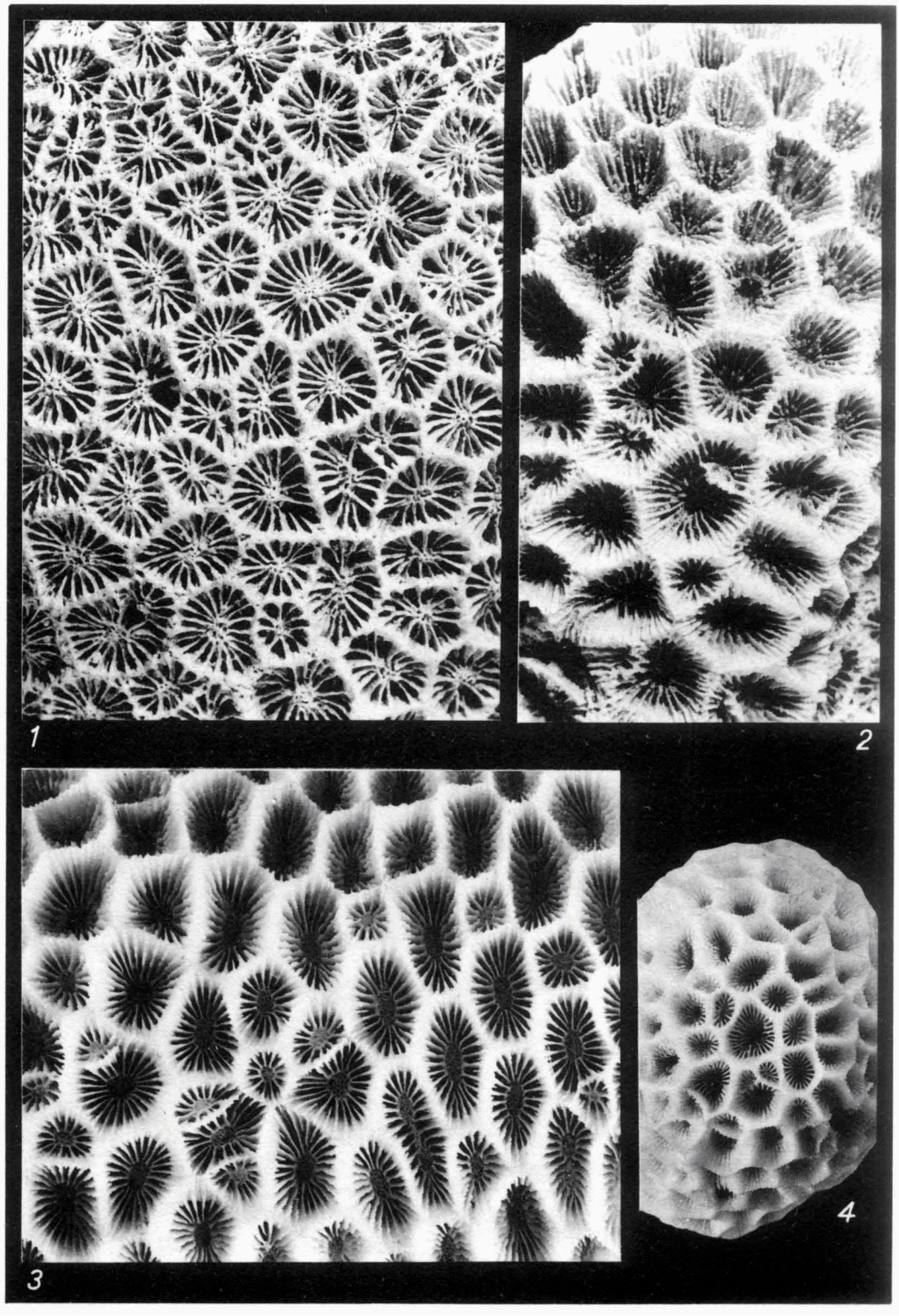
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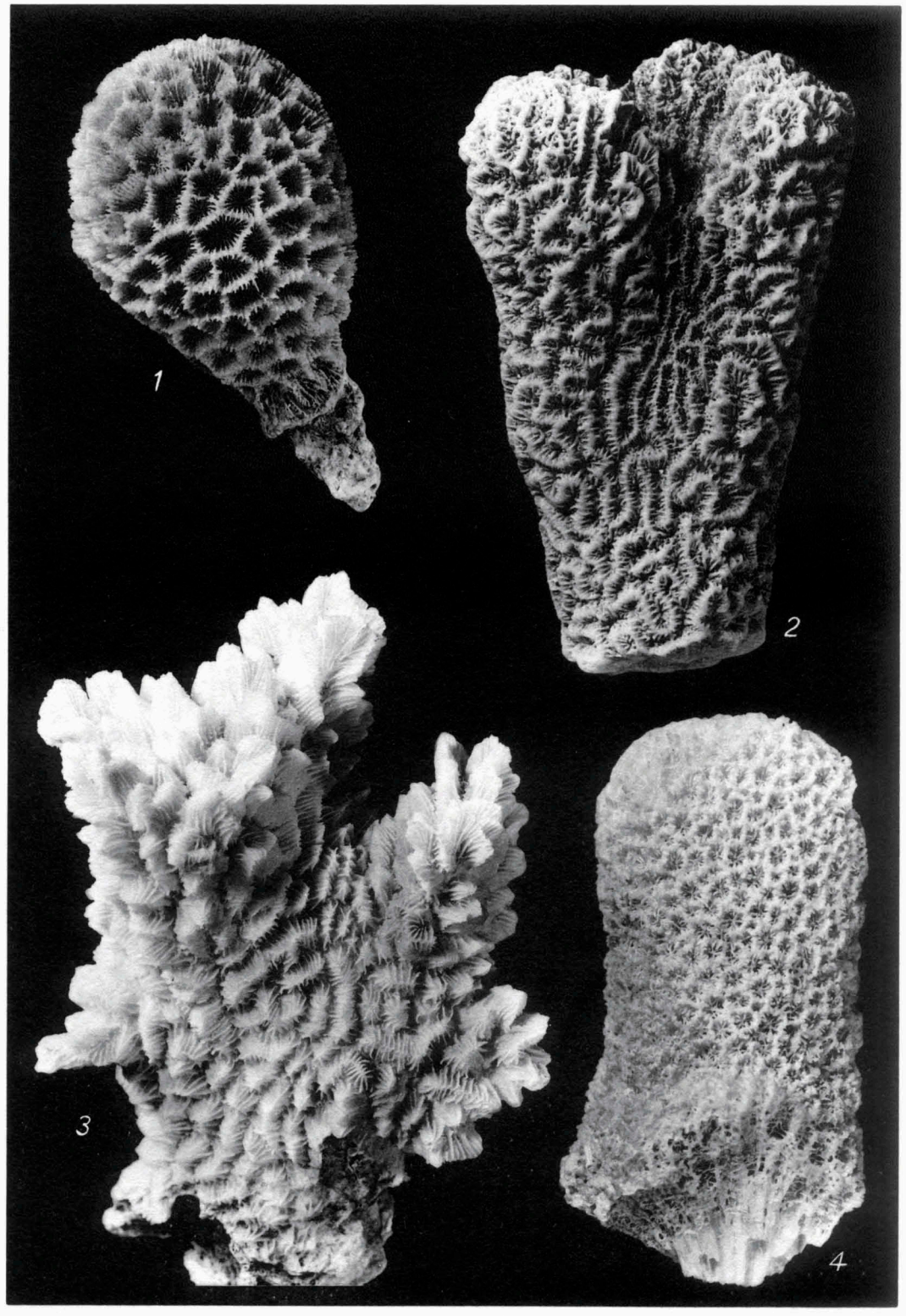
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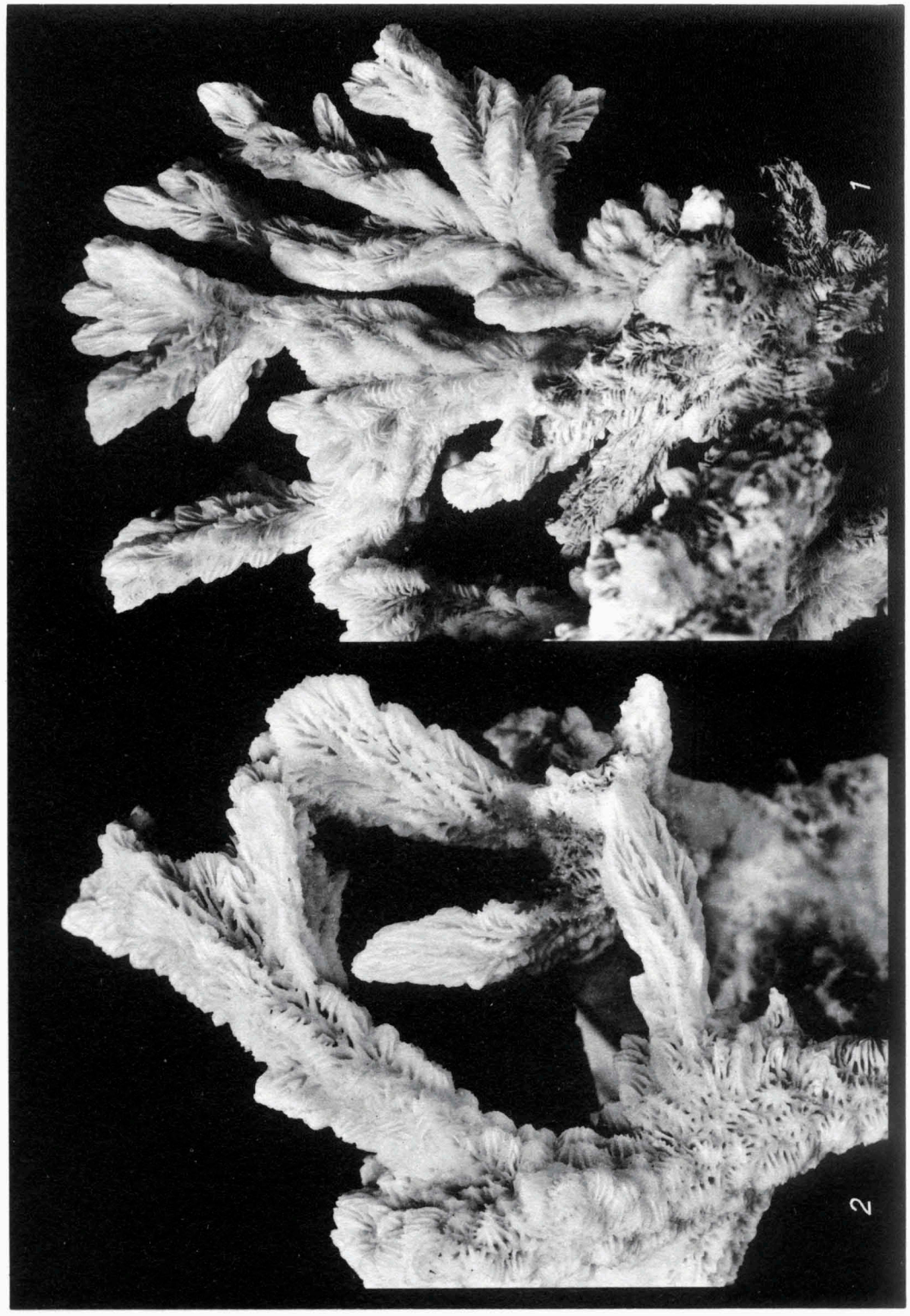
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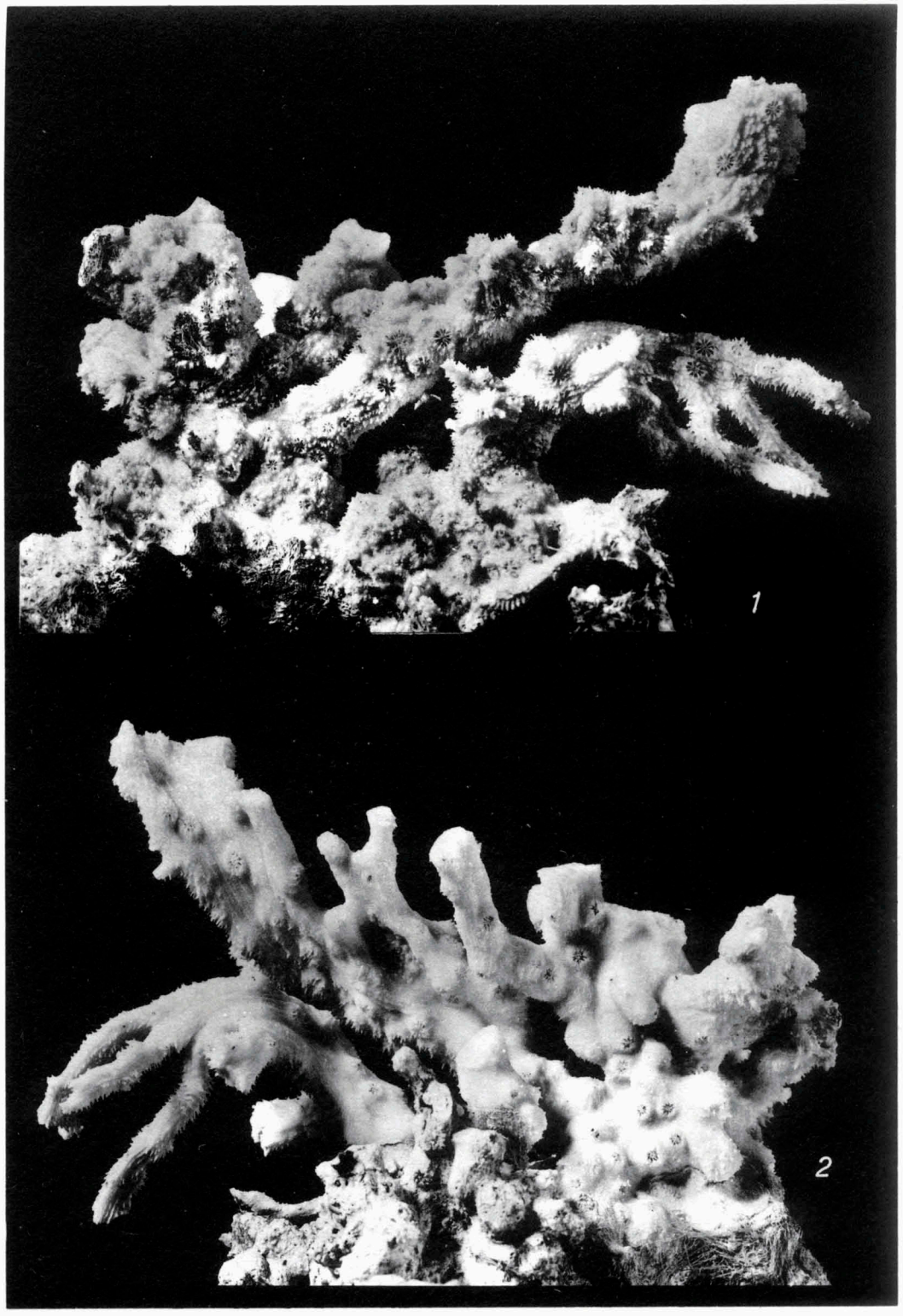
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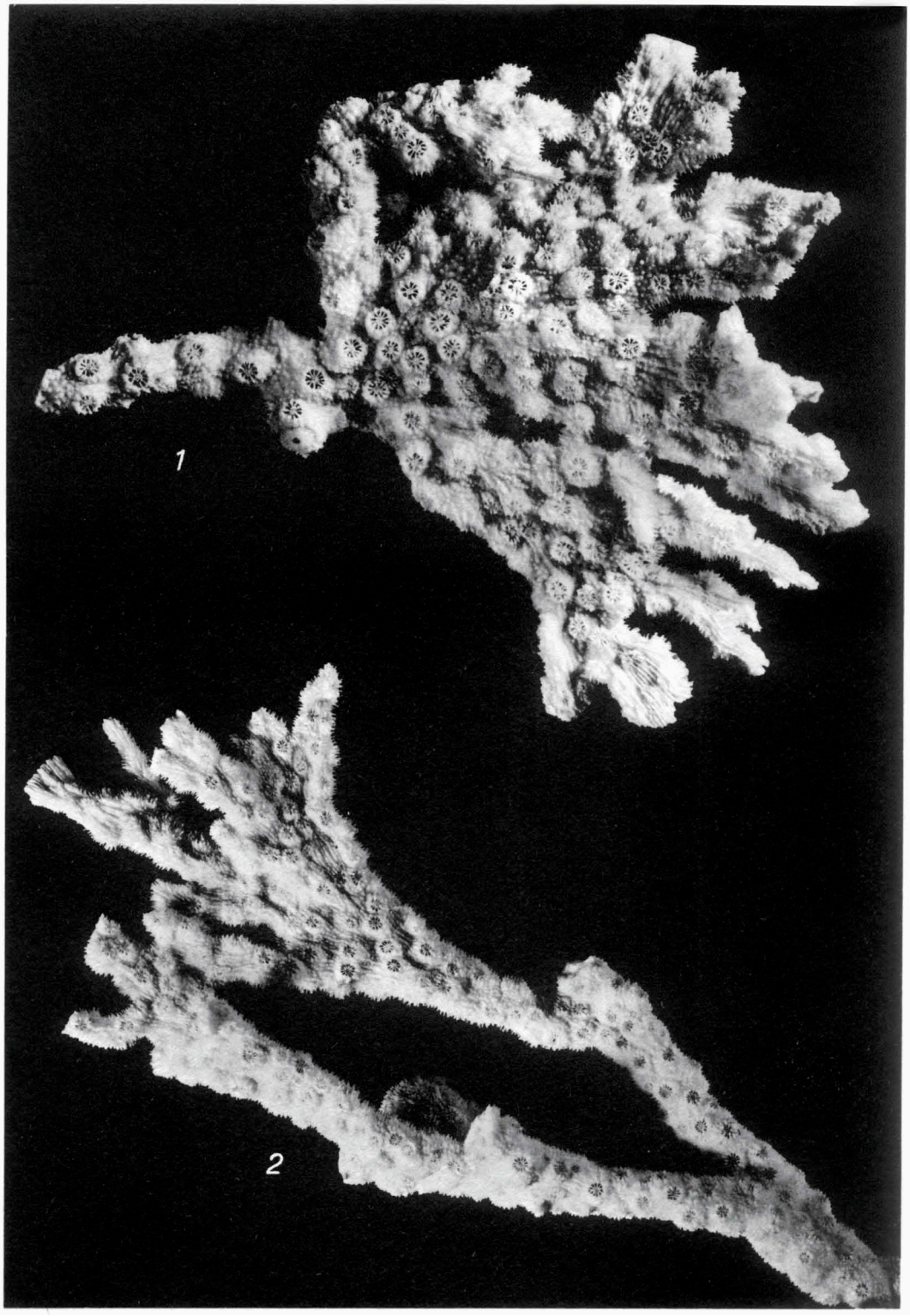
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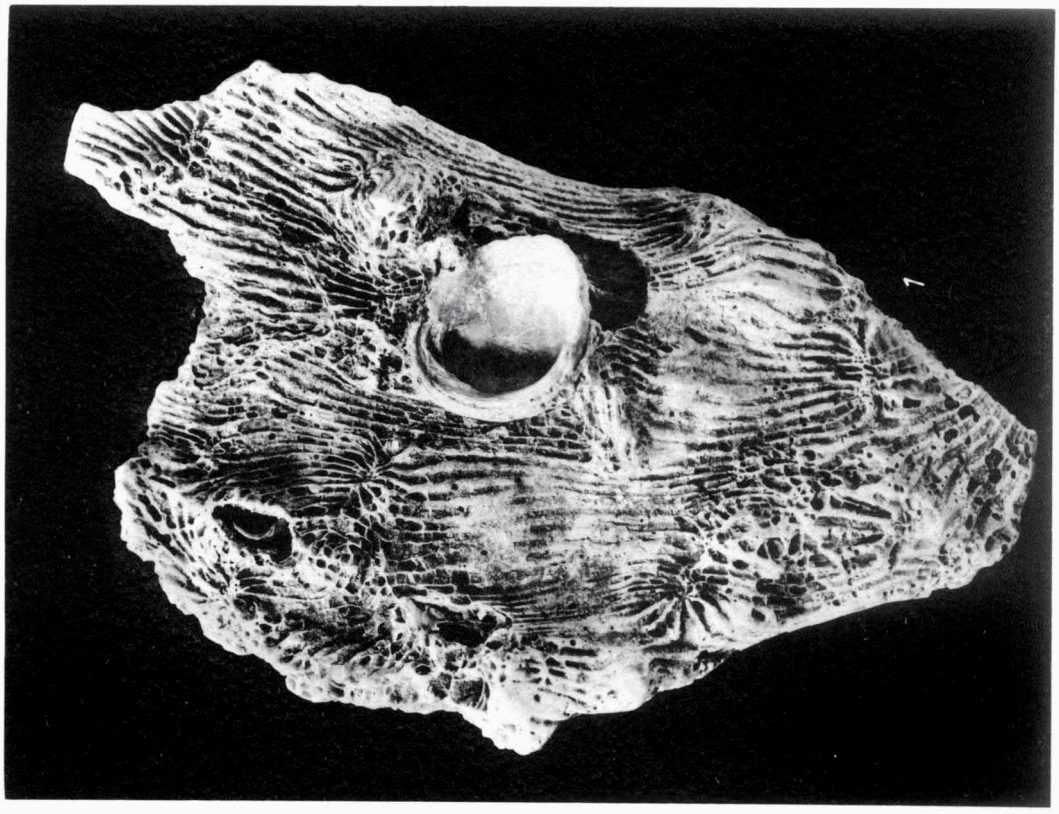
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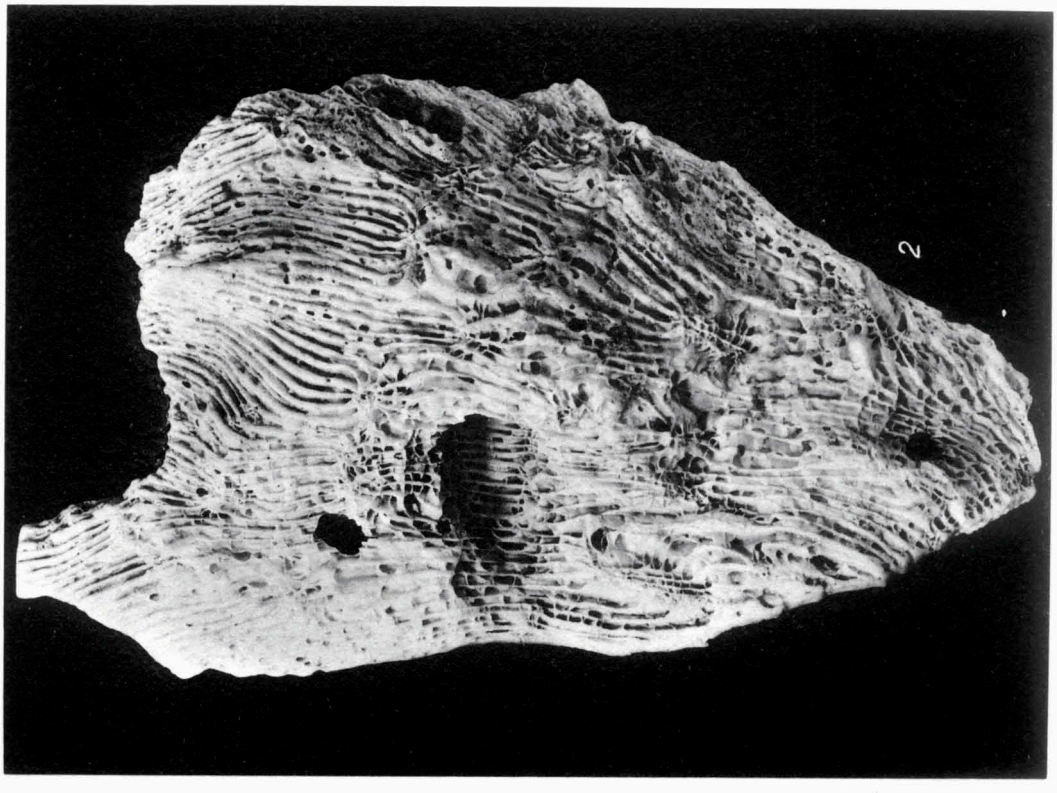
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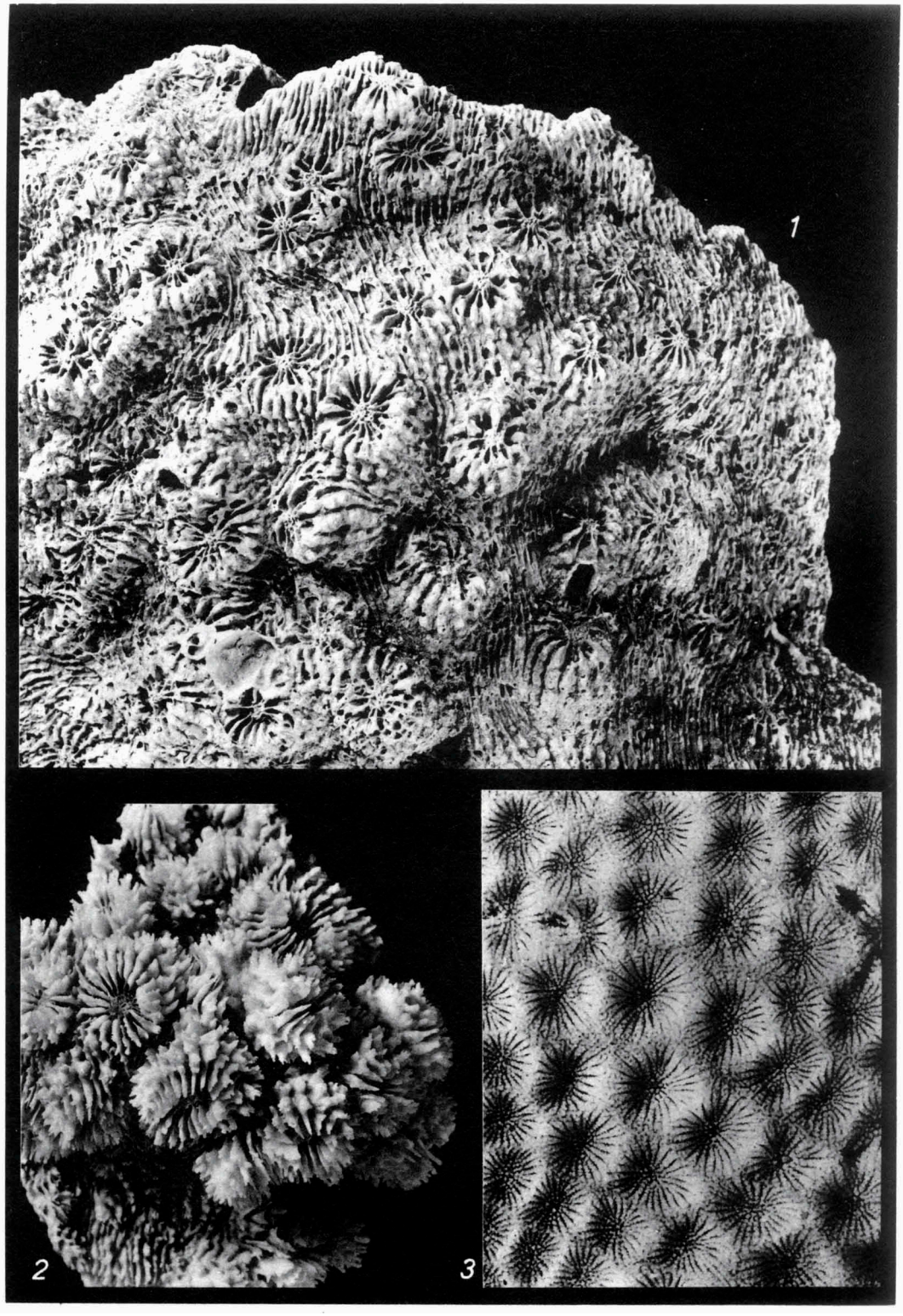
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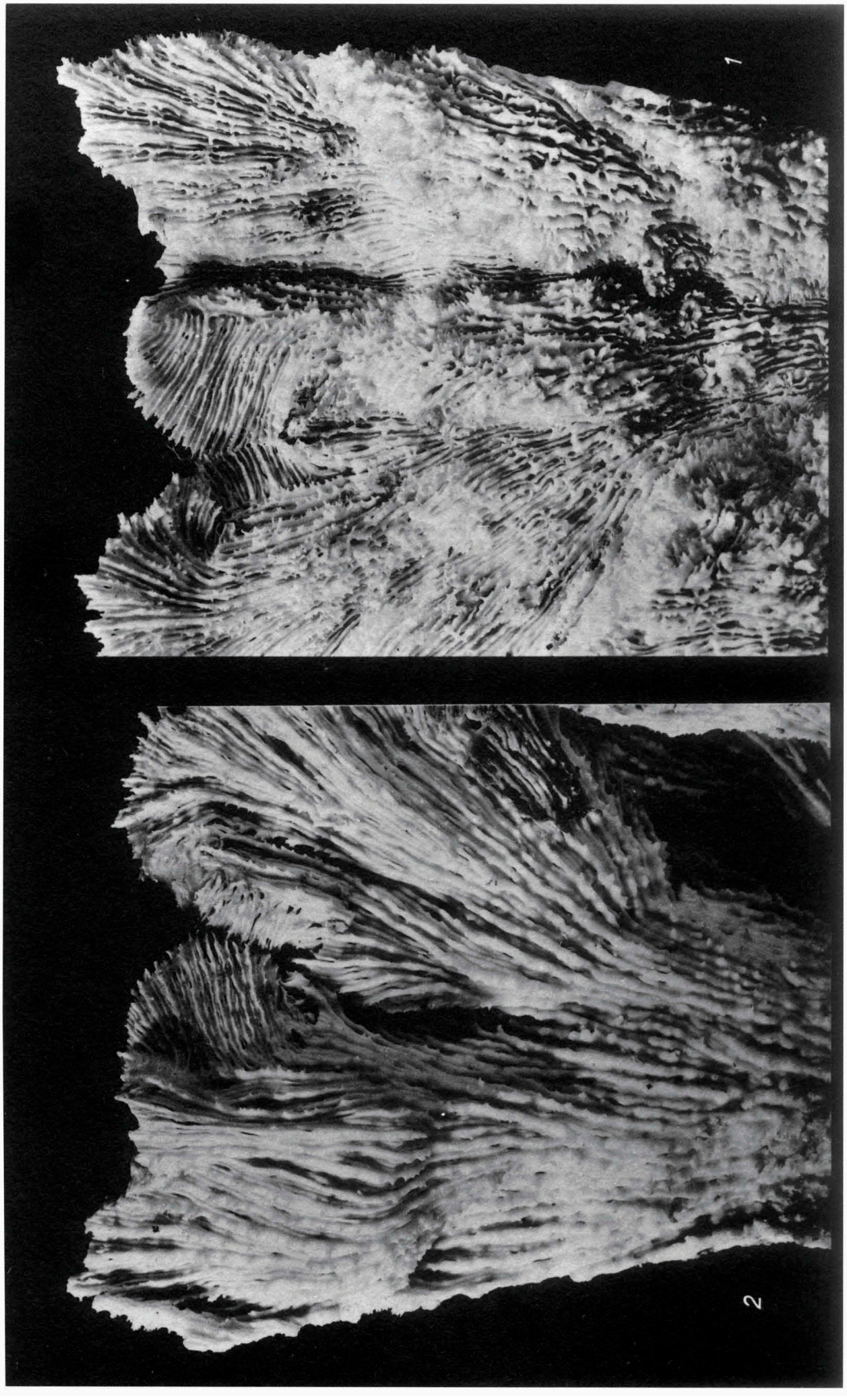
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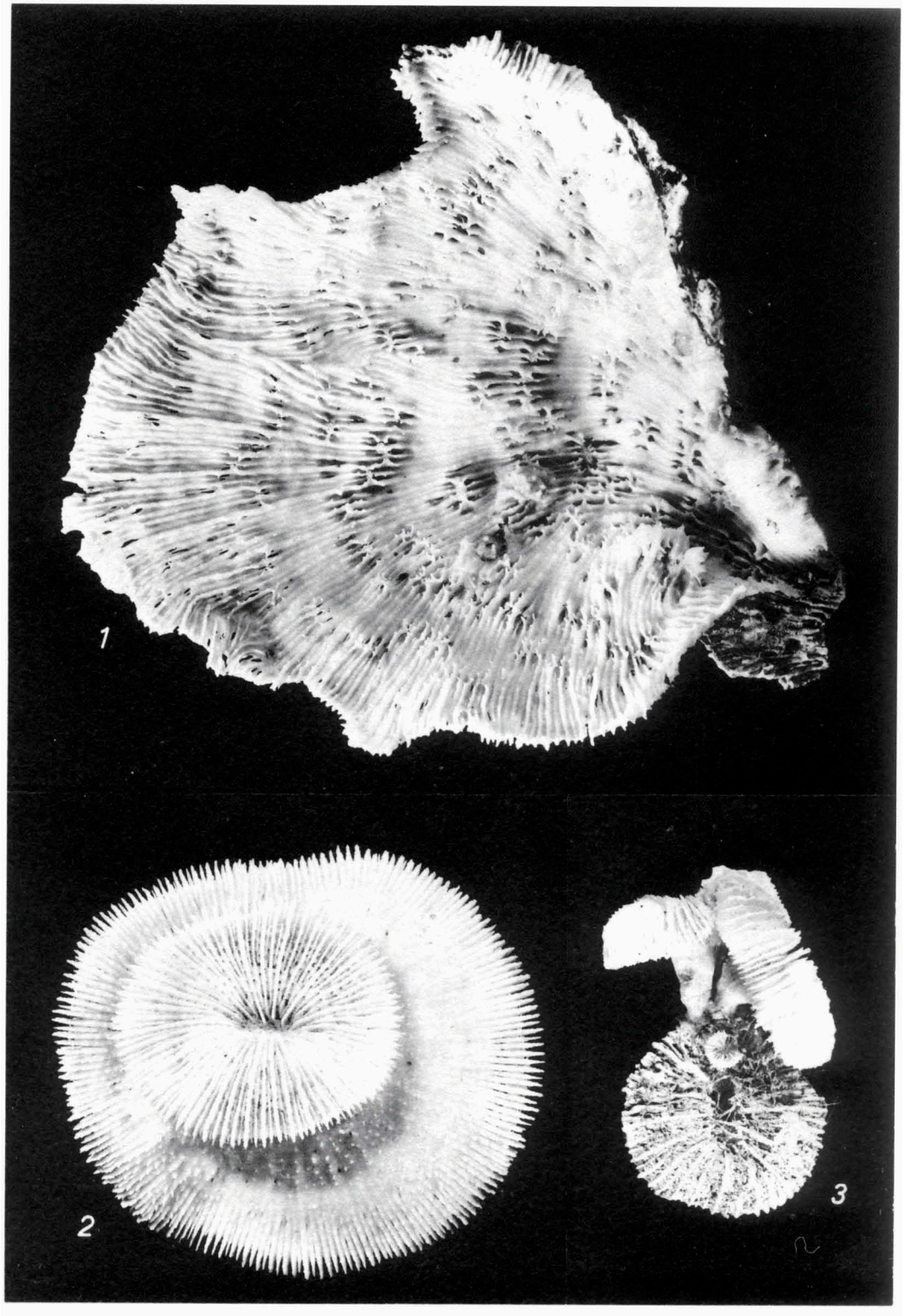
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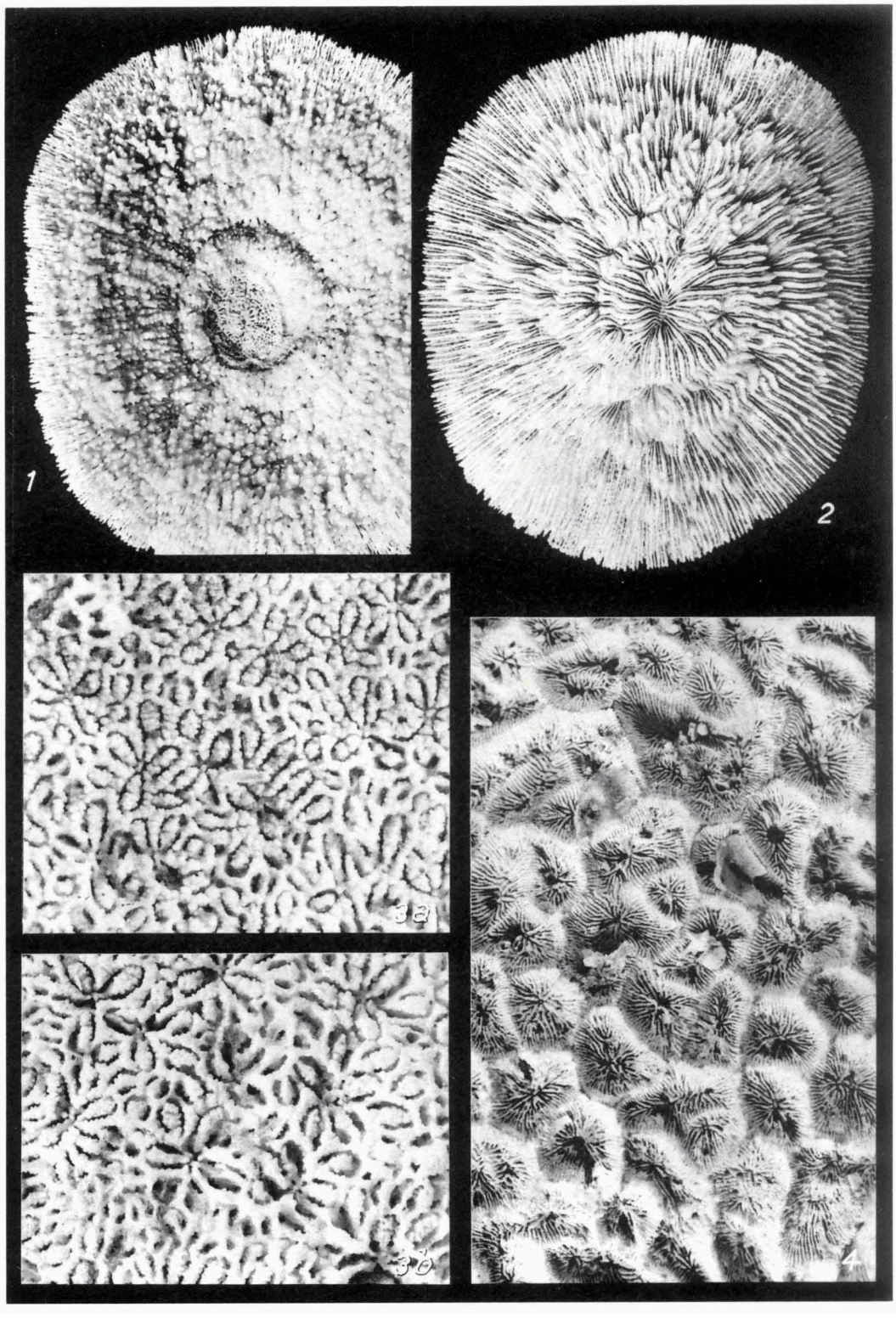
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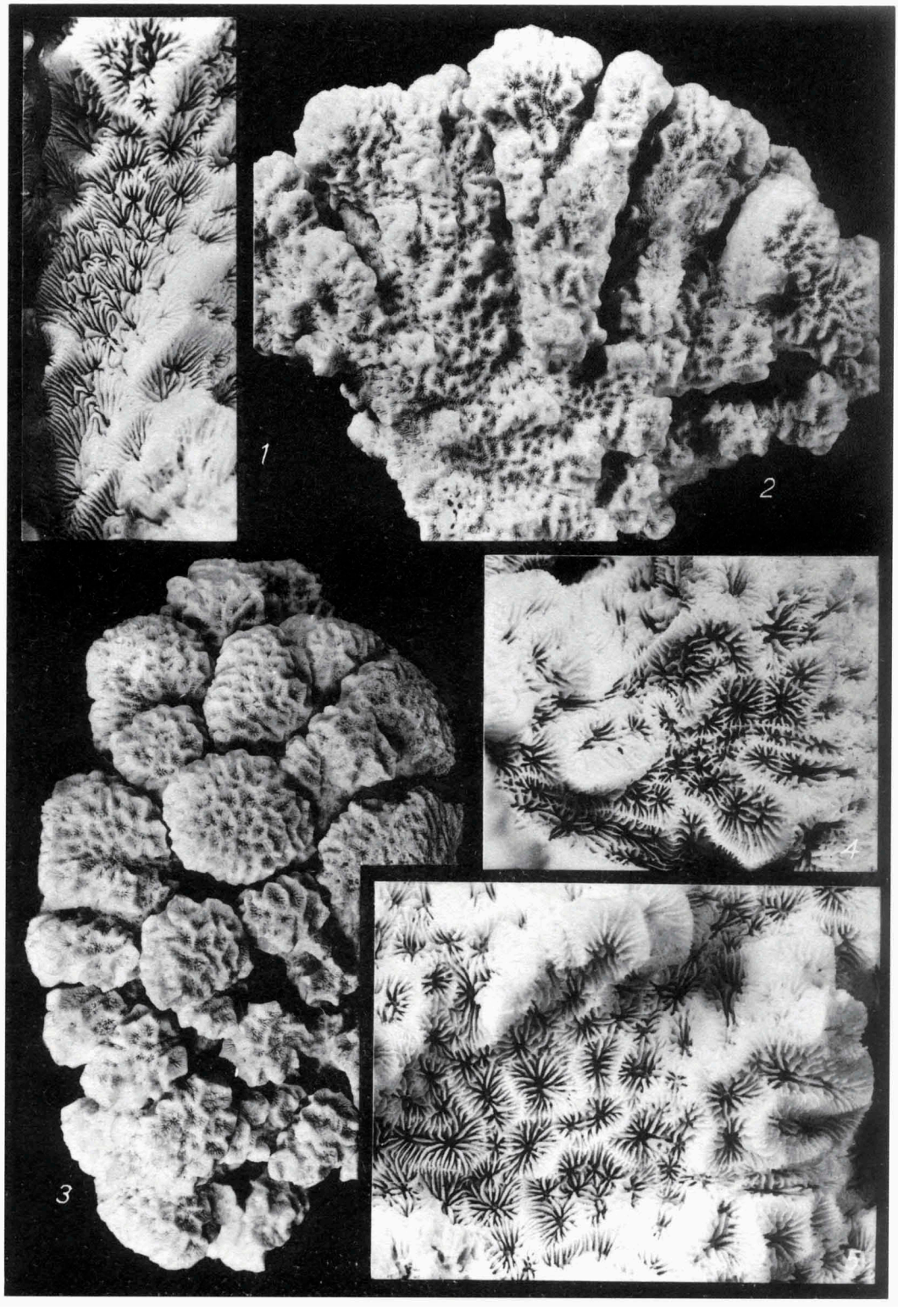
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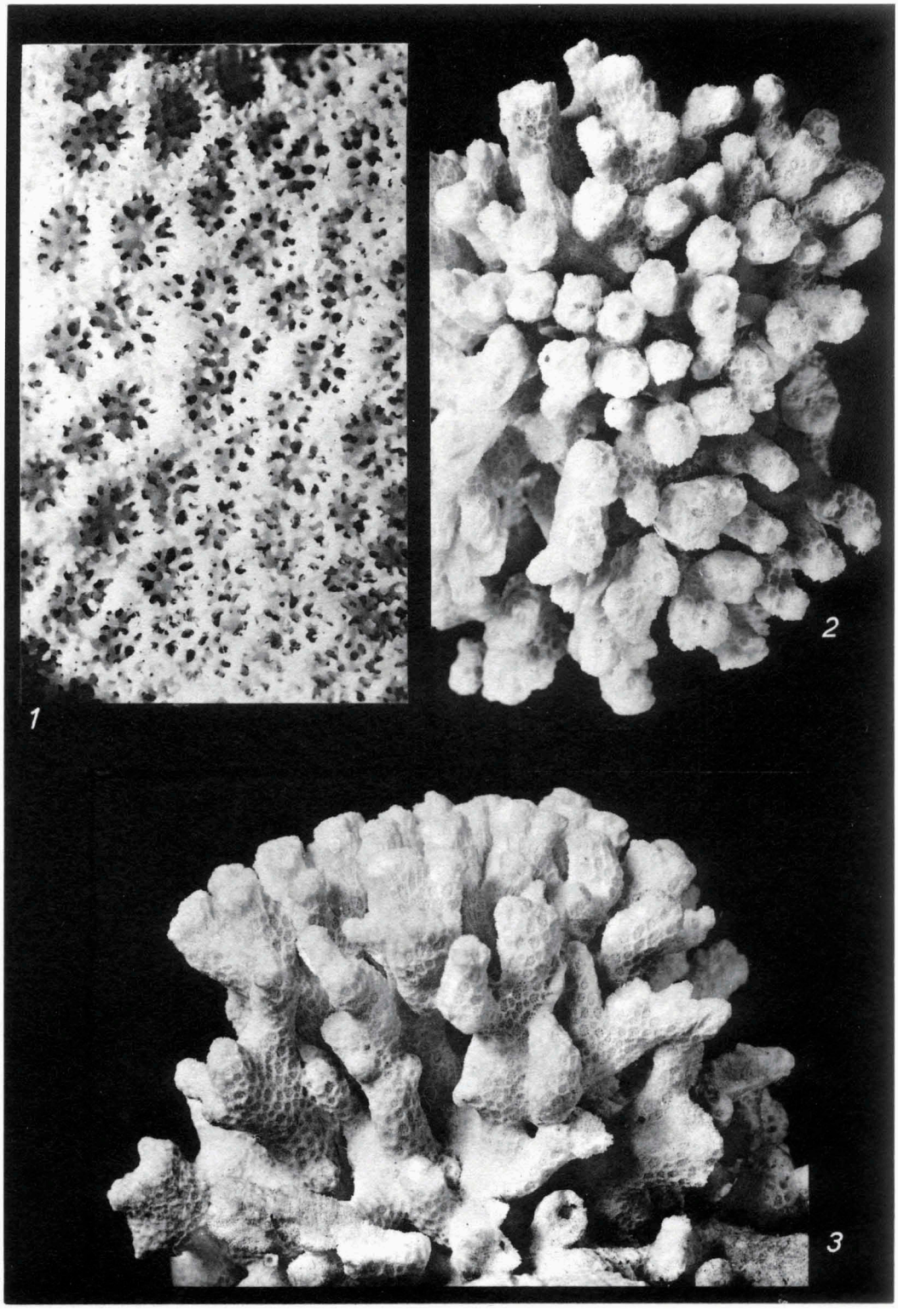
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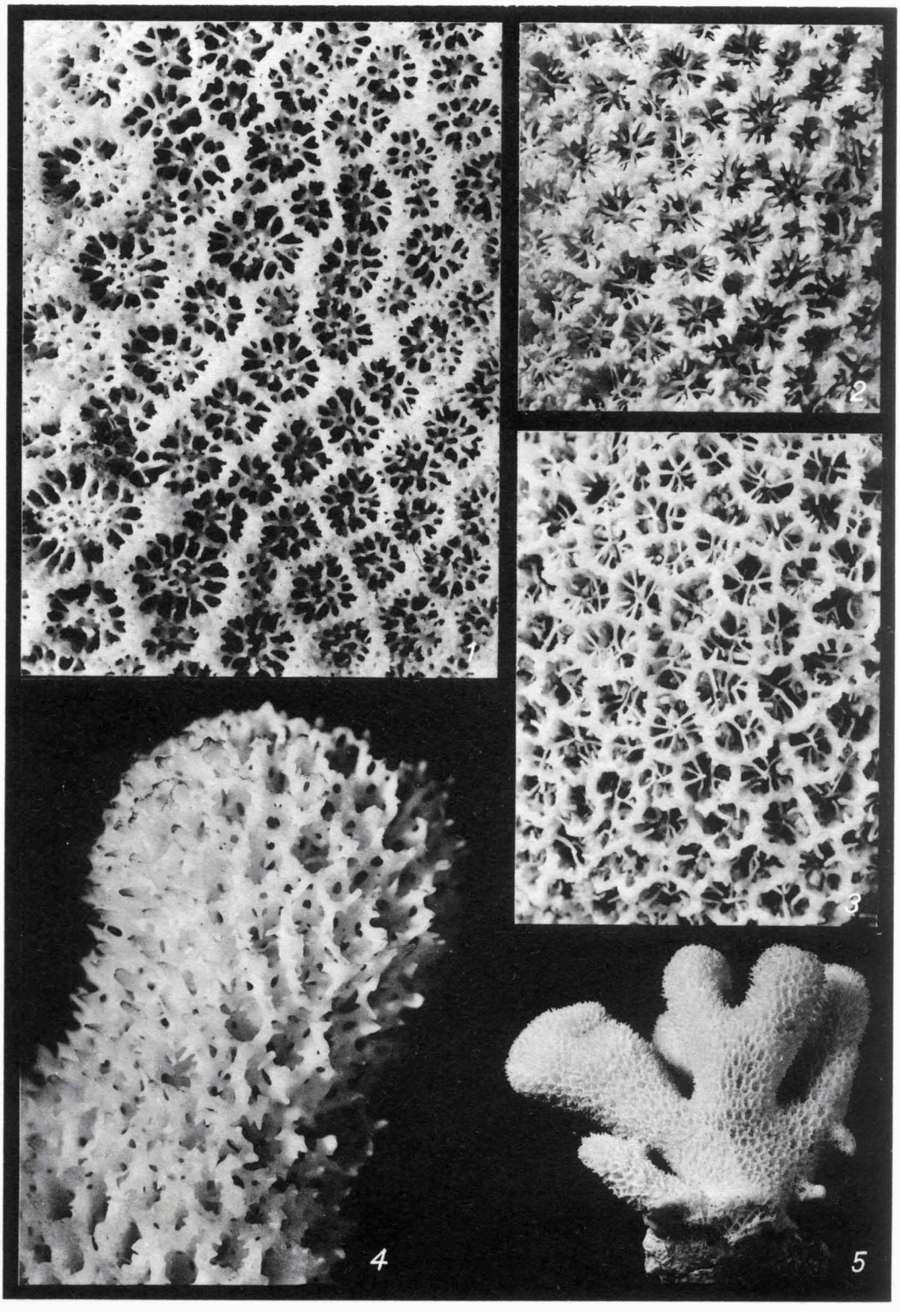
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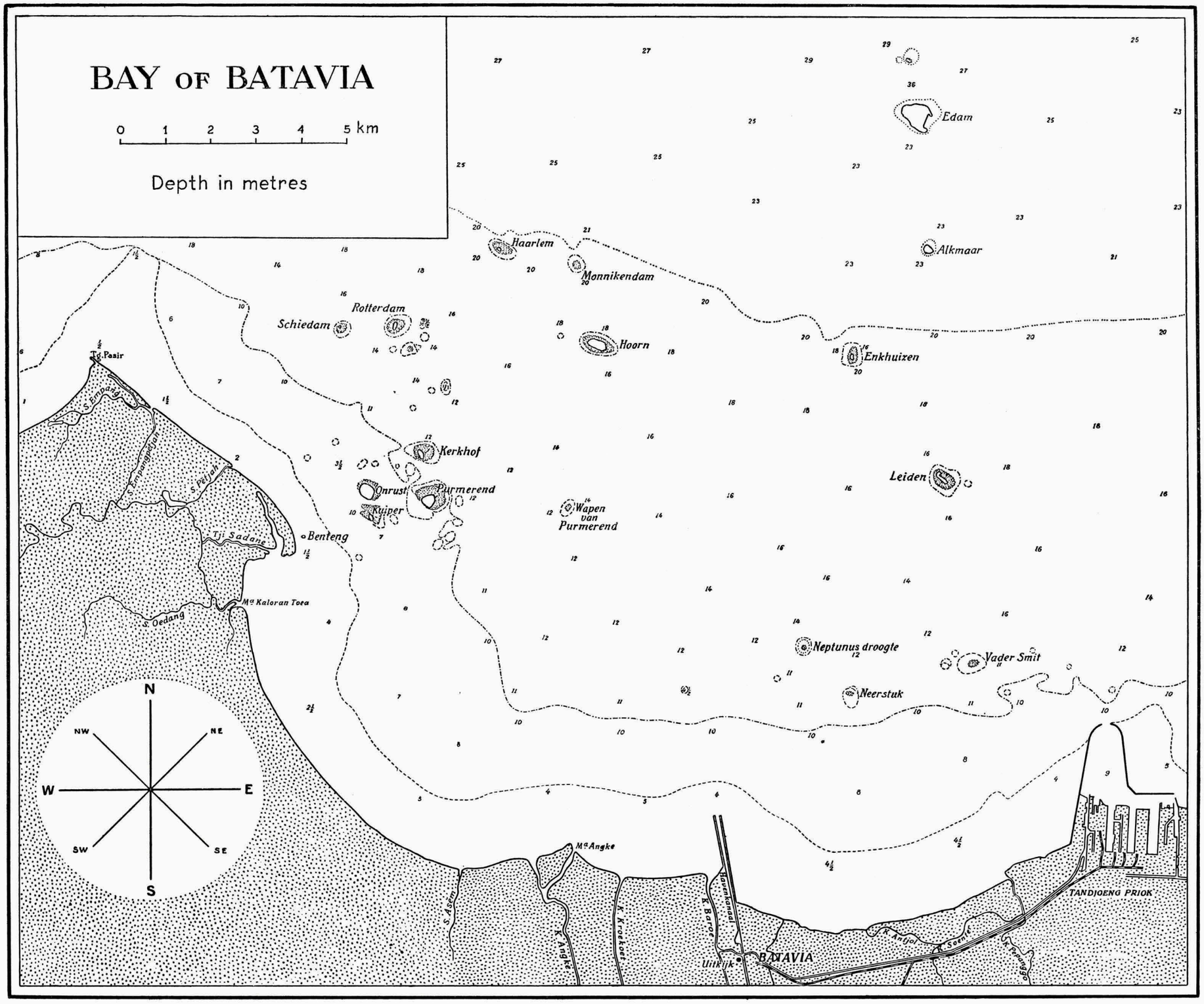
BAY OF BATAVIA
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Depth in metres
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Haarlem
Alkmaar
Monnikendam
Rotterdam
Schiedam
Hoorn
Enkhuizen
Tg. Pasir
S. Ematang
S. Ematangdjahe
S. Pajoan
Tji Sadane
Kerkhof
Onrust
Purmerend
Kuiper
Wapen van Purmerend
Leiden
Benteng
Mg. Kaloran Toea
S. Oedang
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Mg. Angke
S. Asem
K. Angke
K. Krokot
K. Barat
Havenkanaal
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K. Anjol
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TANDJOENG PRIOK

Fig. 1.