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THE MADREPORARIA OF FUNAFUTI.

By THOMAS WHITELEGGE.

Zoologist, Australian Museum.

THE MADREPORARIA.

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Zoologist, Australian Museum.

Mr. C. Hedley furnishes the following note :—

“For one who has surveyed the wealth of life as developed on the great coral reefs of Queensland, New Guinea, or New Caledonia, the chief impression of the coral reef of Funafuti is its poverty. In a single tide one could collect more genera and species on any of the former reefs than an industrious search of several weeks would yield from the latter. Neither is the poverty of species compensated for by an abundance of individuals.

“At the first glance over the windward reef flat, no living corals would probably be seen, but an exploration of the deep cracks and pools near the outer edge would usually reveal a few *Astræa*, *Porites*, and others, sheltered from the blows of the surf.

“A better field for observation is provided by the small reefs which stud the lagoon. Two or three of these, just in front of the village, and from a quarter to half a mile from the shore, yielded much of the material now dealt with.

“On approaching a coral reef the first glimpse a naturalist usually has of his quest are the great hemispherical masses of some *Astrean* coral, dimly seen through the shoaling water, studding the sea floor. If the boat passes a submarine ledge, from its face are sure to project the large basin or bracket-shaped corallia of *Montipora*, sometimes in clusters like a group of huge sea mushrooms. Jumping overboard in shallow water he is likely to step on a flat tabular mass of pale purple, whose corallites are too small to be distinguished in the water. Applying hammer and chisel, he will find that at his first venture he has struck the hardest, toughest, and most unbreakable thing on the whole reef, a *Porites* block. From the *Madrepora* bush beside it his difficulty, on the contrary, is to convey his samples ashore intact. The stout limbs of red, yellow, or green *Pocillopora* or *Stylophora* snap easily; while a skull-shaped mass of *Astræa* will split along the grain. A fragile little coral is the *Pocillopora cæspitosa*, which grows in dainty little pink tufts here and there among the stones. *Fungidæ* were very uncommon on Funafuti; I only picked up one alive and saw a few others dead on the western side of the atoll.

Where the soft *Alcyonaria* luxuriate, hard corals do not occur: the latter are perhaps smothered by their rivals.

"Dead corals thrown up on the outer beach suggested a distinct deep-water fauna that was beyond my reach. One of these is *Mussa*. Another much battered species of which I preserved no examples was frequently seen on the outer beach of both Funafuti and Nukulailai, I suppose to be a *Tridacophyllia*.

"Noticeable for their absence were the genera *Galaxea*, *Turbinaria*, *Merulina* and *Dendrophyllia*.

"The usual method of collecting was to anchor a boat or canoe on a reef, wade round in water from knee to waist deep and break off with a hammer and chisel any attractive specimens. Size and colour, the least stable of characters, chiefly guided me in such selection. With many genera a specialist in his study separates with difficulty the species by microscopic characters. When a non-specialist in the field views specimens through several feet of water, it is obvious that he must often confound together distinct species, and therefore fail to collect what he ought to take. Mr. Whitelegge has so frequently recognised two species in material that had been chosen as illustrating one, that I am not now as confident of the completeness of the collection as I was on my departure from Funafuti."

The Madreporarian corals obtained by Mr C. Hedley at Funafuti consist of one hundred and seventy specimens, referred to forty-seven species, and include representatives of nineteen genera.

The larger portion of the collection comprises the usual forms common throughout the coral regions; there are, however, a few rare or little known species not hitherto recorded from the Pacific, and also two species and one variety apparently new to science.

In the following pages, a few of the rarer forms have been described at some length, and in many cases, when dealing with the surface echinulations, I have given micrometric measurements of the average distance apart at the apex. It appears to me that the echinulations, if carefully measured in each species, would afford a fairly constant specific character which has hitherto been neglected.

The measurements given herein have been taken from the younger portions of the corallum. The echinulæ are generally a little compressed, at least at the base, and the micrometre lines have been brought parallel with the compression, but the measurements have been taken from the apices.

Of course there is a considerable amount of variation in the distance apart at the apex, owing to the bending of the echinulæ,

or to secondary spinular growths at the summits, but the average distances, when numerous measurements are taken, prove to be pretty constant and equally as reliable in corals as in other organisms determined by micrometric measurements.

The species described as new are *Madrepora spinulifera* and *M. impressa*. The former is referable to the subgenus *Odontocyathus* and the latter to the subgenus *Isopora*.

Order MADREPORARIA APOROSA.

FAMILY TURBINOLIDÆ.

CARYOPHYLLIA CLAVUS, var. EPITHECATA, *Duncan*.

Caryophyllia clavus, var. *epithecata*, *Duncan*, *Trans. Zool. Soc.*, viii., p. 311, pl. xlviii., figs. 13–16.

A small immature example in the collection is referable to this variety.

The corallum is erect, elongate, conico-turbinate, incrusting at the base and elliptic in outline at the summit.

The epitheca is finely granulate and extends from the base to the calicular margin.

The costæ are slightly prominent above, and cease at the median constriction below.

The septa are strongly exserted, radiately granulose at the sides and evenly rounded at the summits.

The pali are sinuate and sparsely spinose.

The columella consists of two spirally twisted processes.

There are forty septa and ten pali. The latter are opposite the tertiaries.

Height of corallum 14 mm.

Diameter at apex	7 by 9 mm.
„ base	7 mm.
„ pedicel	3 mm.

Obtained in from forty to seventy fathoms.

FAMILY OCULINIDÆ.

STYLOPHORA DIGITATA, *Pallas*.

Stylophora digitata (*Pallas*), *Klunzinger*, *Die Korall. Rothen. Meeres*, p. 61, pl. v., fig. 5; pl. viii., fig. 1.

There are eight examples of this species, exhibiting considerable variation.

In the young the branches are subcylindrical, transversely nodose, and somewhat conical at the extremities. The larger

specimens are mostly round symmetrical clumps, with compressed branches and obtusely rounded summits.

Common in the shallow waters of the lagoon.

FAMILY POCILLOPORIDÆ.

POCILLOPORA CÆSPITOSA, *Dana*.

Pocillopora cæspitosa, Dana, Zoophytes, U.S. Explor. Exped., p. 525, pl. xlix., fig. 5.

Three specimens of this common form are in the collection. It was the most abundant coral in the lagoon. The colour was pale rose when alive. Native name "Kamu."

POCILLOPORA GRANDIS, *Dana*.

Pocillopora grandis, Dana., Zoophytes, U.S. Explor. Exped., p. 533, pl. li., fig. 2.

Five examples; the largest is subflabellate, the branches being from 9 to 17 cm. thick. Bright emerald green when alive.

Uncommon in the lagoon.

POCILLOPORA VERRUCOSA, *Ellis & Solander*.

Pocillopora verrucosa, Ellis & Solander, Nat. Hist. Zoophytes, p. 172.

Four specimens.

Frequent in the lagoon and on the ocean shore.

FAMILY ASTRÆIDÆ.

MUSSA COSTATA, *Dana*.

Mussa costata, Dana, Zoophytes, U.S. Explor. Exped., p. 179, pl. vii., fig. 2.

Three water-worn fragments which may possibly belong to this species.

CÆLORIA ESPERI, *Edwards & Haime*.

Cæloria esperi, Edwards & Haime, Hist. Nat. Corall., ii., p. 417.

Seven examples of this species are in the collection.

Common in the lagoon, and on the outer reefs.

HYDNOPHORA MICROCONIA, *Lam.*

Hydnophora microconia, Lam., Hist. Anim. sans Vert., ii., 1816, p. 251.

Three specimens obtained on the lagoon reefs.

ASTRÆA VERSIPORA, *Dana*.

Astræa versipora, Dana, Zoophytes, U.S. Explor. Exped., p. 233, pl. xii., fig. 5.

Four large specimens.

Very common at low water in the lagoon and on the outer reefs.

ASTRÆA DANÆ, *Edwards & Haime*.

Favia dance, Edwards & Haime, Hist. Nat. Corall., ii., p. 442.

Astræa porcata, Dana, Zoophytes, U.S. Explor. Exped., p. 226, pl. xi., fig. 5.

One specimen.

Common in the lagoons and on the outer reefs.

ASTRÆA DENTICULATA, *Ellis & Solander*.

Madrepora denticulata, Ellis & Solander, Nat. Hist. Zoophytes, p. 166, pl. xlix., fig. 1.

Four specimens.

Abundant on the reefs.

ACANTHASTRÆA PATULA, *Dana*.

Acanthastræa patula, Dana, Zoophytes, U.S. Explor. Exped., p. 209, pl. x., fig. 14.

One small example.

The calices are subcircular, oblong, or polygonal and very unequal in the size of the fossa, and also in the relative thickness of the walls. The former measure from 5 to 10 mm. in diameter, the latter from 2 to 6 mm. in thickness. The septa vary in number from twelve to thirty-six.

The columella consists of a series of compressed denticles, frequently more or less connected.

Among loose stones on the lee side of the atoll.

ACANTHASTRÆA ECHINATA, *Dana*.

Acanthastræa echinata, Dana, Zoophytes, U.S. Explor. Exped., p. 229, pl. xii., fig. 1.

A single specimen in spirit is in the collection.

The larger calices are about 9 mm. in diameter. The third cycle of septa is incomplete. The septal spines are from 2 to 3.5 mm. in height.

Colour dark blackish brown.

Occurring with the preceding.

LEPTASTRÆA SOLIDA, *Edwards & Haime*.

Leptastræa solida, Edwards & Haime, Hist. Nat. Corall., ii., p. 512, pl. D 8, fig. 2.

Four specimens of this species were obtained. All are incrusting and assume the shape of the object they have invested, forming irregular nodular masses without any points of attachment.

Occurring among loose stones on the lee side of the reef.

LEPTASTRÆA TRANSVERSA, *Klunzinger*.

Leptastræa transversa, Klunzinger, Die Korall. Rothen. Meeres, iii., 46, pl. vi., fig. 2.

Three examples.

Incrusting, forming irregular convex plates on dead coral.

CYPHASTRÆA DANÆ, *Edwards & Haime*.

Cyphastræa danæ, Edwards & Haime, Hist. Nat. Corall., ii., p. 487.

Astræa microphthalmæ, Dana, Zoophytes, U.S. Explor. Exped., p. 217, pl. x., fig. 11.

One small example, consisting of a thin incrusting living layer growing on a dead crust of the same species, which completely invests some foreign object.

In the central region of the corallum the calicles are contiguous, the walls being frequently in contact with each other; near the margin they are separated by narrow spaces about half their own diameter.

The calicles are from 1.5 to 2 mm. in diameter, they are prominent, and have the walls and septa exerted.

The costæ and intercalicine spaces are finely echinulate. The echinulæ are from 0.15 to 0.2 mm. apart.

The columella is small, and consists of from three to six sub-spiniform granules.

Obtained in the passage between the islets of the reef.

Order MADREPORARIA FUNGIDA.

FAMILY PLESIOFUNGIDÆ.

PAVONIA REPENS, *Bruggemann*.

Lophoseris repens, Bruggemann, Abhandl. naturw. vereins zu Bremen, v., p. 395, pl. vii., fig. 1, a-b.

Pavonia repens, Klunzinger, Korall. Rothen. Meeres, 1879, p. 75, pl. ix., fig. 3.

Three specimens.

Obtained by a native diver in twenty feet of water in the lagoon.

Colour dull dark brown.

PAVONIA EXPLANULATA, *Lam.*

Pavonia explanulata, Lam., Anim. sans Vert., ii., 1816, p. 244; Edwards & Haime, Hist. Nat. Corall., iii., p. 69, pl. D 11, fig. 2.

Two small incrusting specimens were obtained in the lagoon.

FAMILY CYCLOSERIDÆ.

PSAMMOCORA FOSSATA, *Dana*.

Psammocora fossata, Dana, Zoophytes, U.S. Explor. Exped., p. 347, pl. xxvi., figs. 2, 2a.

Two specimens: one explanate, convex, with a large free epithecate margin exhibiting concentric lines of growth on the lower surface; the other a roll-like form incrusting a dead piece of coral. The meandering calicine valleys are mostly short, containing from two to six calicles; near the margins of the corallum as many as twelve may be found in one valley.

The ridges are rounded, and somewhat strongly echinulate. The septa vary in number from twelve to thirty-six; their summits are thick and echinulate. The echinulæ are arranged transversely in subquadrate groups, about 0.2 mm. apart at the apex.

The columella is small, and consists of a few spiniform granules.

Obtained in the lagoon.

PSAMMOCORA CONTIGUA, *Esper*.

Madrepora contigua, Esper, Die Pflanz., i., 1797, Suppl., p. 81, pl. lxvi.

Psammocora plicata, Dana, Zoophytes, U.S. Explor. Exped., p. 346, pl. xxv., fig. 2.

Two fine specimens of this species were obtained at low tide mark on the western side of the atoll.

OXYFORA, sp.

A small fragment was obtained in from forty to seventy fathoms outside the atoll. Its condition, however, is such as to preclude the possibility of specific identification.

FAMILY FUNGIDÆ.

FUNGIA TENUIDENS, *Quelch*.

Fungia tenuidens, Quelch, Chall. Rep., Zool., xvi., p. 138, pl. vi., fig. 1.

One example, similar in size, shape, and general characters to the specimen figured in the "Challenger" Report.

Occurring on the western side of the atoll.

FUNGIA DISCUS, *Dana*.

Fungia discus, Dana, Zoophytes, U.S. Explor. Exped., p. 291, pl. xviii., fig. 3.

A single beach-worn example is referable to this species.

Western side of the atoll.

MADREPORARIA PERFORATA.

FAMILY MADREPORIDÆ.

MADREPORA SYRINGODES, Brook.

Madrepora syringodes, Brook, Cat. Madr. Corals, Brit. Mus., i., p. 177, pl. xxxiii., fig. E.

Two small examples are somewhat doubtfully referred to this species.

MADREPORA SPICIFERA, Dana.

Madrepora spicifera, Dana, Zoophytes, U.S. Explor. Exped., p. 442, pl. xxxiii., fig. 4.

A single specimen, consisting of a stout pedicel and two plate-like lobes, one of which is much larger than the other; the irregular shape appears to have been due to the corallum growing in a narrow passage subject to strong inrushing currents of water. The lower surface near the pedicel is destitute of corallites except near the margins and angles of the branches on which there exist a few scattered immersed corallites. Towards the extremities of the branches the surface bears distinct immersed and subimmersed corallites.

The echinulæ on the upper and lower surface consist of compressed processes, usually wider at the summit than at the base, and on an average are about 0.15 mm. apart.

The striæ on the radial and axial corallites are about 0.1 mm. apart.

Collected on the outer reef, south-east of the main islet.

MADREPORA BOTRYODES, var. FUNAFUTIENSIS, var. nov.

Madrepora botryodes, Brook, Cat. Madr. Corals, Brit. Mus., i., p. 153, pl. xxxiv., fig. c.

A single example, referable to this species, but differing sufficiently to merit a varietal name.

The corallum is 12 cm. high, 28 cm. long, and from 9 to 12 cm. broad. The main branches are about 7 cm. high and 1.5 cm. in diameter; they are angular below, and give off from two to six branchlets, which reach the same level. The apices of the branchlets are irregularly thickened by aggregations of proliferous corallites. The branchlets are about 1.2 cm. in diameter at the base, and from 1 to 2.5 at the summit; at the apex they are 2 cm. apart and are separated below the clustered corallites by spaces 5 mm. wide.

Axial corallites from 2 to 3.5 mm. in diameter and 2 mm. exsert, aperture about 0.8 mm., septa twelve, the primaries meeting at the base; the secondaries are very narrow at the margin.

Radial corallites extremely variable in shape and in distance apart. On the lower parts of the main branches they are distant and deeply immersed; in the angles between the branchlets they are crowded, immersed, or slightly verruciform; on the lower two-thirds of the branchlets they are appressed, half tubular, and have the apertures directed upwards.

The clustered radials at the summits of the branchlets are immersed or subimmersed, passing through shallow nest-shaped to beak-nariform, with an elongated aperture. They are so irregularly heaped together that the axial corallites become obscured. The largest are about 3 mm. in length and 2.5 mm. in diameter.

There are twelve well developed septa. The primaries and also the directives in the elongate forms are broad and frequently meet below.

The surface, including the corallite walls is closely echinulate. The echinulæ consist of flat plates, often denticulated and wider at the apex than at the base. They are about 0.12 mm. apart.

Reefs in the lagoon.

MADREPORA PATULA, *Brook*.

Madrepora patula, Brook, Cat. Madr. Corals, Brit. Mus., i., 1893, p. 111, pl. ix., fig. E.

One fine example of this species in the collection.

Reefs in the lagoon.

MADREPORA EFFLORESCENS, *Dana*.

Madrepora efflorescens, Dana, Zoophytes, U.S. Explor. Exped., p. 441, pl. xxxiii., fig. 6.

A young specimen, referable to this species, was obtained in the lagoon.

The base is incrusting, and forms a discoidal expansion 12 cm. in diameter. At the origin of the pedicel it is 2 cm. thick, thinning down to 2 or 3 mm. at the margin. The pedicel is 6 cm. in diameter, and 2 cm. in height. The branches number between forty and fifty; inferiorly they are all more or less fused, superiorly their apices are free; about 1 cm. in height and pretty regularly the same distance apart at the apex. Their diameters range between 5 and 10 mm.

The corallites on the expanded base are nariform or tubulariform, with numerous immersed ones between. They are 2 mm. in diameter, the same or less in height, and about 2.5 mm. apart. The outer wall is more or less wanting.

The corallites on the pedicel and the lower parts of the branches are longer, stouter, and farther apart than those on the base. The

inner walls are short and the immersed corallites are more numerous.

Radial corallites of the branchlets and of the central region are labellate or tubo-labellate; they are longer and narrower than those on the under surface. They average about 1 mm. in diameter and vary from 2 to 3 mm. in height.

The axial corallites are from 2 to 2.5 mm. in diameter and are 2 mm. exert. The septa of the axial corallites are twelve, the primaries are well developed, and the directives meet below. In the radials of the upper surface there are usually only six septa; the directives are a little broader than the rest. On the lower surface of the branches, pedicel, and base, the septa are in two cycles, the primaries broad, the secondaries narrow, and the directives meet at the base.

Echinulæ flat; denticulate plates 0.1 mm. apart.

On the upper surface of the corallum the ridges on the walls of the corallites are 0.2 mm. apart; on the lower they are about 0.15 mm. Each ridge, when unabraded, has two longitudinal rows of spinules, which arise from the crest on either side; they are opposite or alternate, and diverge at such angle as to project over the interstices between the ridges.

Reefs in the lagoon.

MADREPORA FRUTICOSA, *Brook*.

Madrepora fruticosa, Brook, Cat. Madr. Corals, Brit. Mus., i, p. 138, pl. xviii., fig. A.

One small specimen obtained on the reefs in the lagoon.

MADREPORA EURYSTOMA, *Klunzinger*.

Madrepora eurystoma, Klunzinger, Die Korall. Rothen. Meeres, ii., p. 16, pl. i., fig. 8, pl. iv., fig. 7, *a, b*, pl. ix., fig. 12.

One specimen obtained in the lagoon.

The corallum is subcorymbose, and is attached by an incrusting base to a dead specimen of the same species. The living portion is 10 cm. high, and 14 cm. in diameter. The stouter main branches are angular, often compressed and fused at the base, varying from 1 to 2 cm. in thickness; towards their summit they give off numerous short simple branchlets, usually about 2.5 cm. in length, 4 to 5 mm. in diameter, and 1 to 2 cm. apart at the apex. They are fairly uniform in diameter, except the apical third which tapers to the base of the axial corallite.

The basal corallites are immersed or subimmersed; the septa are in two cycles, both narrow at the summit; the primaries become broader below and often meet in the centre.

The radial corallites on the basal portions of the branches and branchlets are immersed, or short and verruciform towards the

summits ; they are funnel-shaped, 2.5 mm. in diameter, 1.5 to 3 mm. in length, with an aperture of about 1 mm. Corallite walls porous, faintly striate, and denticulate ; the striæ 0.2 mm. apart, the denticles 0.15. Outer margin stout, inner thin, rarely incomplete except near the summits of the branchlets.

Axial corallites 2 to 3.5 mm. in diameter, 2 mm. exsert, with thin walls, a large aperture, and twelve septa, narrow above and broad below.

MADREPORA SPINULIFERA, sp. nov.

Corallum prostrate, openly reticulate ; mesh from 2 to 3 cm. long, and 1 cm. wide. Main branches angular, 1 cm. in diameter. Under surface without branchlets, upper with a series of short ones set at an angle of fifty degrees and directed outwards ; they are 5 mm. in diameter at the base, 1.5 cm. in height, and 1.2 cm. apart at the apex. Inner branchlets simple or with incipient twigs, tapering a little to their frequently compressed apices. Outer branchlets subcylindrical and more or less proliferous near their summits.

Corallites of the under surface of the branches immersed or subimmersed, becoming depressed nariform a short distance from the extremities ; they are about 2 mm. apart, 1 mm. or less in diameter, and have a round or oval aperture.

Calicles very deep, with twelve septa all narrow except the directives, which are broad and but rarely meet below. The secondaries are occasionally rudimentary in the young corallites.

The corallites of the upper surface of the branches and bases of the branchlets are similar to those on the under, but are wider apart, usually about 3 mm.

Radial corallites of the branchlets nariform, compressed inner wall often incomplete, tubo-nariform only in buds destined to form branchlets ; aperture oblique, opening upwards, longer than broad or more frequently twice as long as broad ; septa six, the directives large ; length 2 to 3 mm., diameter 2 mm. at the base.

Axial corallites compressed ; 1.5 mm. in their shorter and 2.3 in their longer diameter ; aperture elliptic, frequently narrowed in the middle.

Septa in two cycles, the secondaries narrow, the directives broad and nearly meeting below.

Surface of corallum porous, minutely spinulose ; spinules compressed, acute at the apex, 0.2 mm. high and about the same distance apart. Corallite wall thin, porous within and without, striate ; the striæ 0.14 mm. apart ; base and marginal lip beset with spinules similar to those on the rest of the surface ; intermediate portion of wall with spiniform granules.

There are eight pieces, evidently detached from one large specimen; the largest is 12 cm. in length, and 7 cm. broad at the outer extremity.

Reefs in the lagoon.

MADREPORA IMPRESSA, sp. nov.

One example obtained in the lagoon.

Corallum consisting of a subreniform plate, spreading out from a lateral attachment; the plate is 30 cm. long, from 14 to 20 cm. broad, 11.5 cm. thick at the point of attachment, from thence thinning out gradually to 1 cm. or less at the margin.

The living layer, as in other species of the subgenus *Isopora*, is about 1 cm. in thickness. The under surface is smooth and destitute of corallites. The basal epitheca is marked by a series of concentric ridges, indicating the lines of growth.

Upper surface very uneven, covered with low, irregularly rounded elevations, 1 cm. in diameter, 5 mm. high, and usually about 7 mm. apart. The intervening depressions vary in shape from subcircular to elongate, the latter form occurring near the margins, where the elevations are more or less connected by narrow ridges. Besides the numerous small prominences, there are six or seven larger ones from 2 to 3 cm. high and 3.5 cm. in diameter.

A few obtuse, compressed, or subquadrate branches are present near the margin, the largest is 3 cm. in height and 1.5 cm. in diameter.

Axial corallites numerous, situated in groups on the elevations, from 1.5 to 2 mm. in diameter; aperture circular, small, rarely exceeding 0.7 mm., generally between 0.5 and 0.6 mm. in diameter; walls 0.6 to 0.7 mm. in thickness, often confluent to the summits, which are plane or but little rounded.

Septa in two cycles, the directives seldom more than 0.1 mm. broad at the margin and about 0.15 at the base, the remaining primaries are very narrow, the secondaries barely distinguishable.

Radial corallites crowded, frequently confluent, subimmersed, nariform, tubo-nariform, or tubular; inner part of wall occasionally incomplete. Apices rounded, but generally thin and denticulate at the margin; diameter about 1.5 mm., length up to 2.5 mm.

The second cycle of septa either absent or rudimentary, primaries similar to those of the axial corallites.

Corallite walls densely covered with compressed denticulate echinulations, 0.15 mm. high and about 0.1 mm. apart.

The echinulations are more closely packed than in any of the described species known to me. The following measurements of the echinulations on the younger parts of the corallum and on the corallite walls have been taken from specimens in the Museum collection :—

	Height of echinulæ.	Distance apart.
<i>M. hispida</i>	0·2 mm.	0·18 mm.
<i>M. plicata</i>	0·17 ,,	0·13 ,,
<i>M. palifera</i>	0·17 ,,	0·12 ,,
<i>M. cuneata</i>	0·15 ,,	0·15 ,,
<i>M. impressa</i>	0·15 ,,	0·1 ,,

ASTRÆOPORA INCRUSTANS, *Bernard*.

Astræopora incrustans, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 89, pl. xxvii., pl. xxxiii., fig. 10.

A fine example of this species is in the collection.

The corallum forms a slightly convex plate, 17 cm. broad, 20 cm. long, and from 1 to 2 cm. in thickness.

Outline irregularly elliptic, margin pendant on one side obscuring the epitheca, on the other subhorizontal, the epitheca being radiately scalloped and concentrically ridged. The calicles are separated by spaces about 3 mm. wide. The walls are low, inclined in various directions, one side often flush with the surface, the other more or less elevated; diameter of the aperture usually about 2·5 mm., rarely 3·5.

Interclated young and marginal calicles smaller, varying from 1 to 1·5 mm.

Septa in two cycles, with an incomplete third, usually perceptible at the margin, but very narrow. The primaries rapidly widen out towards the base of the fossa.

Surface porous and echinulate; the echinulæ are flat denticles about 0·5 apart at the apex.

ASTRÆOPORA OCELLATA, *Bernard*.

Astræopora ocellata, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 95, pl. xxix., pl. xxxiii., fig. 16.

There are two fine examples of this species; both are pulvinate and attached to dead specimens of the same form.

The larger corallum is 12 cm. broad, 23 cm. long, and about 10 cm. in thickness.

The submarginal calices are large, prominent, with solid sloping walls and regular radiating rows of plate-like echinulæ, tipped

with spinules; the plates are about 0.4 mm. apart at the lip, and 0.5 mm. at the base of the wall.

The calicles on the central region of the corallum are not so large as those near the margin; they are less prominent, with but little sloping walls, and packed so closely together that the echinulations are almost in contact at their apices.

The corallites measure from 4 to 6 mm. in external diameter; the aperture is usually circular, and from 2 to 3 mm. across; frequently where the corallites are crowded, the aperture is elliptic or narrow elongate, and twice as long as broad.

The septa are in two cycles, with an incomplete third; they are narrow and ill-defined at the margin. Towards the base of the fossa the primaries widen out and meet in the centre.

Obtained on the lagoon reefs.

ASTREOPORA HIRSUTA, *Bernard*.

Astreopora hirsuta, Bernard, Cat. Madr. Corals, Brit. Mus., ii., p. 94, pl. xxxiii., fig. 13.

There are three examples referable to this species.

The larger is 25 cm. long, 8 cm. broad, and 7 cm. thick. The upper surface irregular in shape and almost divided into three cushion-like masses; the under surface is flattened, and a thin layer extends a short distance along a dead colony of the same species.

The corallites are rarely raised above the rest of the surface; the aperture is about 2 mm. in diameter, the spaces between are about the same, rarely more but frequently less.

The septa are in two cycles, well defined at the margin, the primaries meeting below.

The surface is closely echinulate; the echinulæ are usually compressed, single-pointed, and about 0.45 mm. apart.

The septo-costal and synapticular elements frequently combine and form a reticulated lip round the apertures of the corallites.

Reefs in the lagoon.

MONTIPORA FOVEOLATA, *Dana*.

Montipora foveolata, Dana, Zoophytes, U.S. Explor. Exped., p. 507.

There are three specimens referable to this species, one of which is a remarkably fine example, 28 cm. high and 26 cm. in diameter.

The base is somewhat flattened, subcircular in outline, and 22 cm. in diameter; it exhibits zones of growth enclosing dead material, probably of the same species.

The whole of the living layer appears to be incrusting, about 1 cm. or less in thickness, and is characterised by an extremely uneven surface, beset with numerous irregular nodular elevations. The larger elevations are from 5 to 6 cm. in diameter and about the same in height; the smaller are about 3 cm. in diameter and 2.5 cm. high; they are scattered over the whole surface of the corallum.

The apertures of the corallites are situated at the bottom of deep funnel-shaped pits; they are about 1 mm. or less in diameter. The raised ctenenchymatous walls are confluent, with thin, acute, or rounded margins. They range between 1 and 2 mm. in diameter at the summits, and are about the same in height.

The surface is finely porous and echinulate; the echinulæ are usually compressed and single-pointed; they are about 0.17 mm. high, and the same distance apart.

There are twelve well developed septa; the primaries are usually 0.3 mm. broad at the margin and meet in the centre below; the secondaries are narrower, about 0.2 mm., and are often united to the primaries near the columella.

MONTIPORA VERRUCOSA, Lam.

Montipora verrucosa, Lam., Hist. Anim. sans Vert., ii., p. 271, 1816.

Montipora planiuscula, Dana, Zoophytes, U.S. Explor. Exped., p. 507, pl. xlvii., fig. 3.

There are three specimens of this species, all of which are incrusting, forming irregular convex cushion-shaped masses.

The largest example is broken; it is 22 cm. long, 10 cm. broad, and 3 cm. thick, thinning down to about 7 mm. at the pendant margin.

The calicles are deeply sunk between the elevated papillæ; they are usually about 1 mm. in diameter, possessing a very distinct star of twelve septa; the secondaries, although narrow at the margin, frequently reach and unite with columella like the primaries. A few of the larger calicles, near the centre of the corallum, have an incomplete third cycle.

The papillæ are absent on the under surface; on the upper they are very variable in size; in some parts they are thin, compressed, and confluent at the base, in others they are thick, high,

and semi-isolated or united in twos or threes, forming short ridges. The apices are all more or less rounded; they are about 2 mm. in diameter, 1 to 3 mm. high, and 2.5 mm. apart at the apex.

The surface is finely echinulate; the echinulæ are compressed, single or double pointed spinules, about 0.13 mm. high and 0.1 mm. apart.

Obtained on the lagoon reefs.

MONTIPORA TUBEROSA, *Klunzinger*.

Montipora tuberosa, Klunzinger, Die Korall. Rothen. Meeres, p. 32, pl. vi., fig. 6, pl. v., fig. 11, pl. x., fig. 3.

A very fine specimen is here somewhat doubtfully referred to this species.

The corallum consists of a foliate expansion, arising from a stout lateral pedicel.

The frond is concave above, and exhibits a series of wide shallow grooves, which radiate from the centre of the concavity to the margin. On the under surface the grooves are more sharply defined, as are also the ridges occurring between.

The pedicel is 13 cm. in diameter; the frond is 46 cm. long, 40 cm. broad, 2 cm. thick near the pedicel, and from 2 to 3 mm. at the margin. The latter is broken on one side. When complete, the outline would be nearly circular and 50 cm. in diameter.

The upper surface is very uneven; there are a few large mound-like elevations, a number of small ones, and the whole surface exhibits inequalities due to clusters of from three to six or more corallites which are more or less elevated above the others.

The corallite apertures are 0.7 mm. in diameter; they are surrounded by thin trabicular walls, tipped with from two to five echinulated spines; they rarely form a circle round the lip, and are generally wanting on one side.

The septa are in two cycles, the directives are broad and meet below, the secondaries are narrow and subequal to the rest of the primaries.

There are a few large corallites scattered on the surface in which an incomplete third cycle of septa is present.

The under surface of the corallum has a living layer at the margin, varying from 2 to 12 cm. in width. It exhibits a broad

band of low rounded tubercles, 3 to 4 mm. diameter, 2 to 4 mm. high, and about 5 mm. apart at the apex.

The calicles are either level with the surface or slightly depressed; they are 0.5 in diameter, and vary greatly in distance apart.

The cœnenchyma is comparatively smooth and marked with a vermicular reticulation.

The echinulæ on the upper surface are slightly compressed at the base, above they are somewhat irregular and bear numerous acute spinules; they are from 1 to 2.5 mm. in height and about 0.5 mm. apart.

MONTIPORA SCABRICULA, Dana.

Montipora scabricula, Dana, Zoophytes, U.S. Explor. Exped., p. 502, pl. xlvi., fig. 2.

One small specimen which may be referred to this species; the fragment is, however, too much worn for correct determination.

Lagoon shore.

MONTIPORA EXSERTA, Quelch.

Montipora exserta, Quelch, Chall. Rep. Zool., xvi., p. 174, pl. viii., fig. 5 - 5b.

There are two specimens of this well marked species; one is small, flat, incrusting, and measures 5 cm. in length, 3.5 cm. in width, and 9 mm. in thickness at the broken edge; the other is cushion-shaped, 13 cm. long, 7 cm. broad, and 2 cm. thick, with a very even surface studded with numerous wart-like elevations. The surface is perforated here and there by a boring mollusc, which may be the cause of the warty growths. The calicles are between 0.65 and 0.75 in diameter and about the same distance or more apart. The apertures on the level parts of the corallum are surrounded by a very shallow rim, and all the septa are more or less exserted. The directives are broad and have their inner apices higher than the outer. The septa are usually in two cycles. A few large calicles are present in which a third cycle is more or less complete.

The surface of the cœnenchyma is reticulate, porous, and minutely echinulate. The echinulæ vary considerably; on the higher parts they chiefly consist of spiniform granules. On rapidly growing parts and at the margin they are elongated and more closely packed; their distance apart at the apex is usually about 0.2 mm.

FAMILY PORITIDÆ.

PORITES LICHEN, *Dana*.

Porites lichen, Dana, Zoophytes, U.S. Explor. Exped., p. 566, pl. lvi., fig. 2.

One small example, 3 cm. long, 2 cm. broad, and 5 mm. thick, with a reflexed margin. The calicles are very variable in size, ranging from 1.5 to 2.5 mm. in diameter; in some cases the separating walls are indistinct, and several calicles are included in a somewhat meandering valley as in *Nanopora irregularis*, Quelch.

PORITES LUTEA, *Edwards & Haime*.

Porites lutea, Edwards & Haime, Hist. Nat. Corall., iii., p. 180; Klunzinger, Die Korall. Rothen. Meeres, p. 40, pl. v., fig. 16.

A single specimen of this species is in the collection.

The corallum is 8 cm. high, and about 10 cm. in diameter. The calicles are shallow, polygonal, with thin acute walls; they are about 1 mm. in diameter. The septa are thin and in two cycles; pali distinct, usually six; columella reduced to a single spiniform granule. In a few large corallites there are as many as twelve pali, and an incomplete third cycle of septa.

PORITES LOBATA, *Dana*.

Porites lobata, Dana, Zoophytes, U.S. Explor. Exped., p. 502, pl. lv., fig. 1.

A fine example of this species was obtained.

The corallum forms a broad semi-circular band around a dead block of coral, and measures 22 cm. in diameter, 8 cm. in width, and 12 cm. in height.

The surface is studded with numerous round or elongate gibbous sites, the smaller are about 1.5 cm. in diameter, the larger about 4 cm.; they vary in height from 1 to 3.5 cm. The depressions between are well defined angular grooves, generally running transversely across the band-like corallum. The calicles are polygonal, shallow, almost flat, and about 1.5 mm. in diameter. The walls are distinct, a little raised, but thin and acute. Septa twelve, very thin; pali six, very prominent, as high as the walls and frequently joined at the base, forming a conspicuous ring round the columella, which is usually represented by a solitary spiniform granule.

The surface echinulæ consist of short bluntish spines, bearing a number of ill-defined granules.

PORITES CRASSA, *Quelch.*

Porites crassa, Quelch, Chall. Rep., Zool., xvi., p. 183, pl. xi., fig. 2-2a.

A small incrusting example of this species is in the collection.

PORITES MIRABILIS, *Quelch.*

Porites mirabilis, Quelch, Chall. Rep., Zool., p. 185, pl. xi., fig. 5-5a.

There are three specimens of this rare species in the collection. Of these, two are small, irregularly-convex, and incrusting; about 5 cm in diameter and 2 cm. high. The third and much larger specimen forms a subglobose mass with several basal expansions; the surface is somewhat uneven and gibbous.

PORITES GAIMARDI, *Edwards & Haime.*

Porites gaimardi, Edwards & Haime, Hist. Nat. Corall., iii., p. 179.

There are two specimens referable to this species. The smaller is subglobose, 5.5 cm. in height and 6.5 cm. in diameter. The larger is 19 cm. long, 14.5 cm. broad, and 12 cm. high. When seen in profile the shape suggests a human cranium from which the facial portion has been removed. The surface is even, save some superficial depressions which are present in great numbers, but can only be observed when the specimen is held up towards the light.

The calicles resemble those of *Porites astræoides*, Lamarck, they are, however, smaller, and the walls are not so stout; their diameter is usually about 1.1 mm., rarely more but frequently less. The walls are subsolid at the base, and somewhat acute at the summit.

The septa are in two cycles, thin, and somewhat ill-defined; the interseptal spaces are either circular, elongate, or keyhole shaped. There are six pali, which are usually remote from the centre of the calyx. Columella wide at the top, but rarely with more than one granule.

SYNARÆA UNDULATA, *Klunzinger.*

Synaræa undulata, Klunzinger, Die Korall. Rothen. Meeres, p. 48, pl. vi., fig. 12, pl. v., fig. 30.

One specimen obtained on the reefs in the lagoon.

The example is incrusting, and measures 6 cm. in length, 4 cm. in width, and from 2 to 3 mm. in thickness.

The surface and characters generally closely agree with Klunzinger's figures and description.
