2. On the Fungid Corals collected by the Author in the South Pacific. By J. STANLEY GARDINER, M.A., Gonville and Caius College, Cambridge¹.

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(Plates XLIII.-XLV.)

The present paper forms the third of the series on the corals collected on the reefs of Funafuti, Rotuma, and Fiji. In it 48 specimens are dealt with, of which 39 have been referred to 15 known species, while 6 species have been described as new. It is proposed to absorb the genus *Tichoseris* into *Pavonia* and the genera *Mæandroseris*, *Coscinaræa*, and *Plesioseris* into *Psammocora*.

Genus SIDERASTRÆA.

Siderastræa, Blainville, Dict. des Sci. Nat. t. lx. (1830).

Siderina, Dana, Zooph. p. 218 (1846).

Siderastræa, Duncan, Journ. Linn. Soc., Zool. xviii. p. 134 (1885).

I have referred two specimens to this typical West-Indian genus, after having compared them carefully with a number of specimens of the genus in the British Museum.

1. SIDERASTRÆA CLAVUS Dana. (Plate XLIV. fig. 1.)

Pavonia clavus, Dana, Zooph. p. 332, pl. xxiv. fig. 4.

The largest of the two specimens which I have referred to this species is a much swollen branch, 11 cm. high by 4 cm. in diameter at the base and 9 cm. at the somewhat lobed and twisted apex. The calices at the sides, which are from 1.5-2.5 mm. in diameter, are separated by a dense theca, over which the septa are continuous (Pl. XLIV. fig. 1). The latter are typically 24 in number, alternately large and small, the primary² scarcely distinguishable from the secondary; commonly, however, their number is considerably reduced, owing apparently to the fusion together of several at the angles, where three or more calices meet. In the axial fossa is a small, low, often laterally compressed columella. The calices of the summit are much smaller than those of the sides, being generally less than 1.5 mm. in diameter. Their septa are relatively thinner with wide interseptal loculi, and the thecæ are generally very distinct, the calices often being joined to one another solely by costæ.

The smaller specimen is a nodule 3 cm. high obtained from the reef close to the larger. Its apical calices have 6 large septa fused with the columella and 6 smaller and narrower septa. The thecæ of neighbouring calices are thin and do not fuse, being joined merely by costæ. Deeper in the corallum, in sections, the thecæ

¹ Communicated by W. BATESON, F.R.S., F.Z.S. For former papers see P. Z. S. 1897, p. 941, and 1898, p. 257.

² In this paper, unless otherwise precisely stated, the first six septa are known as the primary, and the second six as the secondary.

and costæ can be seen to be much thicker, almost obliterating the intercostal spaces and forming a dense imperforate wall.

Rotuma; rim of reef.

Genus FUNGIA.

Fungia, Dana, Zooph. p. 318 (1846).

Fungia, Duncan, Journ. Linn. Soc., Zool. xviii. p. 141.

The genus *Fungia* is represented in the collection by 8 large anthocyathi, and 44 trophozooids and anthoblasts.

There were no living specimens obtained from Funafuti, but the dead coralla of apparently four distinct species were picked up on the outer beaches of the islands, showing that the genus must live in considerable abundance close outside the reef. These specimens are, unfortunately, too much worn to be identified with any certainty, but may be provisionally referred to *F. crassa*, *F. patella*, *F. discus*, and *F. tenuifolia*.

1. FUNGIA PATELLA Ellis and Solander.

Madrepora patella, Ellis and Solander, Zooph. p. 148 (1786).

Fungia patella, Edwards and Haime, Cor. iii. p. 7.

Fungia patella, Klunzinger, Die Korallthiere des Rothen Meeres, Th. iii. p. 61.

I have referred three specimens to this species, which were obtained all together in a small pool a few feet across. Among themselves they vary considerably in the perforations of their under surfaces and the thickness and spinulation of their septa. In shape they are more or less round, 11–13 cm. in diameter, with rather open, oval fossæ in the centre.

Wakaya, Fiji; fringing reef.

I have also ascribed to the same species as the above a stunted anthocyathus, which was found in the same pool, about 9 cm. in diameter, with a part of the upper surface killed by an incrusting nullipore. The septa are much thicker than in the preceding specimens and have deeper and more regular dentations, while the under surface is almost imperforate.

In the same pool were obtained 24 trophozooids and anthoblasts, forming a good series to the free anthocyathus. The youngest of these has 24 septa, of which 12 are much the larger and thicker, and are joined by a few synaptacula.

2. FUNGIA DENTATA Dana.

Fungia dentata, Dana, Zooph. p. 293, pl. xviii. fig. 7.

Fungia dentata, Edwards and Haime, Cor. iii. p. 10.

A single specimen closely corresponding to the descriptions. The fourth, fifth, and sixth cycles of septa in one part of the corallum, where the edge of the calice has grown somewhat upwards, are characterized by a large, pointed, raised tooth at the inner edge with a deep bay outside. In other parts, where the upper surface of the disc is convex, the tooth is usually present, but less distinct and with no deep bay.

Rotuma; boat-channel.

3. *FUNGIA CRASSITENTACULATA* Quoy and Gaimard.

Fungia crassitentaculata, Quoy and Gaimard, Voy. de l'Astrol., Zool. t. iv. p. 182.

Fungia crassitentaculata, Edwards and Haime, Cor. iii. p. 19.

I have with some hesitation referred one specimen, 13 cm. in diameter, to this species as it corresponds fairly well with the descriptions and two named specimens—one in spirit—in the British Museum.

Rotuma; boat-channel.

4. *FUNGIA DENTIGERA* Leuckart.

Fungia dentigera, Leuckart, De Zooph. Corall. p. 48, tab. iii. figs. 1, 2.

Fungia dentigera, Dana, Zooph. p. 301, pl. xviii. fig. 4.

Fungia dentigera, Edwards and Haime, Cor. iii. p. 17.

There is one specimen of this species, 13 cm. long by 7 cm. broad, which closely corresponds to Dana's figure and description. The margin, too, has the same obsolescent folds.

Rotuma; boat-channel.

5. *FUNGIA DANÆ* Edwards and Haime.

Fungia echinata, Dana, Zooph. p. 294, pl. xviii. figs. 8, 9.

Fungia danæ, Edwards and Haime, Ann. des Sci. Nat. t. xv. p. 80 (1851).

Fungia danai, Edwards and Haime, Cor. iii. p. 11.

There is one specimen of this species, about 12 cm. in diameter, which seems to be to some extent intermediate between Dana's Fijian and East-Indian specimens. The large radiating lamellæ of the under surface are at the edge of the corallum about 1.2 cm. apart and correspond to the first four cycles of septa; in places the lamellæ of the fifth cycle are nearly as large, while those of the sixth to the eighth can usually be distinguished running inwards for 1-2 cm. On the upper surface the septa are less strongly and more regularly toothed than in either of Dana's specimens. At the inner ends of those septa, which do not reach the axial fossa, there is generally a low but distinct tooth, about 3 mm. broad.

Rotuma; boat-channel.

Genus *HALOMITRA*.

Halomitra, Dana, Zooph. p. 311 (1846).

Halomitra, Duncan, Journ. Linn. Soc., Zool. xviii. p. 144.

Halomitra, and *Podabacia* Quelch, Challenger Reef-Corals, pp. 138-141.

The characters by which Quelch separated *Podabacia* and *Halomitra* are, I consider, mainly due to the age and mode of growth of the specimens which he examined and of those which had been previously described.

The free corallum seems from my specimens (2) to have been formed in a somewhat similar manner to that of the genus *Fungia*, by the breaking off of discs from an attached stock. At first there

is one large central polyp with radiating septa ; then, as growth proceeds, a number of calicular fossæ appear around this. On becoming free, the central polyp may perhaps persist, or, as in my specimens, may become indistinguishable from the daughter polyps, the septa gradually losing their regular radiating arrangement in the centre of the colony.

1. *HALOMITRA IRREGULARIS*, n. sp. (Plate XLIII. figs. 1, 2.)

Corallum subcircular or somewhat irregular, slightly convex above and concave below, heavy and thick. Under surface dense and little perforated, with no distinct costæ, but closely covered by low, blunt, extremely granulated papillæ, in places forming low clusters. Calicular fossæ in the young colony arranged round a large deep central fossa, but in the older colonies equal in size and irregularly arranged in the central parts, only radiating near the edges of the corallum. Calicular fossæ generally somewhat oval in shape and in the centre 6-12 mm. distant from one another. Septa very distinctly radiate on the outer parts of the corallum, but towards the centre of the colony 6-12 large, thick septa can be distinguished radiating in all directions from the calicular fossæ, with a like number of low, thin septa between ; these are continuous between the different fossæ, but the radiating arrangement of the septa of the colony in the centre is very imperfect. The large septa are relatively thick with granular sides ; their free edges are very evenly covered by blunt denticulations, 1-1.5 mm. high and 12-14 in 1 cm. The axial fossæ are deep and have no columellæ.

Funafuti ; lagoon shoals to leeward.

Of the two specimens in the collection the smaller is a nearly round disc about 12 cm. in diameter by 4.5 cm. high. The under surface is very slightly concave with an oval-shaped area in the centre, surrounded by a groove where apparently the disc was broken off from its nurse stock.

The larger specimen is 18 cm. long by 13 cm. broad and 7 cm. high, oval in shape with the edges irregularly bent. The under surface is slightly concave with several deep grooves, from which two nurse stocks grow outwards. The smaller of these is about 1.5 cm. high, with the calice about 8 mm. broad and somewhat turned upwards and inwards, so that its inner half is incomplete, while in the outer half primary, secondary, and tertiary septa can be distinguished. The larger nurse stock is about 3 cm. high by 4 cm. broad at the top and 2 cm. at its lower end, where it is rather constricted. It consists of a single large calicle with a central axial fossa, 1.5 cm. deep. From this 5 cycles of septa can be distinguished radiating to the circumference. These are broken, however, in 6 or 7 places where daughter calicular fossæ are being formed, the corallum underneath the new polyp mouth being absorbed or ceasing to be formed, so that a fossa results.

Generally on the upper surface of the corallum the large septa are very regular in appearance, bending inwards towards the ends of the daughter fossæ. Near the edges of the colony the

end septa of the calicles are often formed by mere thickenings, standing out at right angles on the radiating septa of the original central calicle.

Genus HERPOLITHA.

Herpolitha, Eschscholtz, Isis, p. 746 (1825).

Herpetolitha, Edwards and Haime, Cor. iii. p. 23.

Herpolitha, Duncan, Journ. Linn. Soc., Zool. xviii. p. 145.

A good description of the corallum of this genus has been given by Duncan¹. A comparison with that of *Polyphyllia* will probably cause the absorption of that genus, as the smaller specimens of both genera are extremely alike.

1. HERPOLITHA CRASSA Dana.

Herpolitha crassa, Dana, Zool. p. 310, pl. xx. figs. 5-5 c.

Two specimens of this species were obtained, which closely resemble the description and figures given by Dana. The smaller is regular in shape, 16 cm. long by 6 cm. broad, 4.5 cm. high, concavity of the under surface 1.7 cm. deep. The larger specimen has the edges, especially at the ends of the corallum, very irregular and much bent; the calices, too, are less regular on each side of the central row. The colony is 21 cm. long by 11 cm. broad, 7.2 cm. high, concavity of the under surface 4 cm. deep.

The colour of the living colony was light brown, with dark bands around the mouths of the polyps.

Funafuti; lagoon shoals.

Genus PAVONIA.

Pavonia, Lamarck, Syst. des Anim. sans Vert. p. 372 (1801).

Pavonia, Lamarck, Hist. des Anim. sans Vert. t. ii. p. 238 (1816).

Lophoseris, Edwards and Haime, Cor. iii. p. 65.

Lophoseris, Duncan, Journ. Linn. Soc., Zool. xviii. p. 157.

I have retained the name *Pavonia* for this genus, as it has clearly the priority over Hübner's use of the term for a genus of Lepidoptera.

The genus is represented in the collection by 19 specimens, of which 17 have been referred to 4 well-known species. The other two, which I have described as new under the names of *P. intermedia* and *P. calicifera*, are intermediate between *P. repens* and *Tichoseris obtusata* in some of those characters by which Quelch diagnosed the genus *Tichoseris*². In *P. intermedia* the character of the valleys and ridges approaches *P. repens*, while *P. calicifera* has almost completely circumscribed calices, *Tichoseris obtusata* coming between the two with "sinuous groups of two or more centres." The same method of increase is found in all 3 species, by fissiparity and also by gemmation, the calices

¹ Journ. Linn. Soc., Zool. xvii. pp. 152-155 (1884).

² Ann. & Mag. Nat. Hist. vol. xiii. 1884, p. 295.

being separated by the upgrowth of a wall between the septa connecting the axial fossæ. The septa are not confluent in *Tichoseris*, but lie opposite to one another, while in *P. intermedia* over the highest ridges and in *P. calicifera* generally they are almost completely separated, being joined over the walls only by their small spines. The columella in *P. intermedia* is visible from the surface as a small spine; in *P. calicifera* it is very deep, with usually no spine; and in *Tichoseris* it is very rudimentary. In all it appears to be a true columella and is joined by trabeculæ to the septal edges. The synapticula gradually decrease in size from *P. repens*, in which they are very abundant; in *Tichoseris* they are "distant, being generally rather thick interseptal outgrowths of the upper part of the wall,"—almost precisely the same condition as in *P. calicifera*, where they are only found near the wall. The septa, further, in all the species are almost precisely similar in their arrangement and spines.

For the above reasons I consider that the genus *Tichoseris* must be absorbed in the genus *Pavonia*.

1. PAVONIA DIVARICATA Lamareck.

Pavonia divaricata, Lamareck, Hist. des Anim. sans Vert. t. ii. p. 240 (1816).

Pavonia divaricata, Dana, Zooph. p. 327, pl. xxii. fig. 6.

Three specimens, apparently from the same clump at Rotuma, and some fragments have been referred to this species, from which *P. minor*, Brüggemann, does not seem to be distinct.

Rotuma; deep pool in outer reef by Soikopi. Wakaya, Fiji; lagoon reef.

2. PAVONIA CRISTATA Ellis and Solander.

Madrepora cristata, Ellis and Solander, Zooph. p. 158, tab. xxxi. figs. 3, 4 (1786).

Madrepora boletiformis, Esper, Pflanz., Forts. Th. i. p. 61, tab. lvi. (1797).

Pavonia decussata, Dana, Zooph. p. 329, pl. xxii. fig. 4.

Lophoseris cristata, Edwards and Haime, Cor. iii. p. 66.

I have referred a number of fronds to this species, some of which closely resemble Dana's figure of *P. decussata*, while others approximate more to Esper's figure of *M. boletiformis*, and others, again, are much more subdivided at their free edges and crispate.

The septa in the different specimens vary greatly in thickness, but large and small always alternate. In the more crispate fronds the large septa are very thin with almost smooth sides, and the small septa are often indistinguishable, while in the flatter fronds the former are thick with rough sides and the latter are quite distinct. If the septa, however, in a camera lucida drawing of a few calices of a crispate frond are thickened, as would naturally occur with increased age, the arrangement in both forms is seen to be precisely similar. In some fronds the calices

tend to be somewhat circumscribed, but generally they lie in rows nearly parallel to the free edges.

The vertical keels mentioned by Edwards and Haime are not, I think, of any specific importance; one of the fronds shows their formation by the fusion of the edges of two of the crisped ends, the septa later, as growth proceeds, becoming secondarily continuous over them.

Rotuma; deep pool in outer reef by Solkopi.

3. *PAVONIA FRONDIFERA* Lamarck.

Pavonia frondifera, Lamarck, Hist. des Anim. sans Vert. t. ii. p. 241 (1816).

Pavonia frondifera, Dana, Zooph. p. 328.

There are two fronds which closely correspond to the descriptions of this species, but which may perhaps belong to the last. The synapticular separations of the calices are not so broad as in *P. cristata*, and the fronds are much thinner and more delicate.

Wakaya, Fiji; outer reef.

4. *PAVONIA REPENS* Brüggemann. (Plate XLIV. fig. 2.)

Pavonia repens, Brüggemann, Abh. nat. Ver. zu Bremen, Bd. v. p. 395, Taf. vii. fig. 1 (1878).

Pavonia repens, Klunzinger, Die Korall. des Roth. Meeres, p. 75, Taf. ix. fig. 3.

There are four specimens of this species, which is well marked by its long valleys, meandering over the whole of the colony. The walls are very much thickened below, making the whole corallum very dense and almost obliterating the cavities of the calices. The corallum is in places 2-3 cm. thick.

Funafuti; outer reef (fairly common to leeward) and lagoon shoals.

5. *PAVONIA INTERMEDIA*, n. sp. (Plate XLIV. fig. 3.)

Corallum primarily incrusting, then massive with the upper surface very irregular, often raised up into knobs and hillocks; edge sometimes free for a few mm. and covered apparently by an epitheca.

The axial fossæ are usually deep and surrounded by very steep radiating septa, leading up to the summits of the walls. Budding takes place anywhere over the septa, fission rarely occurring. Commonly about 4 low septa extend from the new axial fossa to the old calicular fossa. Soon, however, these grow up to the height of the calicular wall, and an imperforate wall is built up between them, completely separating the new calice except over its summit. Before the latter occurs, other buds are generally formed from the parent polyp, so that often 3 to 6 distinct fossæ are found in the same valley, which, however, is always bounded on all sides by a wall, thin at the surface but much thicker below, so that the corallum is very dense and heavy.

In the smallest circumscribed calices 12 or 14 septa can be

distinguished, of which about half extend to the axial fossæ. In the larger there are from 20 to 30, alternately thick and thin, the former projecting to the fossæ and the latter about half as far. In the still larger calices, which are about to bud, there are often 40 to 60 septa, the increase being due to the appearance of a fresh cycle.

The septa are continuous over all except the highest ridges, where they lie opposite to one another. All are rough and very irregularly granulated both at the edges and sides. The synapticula are numerous, small, and thin, being especially abundant near the wall, into which, as it thickens, they are mostly absorbed. There is apparently a true columella arising deep down in the calice, joined to the septal edges by trabeculæ and from the surface generally visible as a small compressed spine.

Depth of the calices from the top of the ridges to the columella about 3 mm.; breadth from ridge to ridge about the same. Valleys seldom more than 1 cm. long, with 40-60 septa on their edges in 1 cm.

Rotuma; outer reef.

The specimen on which this species is founded is a small incrusting mass 9 cm. in greatest width by in one place 4 cm. in height. Its base is much bored into by Chætopoda, Sipunculoidea, and other organisms. In one place, where a nodule has grown out at the edge, the under surface is covered by very shallow calices, with a limited number of septa, alternately thick and thin, and continuous between the fossæ, the appearance more approximating to that of the branching species of the genus.

6. *PAVONIA CALICIFERA*, n. sp. (Plate XLIV. fig. 4.)

Corallum dense and heavy, incrusting and massive, often with the edges free for a few mm.

Surface covered by usually completely circumscribed calices, separated by thin imperforate walls. Increase both by fissiparity and gemmation, the latter from any part of the polyp, but generally close to the wall, where several calices meet. The septa are at first continuous between the axial fossæ; but the wall quickly grows up between them, so that the new calice soon becomes completely circumscribed and valleys do not result. The calicular wall is thin at the surface, but thickens below, fusing with the outermost synapticula. The latter are not numerous, being found only near the opening of the calice.

The septa are continuous by their spines over the wall from calice to calice; all are thin, rough, and granulated irregularly, both at their sides and edges, and project inwards with at first a gradual slope, ending perpendicularly by the fossæ. In the smallest calices primary, secondary, and tertiary septa can be distinguished, the former projecting to the axial fossa and being joined to the columella by trabeculæ. In the larger calices a few of the secondary septa have become fused to the columella, and two additional cycles can usually be distinguished. The columella

lies deep down in the axial fossa, closing it below and not projecting appreciably above its first junctions with the septa.

Depth of the calices to the top of the columella varying up to 4 mm.; breadth about the same.

Rotuma; outer reef.

This species is to be distinguished from *P. intermedia* by the far more completely circumscribed calices. The wall, too, is thinner and no ridges between valleys are found. The fossæ have a far less open appearance, the septa in *P. intermedia* sloping inwards from the wall, more precipitously at first.

Genus PSAMMOCORA.

Psammocora, Dana, Zooph. p. 344 (1846).

Coscinaræa, Edwards and Haime, Compt. Rend. t. xxvii. p. 496 (1848).

Mæandroseris, Rousseau, Voy. au Pôle Sud de D'Urville, Zool. t. v. p. 121 (1854).

Plesioseris, Duncan, Journ. Linn. Soc., Zool. xvii. p. 309 (1884).

The genus *Psammocora* was placed by Dana among the Fungida, and diagnosed as follows:—"Attached Fungidæ, glomerate or ramose; tentacles of polyps obsolete, polyps not seriate; interstices sometimes flat, usually throughout turgidly elevate, the surface, then, consisting of excavate cells. Coralla porous; orizimes minute; lamellæ very minute, often indistinct, and very minutely arenoso-denticulate, often irregular, not alternately smaller."

The genus is represented by four named species in my collection, of which I have examined *P. obtusangula* and *P. haimiana* as types respectively of the ramose and massive forms. In the former the calices are superficial, the surface has generally a rather sandy appearance, and the septa are thick and few in number (very commonly 8). In *P. haimiana* the calices are very deeply excavate, with an appearance of distinct walls at the surface, and the septa are thin and numerous (seldom less than 16).

Fractures, made longitudinally and transversely, show that the septa in *P. obtusangula* are at first continuous between neighbouring axial fossæ. They are usually studded at the free surface with a few rather wide, blunt spines, which are commonly rather broader than the parts of the septa between. The septa under these spines are thick and very solid, while the parts between are thin and sparsely perforated; the septa thus, in section, have a ridged appearance. The ridges on neighbouring septa lie opposite to one another, and in places are thickened and meet, forming synapticula, which are accordingly arranged in vertical series. In the middle of the septa, extending from fossa to fossa, the synapticula are especially large and closely arranged, forming a much perforated wall, which becomes thicker and more solid below, partially, apparently, owing to trabeculæ arising from the sides of the septa. Commonly, on either side of this central row, another line of synapticula is well marked. In the centre of the axial fossa is a small blunt spine, which does not appear to be a

true columella, but to be formed on the top of fused trabeculæ from the septal edges.

In *P. haimiana* (Pl. XLV. fig. 1) the septa are evenly covered on the upper surface with blunt, subequal spines, which are much more numerous than in *P. obtusangula*, but have given rise to the same ridging of the septa, although less markedly. Intermediate to the axial fossæ the synapticula form a very thick vertical row between the several septa, reaching right up to their edges below the spines and simulating a wall. Commonly, close to this, on either side, is another row of large synapticula. Deeper in the colony these rows fuse, owing apparently to the thickening of the corallum between and the formation of trabeculæ from the sides of the septa, a single, thick, slightly perforated wall resulting. Synapticula are found also between the septa within this false wall; they are much thinner and less elongated than those which form the wall, but placed in the same way in vertical series between opposing thickenings of the septa. The axial fossa is closed below by trabeculæ from the septal edges; commonly a central spine can be distinguished, surrounded by a circle of spines, corresponding more or less in number with the septa.

I have also ascribed to the genus *Psammocora* three new species, which I propose to call *P. profundacella*, *P. superficialis*, and *P. savigniensis*, which agree with it in the general characters of their septa, the arrangement of the synapticula, and the formation of a false columella by the fusion of trabeculæ from the septal edges.

P. superficialis (Pl. XLV. fig. 2) resembles *Mæandroseris bottæ*, Rousseau, and differs from *P. haimiana*, in that its calices are not nearly so completely circumscribed, and are arranged more or less in series; the septa, too, are more regularly ridged, more perforate, and usually continuous between the calicular fossæ. There is, as in *P. haimiana*, between neighbouring fossæ a distinct central row of synapticula, which, however, do not rise so high as to give from surface-view the appearance of a wall. The rows on either side are well marked, but are not generally visible from the surface; deeper in the corallum, however, they are fused with the central row, and form a wall precisely similar to that of *P. haimiana*. The axial fossa is closed in below, both in *Mæandroseris bottæ*, as described by Duncan¹, and in *P. superficialis* as in *P. haimiana*, by trabeculæ from the septal edges.

P. profundacella (Pl. XLV. fig. 3) very closely resembles *Plesioseris australiæ*, Rousseau, indeed only differing from it, so far as the description goes, in having its calices rather deeper, with a considerably larger number of septa and less regularly arranged in series. *Plesioseris australiæ* has, however, according to Duncan², a true wall. In *P. profundacella*, as also in a specimen named *Plesioseris*, apparently by Duncan, in the British Museum, there is no true wall, but between the fossæ a row of synapticula, very

¹ Journ. Linn. Soc., Zool. xvii. p. 308.

² Loc. cit. p. 309.

elongated vertically and close set, which rises almost to the surface of the corallum as in *P. haimiana*. There is also a row on either side, distinct near the surface, but much thickened below, forming with the central row a broad wall. Additional rows, still deeper, have likewise thickened, so that the corallum appears in section to be extremely dense.

I have compared *P. savigniensis* (Pl. XLV. fig. 4) with a specimen of *Coscinaræa monile*, Forsk. (syn. *C. mæandrina* Ehr.) in the British Museum. The superficial resemblances between the two species are very great, *P. savigniensis* differing mainly in the size of its calices. The basal wall differs, however, from that of the specimen described by Duncan¹ in being without costæ, and is, I consider, an epitheca. From the surface no central row of synaptacula can be distinguished between the fossæ in either *P. savigniensis* or *Coscinaræa monile*, but fractured and ground surfaces of the former show that there is a distinct central row with a well-marked row on either side. The synaptacula are not so thick or so close set as in *P. haimiana*, and, further, scarcely thicken at all deep down in the corallum, so that the spaces between the rows are little obliterated, in this resembling *P. obtusangula*. The septa, too, in *P. savigniensis* are very distinctly ridged, and much perforated in the valleys, as in *Mæandroseris bottæ*, while the axial fossæ are closed below in precisely the same way as in *P. haimiana*.

The genus *Plesioseris* was separated by Duncan² from *Mæandroseris* on the ground that its calices have a distinct wall and very slightly trabeculate and imperforate septa. The examination of the gemmation in *P. profundacella* and *P. superficialis* has shown me that budding usually takes place by the body-wall of the polyp, somewhere over the septa, forming a new calicular centre. The septa, then, between the new and the old fossæ are built up and joined at the same time by synaptacula, so that finally a distinct though slightly perforated wall is formed; ridges result by the budding again and again of the mother-polyp before the wall has had time to grow up. In *P. superficialis* are a number of such ridges, but the calicular centres are not arranged in any determinate order in respect to them, while in *P. profundacella* the calices are single or in short series, completely separated by such ridges.

From a consideration, then, of the resemblances of the above species I propose to absorb the genera *Mæandroseris*, *Plesioseris*, and *Coscinaræa* into the genus *Psammocora*, Dana.

The diagnosis of *Psammocora* in accordance with the hard parts would be as follows:—Colonial Fungida primarily incrusting, but later massive or foliaceous. An epitheca is present as an imperforate basal wall, but there is no true theca. Calicular fossæ distinct, closed in below by trabeculæ arising from the septal edges. Synaptacula numerous and stout, in vertical series, often appearing to form a wall between the calicular fossæ. Septa

¹ *Loc. cit.* p. 314.

² *Loc. cit.* p. 309.

generally thick, and often much fused together, bluntly and evenly spinulose at the free edges, more or less vertically ridged and perforate. Gemmation anywhere over the septa.

The species in the genus naturally fall into two divisions, branching and massive. The former generally have very superficial calices; septa few, with a small number of large spines on the free edges; synaptacula broad and reaching almost to the surface, giving a rather sandy appearance to the corallum. The massive forms have deeper calices separated by collines; numerous septa with a large number of small spines on the free edges.

I. *Branching forms.*

1. *PSAMMOCORA OBTUSANGULA* Lamarck.

Pavonia obtusangula, Lamarck, Hist. des Anim. sans Vert. t. ii. p. 240 (1816).

Psammocora obtusangula, Dana, Zooph. p. 345.

Psammocora obtusangula, Edwards and Haime, Cor. iii. p. 220, pl. E 3. fig. 3.

There is one small dried specimen besides numerous spirit-specimens of this species, which closely resemble Milne-Edwards's description and figure (3 b). In many of the calices there are only eight septa, in some four thick and four thin, the latter projecting furthest into the calices. Colour of the living colony green.

Rotuma.

2. *PSAMMOCORA CONTIGUA* Esper.

Madrepora contigua, Esper, Die Pflanz., Forts. Th. i. p. 81, tab. xlv. (1797).

Psammocora plicata, Dana, Zooph. p. 346, pl. xxv. fig. 2.

Psammocora contigua, Edwards and Haime, Cor. iii. p. 220.

There are two specimens of this species, which very closely resemble Dana's figures and description. The colour of the living colony was a light olive-brown.

Funafuti; lagoon reef.

3. *PSAMMOCORA GONAGRA* Klunzinger.

Psammocora gonagra, Klunzinger, Die Korall. des Roth. Meeres, p. 81, Taf. ix. fig. 1.

I have referred three fragments to this species, which seem to differ from *P. obtusangula* mainly in their less distinct calices, more abundant synaptacula and trabeculæ, and thinner septa.

Wakaya, Fiji; outer reef.

II. *Massive forms.*

4. *PSAMMOCORA HAIMIANA* Edwards and Haime. (Plate XLV. fig. 1.)

Psammocora haimiana, Edwards and Haime, Monogr. des Poritides, p. 68, and Cor. iii. p. 221.

Psammocora haimiana, Klunzinger, Die Korall. des Roth. Meeres, p. 81, Taf. ix. fig. 5.

The structure of the corallum has been described above, with the genus, as a type of the massive species.

Funafuti; lagoon. Three small specimens.

5. *PSAMMOCORA SUPERFICIALIS*, n. sp. (Plate XLV. fig. 2.)

Corallum primarily incrusting, with a thin margin seldom free, then becoming massive, with a tendency to round itself off and fall over by the wearing away of its base.

The surface is covered with irregularly arranged calices, and has a number of scattered ridges. Gemmation takes place anywhere over the septa, but especially at the angles where three or more calices meet. The ridges appear to have been originally collines separating rows of calices, but by irregular budding to have been broken up, so that in the older parts they appear to bear no relationship to the calices.

The calices are 1.5–2.5 mm. in diameter. Owing to the method of gemmation their septa vary greatly, but usually about ten end freely by the axial fossæ, while about the same number are fused towards the exterior with these. The fusion, however, is not regularly in pairs, some of the septa always running to the exterior of the calice; for instance, the nine freely-ending septa of one calice were made up by 5, 1, 5, 1, 3, 1, 4, 1, and 2 septa respectively. The septa are thick, being commonly broader than their interseptal spaces; their upper edges are covered with low, subequal spines, themselves both at the tops and sides minutely spinulose.

There is no true theca between the calices. When a fresh calice is budded off, the septa connecting its fossa to the old calicular fossa grow upwards and become closely connected by synapticula and trabeculæ, so that the ridges often seem to have much perforated walls, over which the septa are not continuous.

The axial fossa is filled up by trabeculæ from the septal edges, which commonly bear a central spine, surrounded by a circle of slightly smaller spines, generally lying opposite to the larger septa.

Funafuti; lagoon shoal.

6. *PSAMMOCORA PROFUNDACELLA*, n. sp. (Plate XLV. fig. 3.)

Corallum primarily incrusting, but later forming low masses, which may break off at the base.

The surface is covered by irregularly-shaped calices, either completely circumscribed or in short series with slightly projecting intermediate ridges; diameter of calices, or from ridge to ridge, 3–4 mm. Gemmation takes place by budding, either within the calice, when a short series results, or from the ridge, where three or more calices meet, when the young calice is from the first completely circumscribed. The valleys and the separate calices are usually 2–3 mm. in depth. A few of the septa of neighbouring

calices in the same valley are continuous between the fossæ, but not over the collines.

There is no true theca, but the calices are separated from one another, except those in the same valley, by a false wall formed by synapticula and trabeculæ.

The septa arise at first almost perpendicularly from the fossa, but towards the exterior of the calice extend more gradually outwards, generally having one very distinct row of synapticula at a short distance within the false wall. They vary greatly in number, but commonly at least thirty can be counted near the edge of the calice, some running singly to the axial fossa, but the majority fusing up irregularly, only about twelve ending freely. Their upper edges are covered with very small, blunt, subequal spines, themselves minutely spinulose at the sides and summit.

The axial fossa is closed in below by trabeculæ, which often above are prolonged into a few blunt spines, which may simulate a columella.

Funafuti; lagoon shoals.

7. *PSAMMOCORA SAVIGNIENSIS*, n. sp. (Plate XLV. fig. 4.)

Corallum at first incrusting, but later forming low, convex masses, which often die in the centre but continue to grow at the periphery. The margin may be free for a few mm., when the base is seen to be formed by a thin, solid, imperforate wall, probably an epitheca.

The surface is marked by very irregularly-shaped calices, which either lie quite separately, or in short series with 2-7 distinct centres. Increase is by gemmation over the septo-costæ at the margin, or anywhere within the calice. The axial fossæ in separate valleys are usually from 3.5-5 mm. apart, in the same valley rather less. In depth the calices vary up to about 3.5 mm.

The septa vary greatly in number, but usually towards the exterior of the calice about 36 can be counted, of which perhaps half reach the axial fossa, the remainder coalescing with them and seldom ending freely; no arrangement of cycles can be distinguished. In the deeper calices they are quite thin, but in the serial calices generally wider than the interseptal loculi. Their free edges are covered with low, rough, subequal, blunt spines, which are often somewhat flattened on the thicker septa at right angles to their plane. The collines are rounded, 1-1.5 mm. in breadth, the lower covered with spines, which are directly continuous between the septa of neighbouring calices, but the higher somewhat trabecular in appearance and irregularly spined.

In section the septa can be seen to be much perforated, especially near the axial fossæ, and appear to be directly continuous between neighbouring calices. There is no true theca, but between the deepest calices a thin, much perforated wall has been formed by the fusion of synapticula and trabeculæ from the septa; a well-marked row of synapticula on either side in addition is a common feature, but it is never fused with the central row.

1898. "On the Fungid Corals collected by the author in the South Pacific."
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