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PAPERS READ.

ON HETEROPSAMMIA MICHELINII, of Edwards and Haimo.
By REV. J. E. TENISON-WOODS, F.G.S., ETC.

Plate XV.

In the enumeration of the Eupsamminæ (first sub-family of *Madreporaria perforata*) made by Messrs. Edwards and Haimo in their Monograph (*Annales des sciences naturelles* tom X. (848, p. 83.) the genus *Heteropsammia* occurs. This was created by the authors for the reception of certain peculiar corals which they say are always parasitic upon shells, and which they envelope completely, leaving only a small orifice for the head of the molluscs to which they are subsequently indebted for their locomotion. The corals were described simple, erect, fixed on a univalve shell, which they completely enclose, continuing however to enlarge in the basal portion during their lives. There is no epitheca. There are no costa, but the exterior surface is very finely vermiculate so as to be quite velvet-like in appearance. Columella spongy and well developed. Septa thick, a little exsert, closely pressed together.

This genus is placed by the authors in their synopsis of the family, among the first and largest division, that is, the simple corals. The species is thus defined. Corallum very short, with a base wider than the calice, which is shaped in the form of a figure of 8. The shorter axis is the highest part of the margin which re-enters here, and the ends of the longer axis are rounded. The greater axis exceeds the smaller by one-third. Columella well developed, of a finely spongy tissue and of velvety surface, not projecting from the fossa, which is shallow. Five cycles of septa, those of the three first orders nearly equal, slightly exsert, rather narrow, thick, and of a spongy texture, those of the last cycle larger than the penultimate, thin, uniting two by two close to the columella, internal edge strongly concave about the middle then becoming conspicuously convex below. Alt. 10 millim., major axis 18. minor 4. depth of fossa 3. Habitat Whampoa, China.

The same species was also described by J. E. Gray in the *Annals for Nat. History*, for May 1850 (vol. 5. 2nd Series, p. 410.) as *Heterocyathus eupsammides*, of which the following is the diagnosis. Coral polymorphous, base flat, sides shelving, sinuous, surface covered with very close irregular, denticulated, sinuous ridges and pierced with numerous minute pores; star irregular, compressed or sinuous, laminæ narrow, then cribellated on the surface and with an oblong elongated, convex, cribellated centre. VAR. star more or less contracted in the centre, forming two more or less distinct roundish stars. Hab. Chinese seas.

From this description it would appear that Dr. Gray was in possession of specimens wherein the calice was divided. If this were the case, the coral would be no longer simple but compound, and a totally different position in the family be required for the species.

Through the kindness of Mons. Theophile Savés, of Noumea, I have recently received a very extensive series of this coral from

New Caledonia, and I find that in a large number of instances the coral is compound. There are two distinct calices often widely separated, but I have every gradation, from the oval calice passing to the figure of 8 outline until it is finally separated by fissiparity.

If we refer to the synopsis of the *Eupsammia* as established by Messrs. Edwards and Haime, we find that they have placed *Heteropsammia* amongst the first great sub-division established for simple forms. The second section includes those with an epitheca (*Astroides* only), and those without, which embraces *Dendrophyllia*, (now made also to include *Cænopsammia*) which increases by buds, *Lobopsammia* fissiparous, and *Stereopsammia*, in which the columella is rudimentary or none.

The question now is whether the genus *Heteropsammia* can be maintained. Naturally there is nothing to distinguish it from *Lobopsammia*. This genus was established to receive the fissiparous compound *Eupsammia*. Only two species are known, and these are both Eocene fossils. Messrs. Edwards and Haime make the following observations on *Lobopsammia*. Coral compound. Multiplication by successive fissiparity. Edge of calice irregular. Always four complete and well developed cycles. In all other respects like *Dendrophyllia*. They remark that the genus entirely depends upon the mode of growth, which in *Dendrophyllia* is always by buds, but in this case by the successive division of the calices which are thus divided into nearly equal portions. The only two known species are then described.

Though there is still a considerable distinction between the fossil genus *Lobopsammia* and *Heteropsammia*, yet I do not see how the latter can be kept distinct, if the former is to include all the fissiparous *Eupsammia*. I therefore suggest that the coral of Messrs. Edwards, Haime and Gray, be classified hereafter as *Lobopsammia Michelinii*. It is found in the Chinese Seas, in the Indian Archipelago, on the Barrier Reef, and throughout the

Pacific as far as New Caledonia. In the latter place it would seem to be very common.

The species which I described the year before last as *Heteropsammia elliptica*, (See Proc. Linn. Soc., Vol. II., p. 339. Pl. 6., fig. 3a, b.) I am now convinced should be placed with *Balanophyllia*. Though the peculiar vermiculate exterior is very much like *Heteropsammia* yet the coral is not always parasitic and never in the way described in *Lobopsammia Michelinii*. The species must be known therefore as *Balanophyllia elliptica*.

It remains now to enquire what is the nature of those perforations which Mr. Edwards regarded as the mouth of a shell and on which opinion he was followed by Dr. J. E. Gray. In the Natural History Review for January, 1862, (No. V., p. 78.) I find a notice of these corals by the surgeon of H.M.S. "Icarus." His paper is entitled "Observations on some Australian and Feejean Heterocyathi and their parasitical Sipunculus. By John Denis Macdonald, R.N., F.R.S." He says that in two separate casts of the lead, on the Bellona Reef, Lat. 21°, 51', S., Long. 159°, 28', he obtained specimens of living polypi, referable as Dr. Gray informed him to the genus *Heterocyathus*,* and on comparing them with others previously collected in the Feejee Group he found that they were different species of the same genus. He describes the coral as simple, free depressed, broad and flattened at the base, becoming smaller towards the calice which is more or less oval in figure and comparatively shallow; the columella was spongy; the septa were spongy or minutely granular exteriorly, not compact within. In the specimens taken at Bellona shoal, the calice was distorted with a central construction as though a process of fission was going on. In one specimen the opposite margins had met. The external surface was covered with minute granulations, disposed in broken longitudinal lines,

* From this it would appear that Gray had not seen M. Edwards' correction of his genus

with porous channels between them. In the Feejean specimens the calice was regular and the exterior surface coarsely granular without any linear disposition like costæ.

At Moreton Bay they dredged at a few fathoms what Dr. Macdonald regarded as another species. The two specimens taken had well-marked costæ, which corresponded exactly with the four cycles of septa.

I have very little doubt from the description and from the figures, copies of which are here given, that the specimens were (some of them) specifically identical with the *Lobopsammia* referred to in this paper. The specimens from Moreton Bay are more like the species of *Psammoseris* described by me* as *P. cyllicioides*. I will now give the observations of the author.

"The most remarkable circumstance connected with these polyps, is the invariable presence of a little solitary *Sipunculus* in a beautifully excavated burrow at the base of the corallum. The uniform position of the opening and sinistral direction of this burrow first observed in dead specimens led me to suppose that it was in some way connected with the economy of the polyps themselves, but having discovered its occupant to be one of the coral perforating *Sipunculidæ*, which abound in the South Seas, the riddle was quickly solved. The body of one of these parasites taken from a Bellona Reef specimen, is about three-quarters of an inch in length, terete but gradually increasing in diameter from before backwards, and exhibiting a permanent curvature forwards corresponding with that of the burrow."

On examining a large number of the corals of *Lobopsammia*, I find that Messrs. M. Edwards and Dr. Gray were both in error in supposing that the coral invested a shell. In the first place it would strike any one as a remarkable fact that the aperture is nearly always sinistral,† while the irregular shape would lead

* Proc. Linnean Soc., N.S.W., Vol. III., (1878) p. 8.

† Out of 50 specimens, all were sinistral but one.

one to believe that if derived from an enclosed shell it must have been of many different species. The shape and size of the corallum varies in a very extraordinary degree. But sinistral shells are rare.

Again it has not been remarked though I have seen it indicated in drawings, that the side of the corallum was perforated with a line of somewhat irregular minute pores, and there are a number of them scattered all over the surface. On making sections of these corals I have found that the burrows are cylinders of only about a turn and a half, nearly on the same plane. There is no trace of shelly matter, but the perforation is direct into the substance of the corallum. On passing a fine bristle into any of the pores they are found to communicate with the main burrow, no matter how far they may be from it. These would appear to be perforated by the animal by the minute asperities which beset the proboscis, and are disposed serially or irregularly scattered.

I give the notes of Dr. Macdonald on the animal. "The crested proboscis is about three times the length of the body and crowned with simple ciliated tentacula. On the dorsal surface, immediately behind the base of the proboscis is a little oval and brownish callosity answering the purpose of an operculum when the animal is retracted within its cell, and close behind this is the anal aperture. The posterior extremity of the body is furnished with a similarly constituted but slightly conical shield as the opercular disk meets the rest of the dorsal surface at an angle more or less obtuse, the proboscis appears to hold a subterminal ventral position and protrudes itself somewhat perpendicularly to the axis of the body. The surface of the latter is beset with minute asperities disposed serially or irregularly scattered. These become larger and more numerous towards the dorsal region, and more definitely aggregated towards the extremities. They constitute the before mentioned opercular and conical disks. As they extend themselves on the proboscis they grow smaller and

begin to assume a more orderly arrangement, and finally form into closely set rings of minute and recurved hooks reaching to base of the oval tentacula."

Dr. Macdonald adds, this parasite is evidently closely allied to the little animal from the Indian Seas, named *Lithodermis cuneus*, by Cuvier, and which was the only species known to him. He further adds that in the coral borers, which are identical with the little animals here noticed, he found that the oesophagus was encircled by a narrow collar, with a cephalic enlargement on either side, from which tentacular nerves arose, and in contact with which dark eye specks were distinctly visible, there is also a single ventral nervous chord giving off lateral nerves at stated intervals, but without any very apparent ganglionic dilatations. I observed moreover that the cavity of the body was lined with a ciliated membrane, which was reflected round the larger branches of a transparent (probably water) vascular system, running along the spirally coiled intestine, with its singularly constructed central suspensory ligament. All this militates against the supposed *Echinoderm* nature of *Sipunculus*, and give it radiating affinities with *Annelida*, *Polyzoa* and *Tunicata*, though perhaps only of a representative kind. The simple anatomy of the larval form, the *Atlas* of Peron, if it be not indeed a permanent one is also of great importance in this connexion. The editors of the *Review* also express their opinion that the paleozoic *Pleurodictyon* is a coral perforated in a similar way.

By referring to my figures of *Psammoseris cylindroides* in last year's *Proceedings*, (Pl. 1.) it will be seen that one of the specimens is clearly burrowed by the same *Sipunculus*, (fig. 2). All the other specimens were noted on univalve shells much longer than the corallum. Perhaps it is in this way that the animal seeks protection from the boring intruder. I imagine that the asperities on the body of the *Sipunculus* must give rise to filaments of considerable length, because the perforations extend sometimes

a long way from the burrow. They are of such extreme fineness that only a very thin bristle will penetrate them.

The coral animal does not seem to suffer from the intruder, but the base is swollen and distorted, sometimes projecting very much at the aperture of the burrow, and often at right angles to the major axis of the calice. In the only specimen in my possession in which the curve of the burrow is not sinistral, the whole base and sides are riddled with the smaller perforations leading from the main passage. I counted no less than 24. As the members of all this family of corals have their walls perforated the filaments probably do no more than to enlarge the openings they find. They have all a radiated circle of laminae round the outer orifice, like the groovings of the main aperture but much more marked. I have never seen a specimen of *Lobopsammia*, no matter how young or how small without these parasites, and from the subsequent growth it would certainly seem as if the secretion of strong matter were made in view of the requirements of the parasite. Knowing how polyps can bear with indifference all kinds of cutting and wounding, everything in fact except removal from the water, it does not surprise us to find that these corals can tolerate such exorbitant lodgers without injury to themselves.

REFERENCES TO PLATE XV.

- Fig. 1.—*Sipunculus heterocyathi*, nat. size; a.—opercular disk; b. caudal disk.
- „ 2.—Ventral side enlarged; a. and b. as before; c. proboscis.
- „ 3.—Dorsal view; a. and b. as before; c. anus.
- „ 4.—Corallum seen from above, enlarged; a. aperture of burrow; b. c. d. first, second, and third orders respectively; e. f. g. corresponding loculi; h. h. h. openings connected with the burrow.
- „ 5.—Side view of corallum; a. aperture. After J. D. Macdonald

Fig. 6.—*Lobopsammia Mitchelini*, Edw. & H., nat. size; h. h. h. lateral perforations; a. aperture.

- „ 7.—Ditto, enlarged to show partial fission of calice.
- „ 8.—Corallum with two calices established by fission.

