A CONTRIBUTION TO THE ACTINOLOGY OF THE BERMUDAS.

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I recently received from Professor Heilprin a number of Actinians which he had collected in the summer of 1888, during a visit to the Bermuda Islands. They were entrusted to me for identification and study, and I gladly availed myself of the opportunity thus afforded of comparing the Actinian fauna of the Bermudas with that of the Bahamas, which I had previously studied.* I may state here that, so far as can be judged from the material studied, there is very great similarity between the two faunas, most of the species from the Bermudas occurring also either in the Bahamas or in the West Indian Islands. Unfortunately it was impossible to adopt the best methods of preserving the material obtained in the Bermudas, the expedition to the islands having been undertaken mainly for geological purposes, and consequently the specific relationships of some of the forms could not be determined with perfect certainty.

Tribe HEXACTINIÆ.

Sub-tribe ACTININÆ.

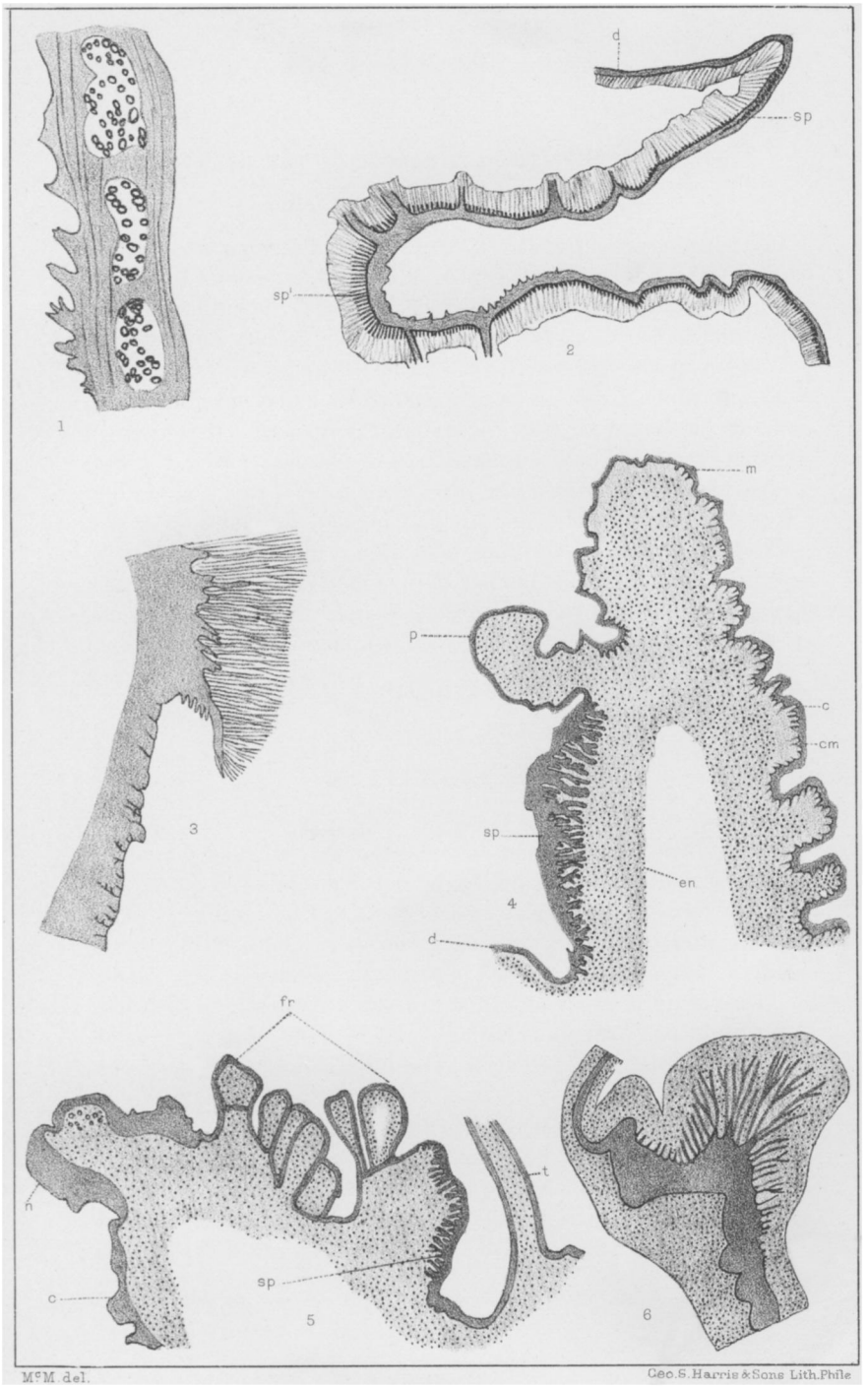
Family SAGARTIDÆ.

1. Aiptasia. sp? (Pl. VI, figs. 1 and 2.)

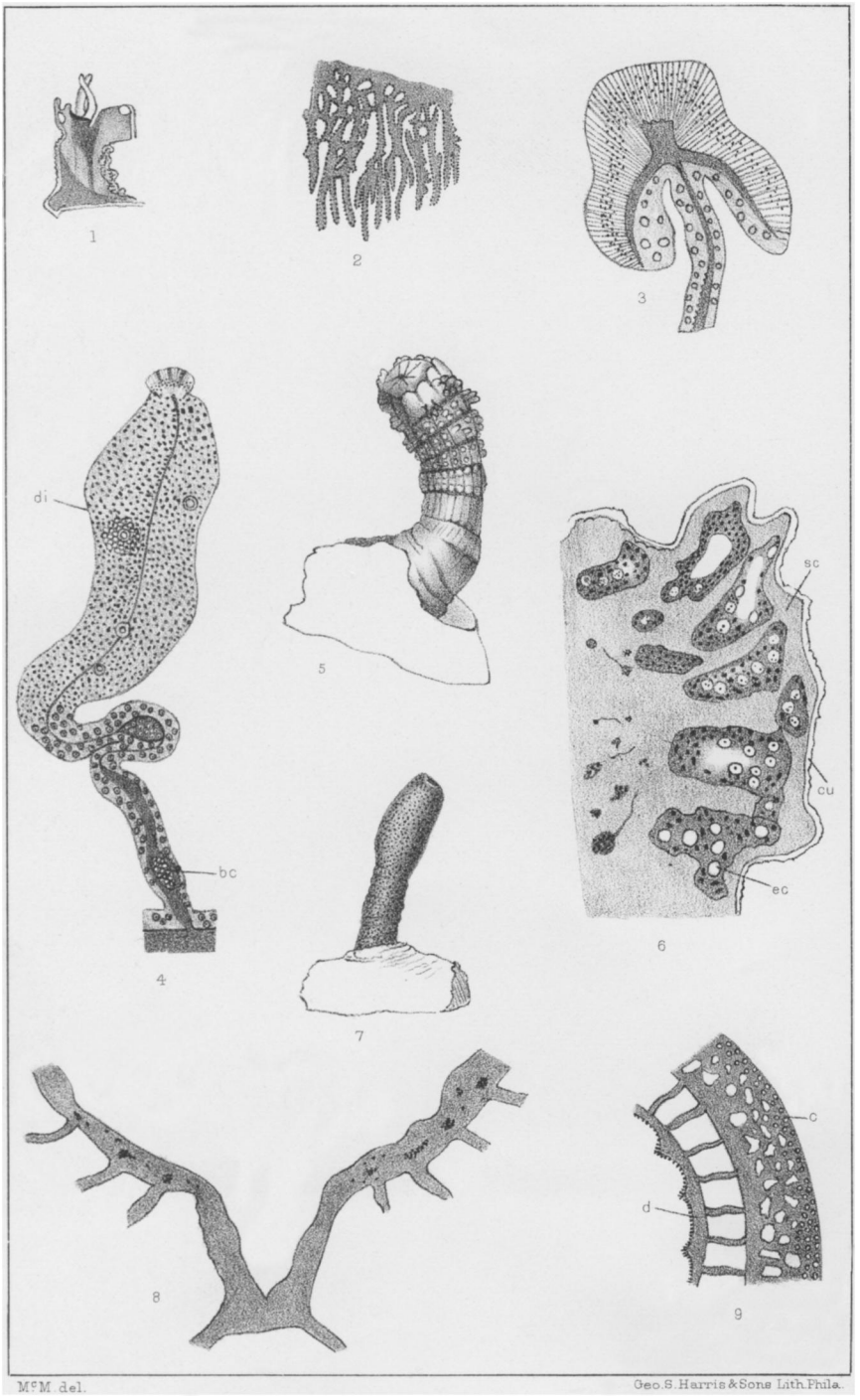
In the collection were four specimens of a form which I refer to the genus *Aiptasia*, inasmuch as in the majority of respects they resemble forms of that genus, although it was impossible to ascertain the presence of an equatorial row of cinclides owing to the ectoderm having been almost completely macerated away. Nematocysts were quite abundant in the macerated substance contained in the inter- and intra-mesenterial chambers, but it was not possible to be certain that they belonged to acontia though such was probably the case.

The specimens are about 1 cm. in length and 0.65 cm. in diameter. The color as ascertained from the alcoholic material is in the upper one-third of the column and in the tentacles grass-green, while the rest of the column presents the dirty grayish-brown color frequent in alcoholic specimens. About one-third of the way down the col-

*See Journal of Morphology, vol. iii. This paper is now in print and will shortly appear.



Mc MURRICH ON ACTINIARIA.



Mc MURRICH ON ACTINIARIA.

umn each specimen presents a well-marked constriction, below which the column is cylindrical, while above it it gradually expands, the disc not being at all infolded in contraction. The base is evidently adherent, but in two of the specimens it is much smaller than the column, and is almost covered by the infolding of the column walls over it; this apparently, however, is an abnormal condition. The column is smooth, and no traces of cinclides could be seen as stated above. Sections (Pl. VI, fig. 2) show that the mesoglœa is thin throughout, and that the circular muscles (cm) are only feebly developed. There is a special sphincter (sp) imbedded in the mesoglœa, immediately below the margin, and, though not very powerful, is yet quite apparent. The only species of *Aiptasia* in which such a sphincter has been observed as yet is *A. pallida* of our Eastern coast. Immediately below this the mesoglœal muscular processes which support the circular muscles are weak, but further down they enlarge gradually and form a second sphincter (sp^1) similar to what has been described by R. Hertwig[1] in *Leiotealia nymphœa*. It is to the presence of this lower sphincter that the contraction of the column mentioned above is due.

The tentacles are 48 in number and are arranged in four cycles. They are strongly entacmæous, and are not infolded during contraction. Those of the first cycle measure 1.1 cm, and those of the outermost cycle 0.3 cm. The ectodermal and endodermal muscular processes are present, but do not call for a special description. The disc is flat and the stomatodæum is without well-marked gonidial angles; sections show that the grooves are hardly developed.

The mesenteries are in four cycles. The six pairs of the first cycle are alone perfect; those of the second cycle are shorter but provided with well-developed longitudinal muscles and while neither those of the third nor those of the fourth cycle have the longitudinal muscles, the members of the latter cycle not projecting above the surface of the endoderm. The parieto-basilar muscles seem to be wanting, or at least have no marked mesoglœal processes. The reproductive organs are borne by the mesenteries of the second cycle, and also by those of the first cycle (except the directives) below the internal opening of the stomatodæum. This is the only Sagartid, with the exception of *A. pallida*, in which I have observed reproductive organs on the mesenteries of the first cycle, and it is a case of con-

[1] *R. Hertwig*—Report on the Actiniaria. Zoology of the voyage of H. M. S. Challenger. Vol. vi. Pt. xv, 1882.

siderable importance inasmuch as it necessitates an alteration in the definition of the family Sagartidæ as given by R. Hertwig[1] One of the essentials of the family is that "the principal septa, or septa of the first order, only are perfect and at the same time sterile." The last portion of this statement, though true for the majority of Sagartidæ, fails in the case of the Aiptasiæ mentioned. It is not possible to separate *Aiptasia* from the Sagartidæ; the members of the genus possess acontia, cinclides, the primary mesenteries alone perfect, and a mesodermal muscle in some cases, and these must be considered as the chief characteristics of the family.

As regards the species to which the form under consideration belongs, the probabilities are that it is identical with *A. pallida* of our Eastern coast, since in its anatomical peculiarities it agrees very closely with that form. The impossibility however of ascertaining the coloration, and, what is of much more importance, the occurence and arrangement of the cinclides, have prevented a certain identification and I have preferred to leave the species in doubt.

Family ANTHEADÆ.

2. Condylactis passiflora. Duch. and Mich. (Plate vi, fig. 3.)

Several specimens were obtained of a large form, measuring 3.3 -2.3 cm. in height and 2.6-3.8 cm. in diameter when preserved, which resembled in coloration, external characters, and for the most part in internal structure also, the West Indian form *Condylactis passiflora*. In the alcoholic specimens the column is of a brick-red color wherever the ectoderm has been preserved, and the tentacles are grass-green, this color evidently being due to the enormous number of zooxanthellæ contained in the endoderm. Professor Heilprin informs me to the best of his recollection the tentacles in the living specimens were as a rule tipped with crimson. In a separate bottle is a single specimen evidently identical with the others, and accompanying it is a note stating that the column was red and the tentacles brown. This specimen was found freely floating near the surface, but had evidently become detached as its base shows that normally it is an attached form.

The ectoderm having been macerated away, the outer surface of the mesoglœa is exposed to view, and is seen to be divided by fine longitudinal and transverse grooves into small quadrangular areas. These grooves are continued over the limbus upon the surface of

[1] Loc. cit.

the base, the longitudinal grooves there becoming radiating and the transverse ones concentric.

The only character which is markedly different from what occurs in the West Indian specimens of the species is presented by the longitudinal muscles of the mesenteries. The middle portion of a section through the muscle-band presents an appearance quite similar to that to be seen in the West Indian form, and the internal edge is also the same, the long mesoglœal processes terminating abruptly, and being followed by smaller processes which extend to the commencement of the reproductive region of the mesentery; but toward the insertion of the mesenteries into the column wall the arrangement is slightly different (Pl. VI, fig. 3). In the Bahama specimens the mesoglœa between the outer edge of the muscle-band and the insertion of the mesentery into the column wall is thin, and the muscle-band gradually thins out externally. In the Bermuda forms, however, the longitudinal muscle begins abruptly, and the mesoglœa external to it is thick with short, stout muscle processes; or, as in the directives, with the muscle cells, instead of appearing to cover processes, presenting rather the appearance of here and there dipping down slightly into the mesoglœa.

It is not probable however that this slight difference is to be regarded as specific, and since in other respects there is almost exact correspondence, the Bermuda forms must be considered identical with those from the Bahamas.

Family PHYLLACTIDÆ.

Some points of considerable importance as regards the characteristic structure of the members of this family have been obtained from the study of the two forms which I include here within it. The family was established by Andres[1] for forms in which the disc is furnished towards the center with simple tentacles and towards the periphery with foliaceous fronds. In one of the forms about to be described the fronds are replaced by short digitiform tentacles arranged in a single cycle, but nevertheless it agrees in other structural points with *Oulactis*, and I have therefore found it necessary to alter the definition of the family, placing importance on internal anatomical structures rather than upon external characteristics.

In the first place in the *Oulactis* about to be described, and in *Diplactis*, as I propose to name the genus to which the form with tentacles

[1] *A. Andres.* Le Attinie. Fauna und Flora des Golfes von Neapel Monographie ix. 1883.

replacing the fronds will be referred, a sphincter of the diffuse type is present, but instead of being situated upon the column wall below the margin, it occurs internal to the margin, between the inner tentacles and the peripheral fronds or tentacles. In *O. flosculifera* from the Bahamas this sphincter was not observed, but was probably overlooked in the single specimen I obtained for study, and none of the preparations which I still possess include the region in which the sphincter should occur. Secondly in the two species of *Oulactis* which I have studied, and in the *Diplactis*, the gonidial grooves are very deep and are prolonged a considerable distance below the inner margin of the stomatodæum; the histological structure also of the ectoderm lining the grooves differs slightly from that of the general surface of the stomatodæum, it is not thrown into folds as it is elsewhere, and the mesoglœa of the grooves is thickened.

I would define the family Phyllactidæ as follows:—Actininæ in which the disc is furnished with simple tentacles towards the center and with a cycle of short digitiform tentacles or more or less foliaceous fronds towards the periphery; a sphincter of the diffuse type occurs upon the inner surface of the disc between the inner tentacles and the outer tentacles or fronds; and the stomatodæum is provided with two deep gonidial grooves which are prolonged some distance below the inner extremity of the stomatodæum.

The family Phyllactidæ was placed by Andres in the suborder (family) Stichodactylinæ, the fronds being considered homologous with tentacles. I have here ventured to remove the family to the suborder Actininæ, and it will be necessary to furnish my reasons for such a change. The tentacles must necessarily be considered outgrowths of the disc, since structurally they resemble it closely while differing greatly from the column. Are the fronds also disc structures?

The question turns upon what we shall consider to be the limit between the disc and the column. The majority of authors have taken a more or less distinct fold of the body wall, the margin, frequently furnished with conspicuous acrorhagi, to be the boundary, and certainly in many cases there seems to be a marked difference on either side of this fold. Thus the column may, as in *Bunodes* and *Phymactis*, be tuberculated as far as the margin, but beyond this the tubercles cease, and there is apparently a decided difference between the region below and that above the limiting fold.

In the Sagartidæ and Paractidæ there is imbedded in the column wall below the margin a sphincter muscle. In other forms, however, such as the Bunodidæ, which possess a circumscribed endodermal sphincter, that structure lies internal to the margin. If we assume with the Hertwigs that the sphincter is a columnar structure its situation in the Bunodidæ would indicate that the margin is not the boundary between the disc and column.

Neither the margin nor the sphincter, however, can be considered the morphological boundary of the disc, since both seem to vary somewhat in position. The true criterion is to be found in the difference of histological structure presented by the disc and column ectoderm. This layer in the disc possesses ectodermal muscle-cells and a nerve-layer, which structures are absent in the column. The tentacles resembling the disc in structure are to be considered outgrowths of that region, and passing outward from these one finds that the characteristic structures of the disc gradually fade out and are lost. It is impossible to say just where the change is completed, but the region in which it occurs must be considered the boundary between the disc and column. In *Bunodes tæniatus* and *Aulactinia stelloides* I find that the sphincter muscles lie beneath the outer border of this indifferent region, and are consequently to be regarded as columnar structures.

In the Phyllactidæ the sphincter muscle lies between the tentacles and the fronds, and although the ectoderm in the region in which it occurred, and in the area between the fronds or their representatives and the margin was completely macerated away in the forms studied, yet reasoning from the relations of the sphincter in other forms we must conclude that the region between the margin and the base of the tentacles is columnar, and that the fronds and outer digitiform tentacles are column structures perhaps comparable to acrorhagi, and cannot be considered homologous with tentacles. Accordingly only one tentacle belongs to each intra-mesenterial space, and the Phyllactidæ must be referred to the sub-order Actininæ.

Andres in the introduction to his Monograph, notes the fact that the margin does not always mark the boundary between the disc and the column. He proposes the term "collar" to denote the portion of the column internal to the margin. Gosse's term "fosse" is not applicable in all cases, as for instance in *Condylactis* where the region does not form a depression, but is horizontal.

3. Oulactis fasciculata. n. sp. (Pl. VI, fig. 5.)

By this name I denote three specimens in various degrees of contraction, the largest of which measured about 1 cm. in height and 1-2 cm. in breadth. The color, as ascertained from alcoholic specimens, is in the lower part of the column a grayish-brown similar to what is frequently seen in preserved Actininæ, while the upper part of the column and the fronds are of a grass-green, the tentacles resembling somewhat the lower part of the column, but having a distinctly greenish tinge.

The column is provided in its upper part with about 48 vertical series of tubercles, probably verrucæ, there being about five or six in each series, and is thrown into numerous transverse folds the result of contraction. The mesoglœa, when exposed, appears to be raised into numerous minute elevations, whereby the surface acquires a finely punctured appearance.

The tentacles are moderately long, simple and pointed at the extremity. They appear to be arranged in two cycles, and from a necessarily uncertain count I estimate their number to be about forty-eight. Their ectodermal longitudinal muscle layer is well developed, being arranged on long slender mesoglœal processes. The fronds (Pl. VI, fig. 5, fr.) are small, yet occupy the entire width of the area between the tentacles and the apparent margin. They consist of hollow evaginations of the disc, arranged in bunches. I could not determine with certainty their number in any of the specimens, but there are probably twenty-four of them in all. A well-defined margin is present.

Immediately external to the bases of the tentacles, and lying between them and the fronds there is an endodermal sphincter (sp.) fairly well developed. Immediately external to it, in the region occupied by the fronds and for a slight distance down the column-wall below the margin, there are no muscle processes, but further down they do occur, forming what might be termed a second sphincter, though it is by no means well developed. The surface of the disc between the tentacles and the mouth is deeply depressed so that a fosse is formed around the peristome. The mouth is large. Sections show that over the general surface of the stomatodæum the mesoglœa is very thin, and upon the ectodermal surface gives rise to numerous more or less regularly arranged fine processes over which the ectoderm passes so as to be thrown into numerous folds. The gonidial grooves are deep, and are prolonged some distance below

the rest of the stomatodæum. Its mesoglœa is much thickened, and is devoid of processes upon its ectodermal surface, being thus strongly contrasted with that of the stomatodæum. In its histology the ectoderm of the groove also differs from that of the general stomatodæum, the glandular cells being evidently fewer in number, but the preservation of the specimens was not sufficiently perfect to permit the details to be made out.

There are altogether twenty-four pairs of mesenteries, twelve of which are perfect. The six primary pairs are united with the stomatodæum to a greater extent than are the six secondaries, and the two pairs of directives have a much more extensive union than any of the other primary mesenteries, owing to the great prolongation of the gonidial grooves. The longitudinal muscle processes form a strongly projecting though rather narrow band, the edges of which are sharply defined, the processes being of equal length throughout the muscular area and diminishing abruptly towards the sides. The mesoglœa of the portion of the mesenteries external to the muscle bands is rather thick, and there is a strong parieto-basilar muscle. Apparently only the mesenteries of the third cycle, *i. e.* the imperfect mesenteries, are gonophoric, but my preparations do not allow of certainty on this point.

A few remarks are called for concerning the relationships of this species. I was at first tempted to identify it with *O. formosa*[1] but further consideration led me to separate it as a new species. The fronds differ markedly from those of other species of *Oulactis*. In these they have been described as being "*chicoracés*," a term which cannot be applied to the fronds of *O. fasciculata*. In it they consist of bunches of finger or club-shaped hollow processes, the various processes of each bunch being united by their base but distinct above. This arrangement suggested the specific term which I have employed, and I think is of sufficient importance to warrant the formation of a new species. It was a question whether a new genus should be instituted as Verrill[2] has done in the case of *Lophactis ornata*, but there is such close agreement with the Bahaman *O. flosculifera* as regards the internal structure, the number of perfect mesenteries, and the distribution upon the mesenteries of the reproductive

[1] *Duchassaing* and *Michelotti*—Mem. Reale Accademia di Torino. 2nd Ser. xix, 1860 and xxiii, 1866.

[2] *Verrill A. E.*—Trans. Conn. Acad. Vol. i, 1868.

organs that such a proceeding was considered unnecessary. It seems probable that the genus *Lophactis* should be fused with *Oulactis*.

DIPLACTIS. Gen. nov.

I propose this generic name for two species, one of which is described below, which do not seem to be referable to any of the genera now recognized. The genus may be briefly defined as follows:— Phyllactidæ in which the fronds are represented by a single cycle of short digitiform tentacles and in which all the mesenteries except those of the first cycle are gonophoric. The term *Diplactis* has been chosen as indicating the tentacular appearance of the fronds, from which it seems as if there were two series of tentacles, an inner and an outer (*diplous*, double and *aktis*, a ray).

In the Supplementary Report on the Actiniaria collected by the "Challenger," R. Hertwig describes a form whose locality is unknown, which he refers to Gosse's genus *Hormathia*. It is very similar to the form about to be described from the Bermudas, and there can be no doubt that though specifically distinct the two must be referred to the same genus. Gosse's *Hormathia*[1] was described from a single specimen brought up on a deep-sea fishing line, and attached to the shell of a living *Fusus*. It was characterized by possessing slightly below the margin about ten spherical protrusions. I do not think it is possible to associate in the same genus with this either the Bermuda *Diplactis* or Hertwig's *Hormathia*. In the first place in both these forms the bodies near the margin are digitiform and not spherical; and secondly, these bodies are situated not below the margin but internal to it. In all the Bermuda specimens, of which there are quite a large number, a well-marked margin is present and Hertwig describes in his form a fold of the column-wall which must be considered equivalent to the margin of the other species. Although the margin cannot be considered of importance as marking the boundary of the disc, yet it is a structure of frequent occurrence and must be taken account of. Structures that occur on the column-wall below it, as in *Hormathia*, cannot be considered identical for systematic purposes with others which invariably lie above or internal to it, and are not quite similar in form.

It must be noticed that Haddon has recently referred to Gosse's *Hormathia* a form[2] altogether different from that assigned to it by

[1] *P. H. Gosse.* Actinologia Britannica. London. 1860.

[2] *A. C. Haddon.*—On two species of Actiniæ from the Mergui Archipelago.—Journ. Linn. Soc. Vol. XXI. 1888.

Hertwig. The correctness of Haddon's identification is quite as doubtful as Hertwig's, if not a little more so. The form is certainly a Sagartid and probably a *Phellia*, it being stated that it is very similar to Hertwig's *Phellia pectinata*.

Hertwig refers his *Diplactis* (*Hormathia*) *delicatula* to the family *Antheadæ*, on account of the diffuse endodermal nature of the sphincter. The situation of the muscle and other characters make it evident that *Diplactis* should be associated in the same family with *Oulactis*. In the Phyllactidæ as here limited we have several grades of complication of the fronds. In *Diplactis* their structure is exceedingly simple, being simply digitiform in *D. bermudensis* and club-shaped in *D. delicatula*. In *O. fasciculata* they are somewhat more complicated, and from this the passage is easy to Verrill's *O.* (*Lophactis*) *ornata*, and from this to the very complicated structure seen in *O. flosculifera*.

4. Diplactis bermudensis. n. sp. (Pl. VI, figs. 4 and 6, Pl. VII, figs. 1 and 2.)

A number of specimens of the form for which I propose this name were obtained. The majority were in a partially contracted condition, but apparently the power of contraction is not fully developed as in none were the tentacles completely concealed. The average height of the specimens is about 1·5 cm. and the breadth nearly the same, and thus *D. bermudensis* is decidedly smaller than *D. delicatula*. The ectoderm has been almost entirely macerated away, so that the external surface of the mesoglœa is exposed to view. This presents numerous transverse folds due to contraction, but in addition fine linear depressed striæ are present, both horizontal and longitudinal, dividing the surface into numerous rows of small quadrangular elevations visible to the unaided eye. The color throughout is a dirty-green.

The base is adherent, flat, and about the same size as the column. It is marked by radiating and concentric striæ, continuations of the longitudinal and horizontal striæ respectively of the column. No verrucæ or tubercles occur on the column, though the quadrangular areas produced by the striæ are slightly more prominent toward the margin. This is well marked and smooth, and is separated from the tentacles by a deep fosse (collar) near the bottom of which are about 12 short digitiform fronds about 1 mm. in height. (Pl. VI, fig. 4p, and Pl. VII, fig. 1.)

Between these fronds and the tentacles there is upon the endodermal surface of the collar a sphincter (Pl. VI, fig. 4, sp.) of the dif-

fuse type, which differs markedly in detail from that of *D. delicatula*, the mesoglœal, processes being much more delicate and anastomosing somewhat in their proximal portions (Pl. VII, fig. 2). The circular muscles of the column wall external to the digitiform fronds are fairly prominent, and are continued the entire way down the column, not enlarging however to form a second sphincter.

The tentacles are simple, conical, and of moderate length, and are arranged in four cycles, their number being probably 96. By actual count they seemed to vary somewhat, usually falling below that number, but the discrepancies are probably due to the difficulty of making a correct enumeration. They possess well-developed mesoglœal processes for the support of the ectodermal muscles. The disc is deeply folded in, internal to the tentacles, so as to form a deep fosse around the peristome (Pl. VII, fig. 1), which, however, does not rise above the level of the margin. I was not able to distinguish in any of my preparations the delicate mesoglœal processes of the disc which support the ectodermal muscle cells in *D. delicatula*, but it is possible that they had been macerated away.

The mesoglœa of the stomatodæum is raised upon its ectodermal surface into prominent but rather delicate ridges, over which the ectoderm is folded. The gonidial grooves are deep, and as in *Oulactis* are prolonged below the level of the internal opening of the stomatodæum, and have the mesoglœa thickened. In *D. delicatula* Hertwig describes the gonidial grooves as being hardly marked in the stomatodæum, and if this is found to be an invariable characteristic, it will be necessary to alter slightly the definition of the Phyllactidæ given above. The depth of the grooves, and their prolongation downwards, is so marked in the other members of the group that I have examined, as to suggest that its apparent shallowness in the specimen examined by Hertwig may be due to distortion.

The primary and secondary mesenteries are perfect throughout the whole length of the stomatodæum; the tertiaries are perfect in their upper part, but lower down separate from the stomatodæum; while the fourth cycle consists entirely of imperfect mesenteries. The directives are attached throughout a greater part of their length than are any of the other mesenteries, owing to the prolongation of the gonidial grooves. The longitudinal muscles in the upper portion of the mesenteries form a low band, covering the greater portion of the non-gonophoric region of the mesentery; internally the muscle processes end rather abruptly, but externally they

gradually diminish in size. In the lower part of the mesentery, below the level of the stomatodæum, the arrangement of the muscle processes is very different (Pl. VI, fig. 6). Throughout the greater portion of the non-gonophoric region of the mesentery they are very small, but as the gonophoric region is approached they suddenly increase in size, forming a strong projection, and then just as suddenly diminish again, the projection being of slight extent. The parietobasilar muscles are well developed and form conspicuous folds. Both external and internal mesenterial stomata are present (Pl. VII, fig. 1). All the mesenteries with the exception of those of the first cycle are gonophoric.

The differences, between *D. bermudensis* and *D. delicatula* may be briefly enumerated as follows:

D. bermudensis.	*D. delicatula.*
Tentacles 96.	Tentacles 160.
Fronds digitiform, about 12 in number.	Fronds dilated at the extremity, about 42 in number.
Mesoglœal processes of sphincter muscle rather delicate, anastomosing slightly.	Mesoglœal processes of sphincter stout, not anastomosing.
Ectodermal muscle processes of disc wanting (?)	Ectodermal muscle processes of disc, long and delicate.

Sub-Tribe STICHODACTYLINÆ.

Family PHYMANTHIDÆ.

5. Phymanthus crucifer. (Les.) Andres.

A single specimen of this species was obtained. I have nothing to add to the statements already made regarding it in my paper on the Bahama Actiniaria.

Tribe ZOANTHEÆ.

Family ZOANTHIDÆ.

6. Zoanthus flos-marinus. Duch. and Mich. (Pl. VII, figs. 3 and 4.)

A large number of specimens of this species were obtained, and enclosed with them was a label stating that they were collected at Shelly Bay, Tuckerstown. In general appearance they resemble *Z. sociatus* from the Bahamas, the individuals as in that species forming stolon-like prolongations from which new individuals bud; their structure, however, shows them to belong to a different species. The colonies are, according to the accompanying label, 4 to 5 cm. in

breadth. The individual polyps in the preserved condition measure 1-2 cm. in height, and in breadth at the upper end 0·5, cm. the lower portion and stolons measuring about 0· 25 cm. All are strongly contracted, a small depression being the only indication of where the entrance into the interior is situated. The color, according to the inclosed label, was "spinach-green," but this must be taken as applying only to the upper part of the column, the lower part and the stolons being brown or sand colored. The disc was "apple-green" and the tentacles green.

The column upon the outside is covered by a cuticle, in which are sparingly imbedded foreign bodies. The ectoderm is separated from the cuticle by a layer of mesoglœa, and consists of cells arranged in groups separated by partitions of mesoglœa, but not showing the degeneration which occurs in *Z. sociatus*. The mesoglœa is comparatively thick, and consists of a homogeneous matrix containing (1) numerous anastomosing spaces more or less filled with cells, and (2) granular cells which give rise to delicate processes which enter into connection with other granular cells, and with the spaces just mentioned, and with the ectoderm and endoderm. Some suggestions regarding the origin and function of these structures will be found in connection with the description of *M. tuberculata* which follows. The endoderm of the column is low, and consists of more or less spherical cells, usually containing zooxanthellæ. A delicate layer of muscle fibres arranged circularly occurs between the endoderm and the mesoglœa.

At the upper part of the column a well-developed double sphincter muscle occurs, imbedded in the mesoglœa. It is stronger than that found in *Z. sociatus*, and more nearly resembles that described by Erdmann[1] and Hertwig[2] in *Z. Danœ*. (?)

The tentacles, according to the brief notes taken of the living specimens, are "short, 50-60 in number, in 3 rows." My preparations, however, show that the last statement is erroneous, the tentacles being arranged in two cycles only. Their ectoderm is not imbedded in the mesoglœa, nor is there a cuticle covering it. The ectodermal muscle processes of the mesoglœa are fairly developed, and immediately below them are to be seen, imbedded in the mesoglœa, peculiar granular pale yellowish-green cells, the proto-

[1] *A. Erdmann.* Ueber einige neue Zoantheen. Jen. Zeit. XIX. 1885.

[2] *R. Hertwig.* Supplement to Report on the Actiniaria. Zoology of the voyage of H. M. S. Challenger. Vol. XXVI. 1888.

plasm of which, with the exception of the nucleus, does not stain with carmine. Otherwise the mesoglœa is homogeneous. The endoderm is thick, and is richly supplied with zooxanthellæ. In structure the disc resembles the tentacles, possessing, like them, the peculiar yellowish-green granular cells.

The mesoglœa of the stomatodæum is homogeneous. I cannot make any statements as to the histology of the ectoderm of this region, as it had macerated into a mass of a characteristic appearance which cannot easily be described. Transverse sections show that the gonidial groove, to which the macro or ventral directives are attached, is very shallow, and indeed can hardly be said to exist.

The mesenteries are arranged on the microtypus[1]. Their mesoglœa is for the most part very thin but thickens towards the base where it contains a canal. (Pl. VII, fig. 4, bc.) A second canal, circular in section and packed with cells occurs in the thin region, the mesoglœa splitting to form its walls. The muscle layers are only slightly developed.

A very peculiar arrangement occurs in connection with the mesenterial filaments of the perfect mesenteries. Immediately below the stomatodæum the mesenterial filament is triradiate (Pl. VII, fig. 3), the central ray being short and stout, the lateral rays longer and recurved. The epithelium covering the central ray and that face of the lateral rays which looks towards it resembles in structure that of the stomatodæum. The outer surface of the lateral rays is, however, covered with cells similar to those which line the general surface of the mesentery. In a section which passes through the stomatodæum a little above its extremity, the intervals between the perfect mesenteries is occupied by macerated tissue resembling the ectoderm of the stomatodæum. Apparently it lines the surfaces of the mesenteries for a short distance outwards from their point of attachment to the stomatodæum, and also the outer surface of the latter for a short distance above its inner opening. It looks as if the ectoderm of the stomatodæum were reflected upwards, so as to cover its endodermal surface and the adjacent surfaces of the perfect mesenteries. Further down (Pl. VII, fig. 4) the two lateral processes of the mesenterial filaments disappear, the central one alone persisting. It is evidently the "glandular streak" of the filament. The cells which cover the surface of the mesentery for some distance outward from this towards the column-wall are very peculiar. (Pl. VII, fig. 4 di.)

[1] See Erdmann *loc. cit.*

They form a layer much thicker than that formed by the ordinary endodermal cells, and are loaded with green granules, closely packed together so that to the naked eye the region occupied by this layer is of that color. Foreign bodies of organic nature are imbedded in the cells, sometimes being surrounded by a number of cells containing no granules, or occasionally imbedded in the mesoglœa.

In unstained specimens, when the animal is laid open by a longitudinal incision, this region of the mesenteries is very distinct on account of its rich green color. When the loose cells of the green area are scraped away with a scalpel and examined, they are seen to be of a very irregular shape (suggesting a power of amœboid movement), and to contain numerous green globules, much smaller than the zooxanthellæ, darker in color, and homogeneous in structure. Amongst the cells are numerous zooxanthellæ, and there are also numerous spherical refractive bodies, apparently of a fatty nature and with a slightly-greenish tinge, as well as the foreign bodies already mentioned as seen in the section, and very numerous delicate acicular silicious spicules.

The occurrence of these spicules and organic foreign bodies in the cells of this region is very strong evidence in favor of the supposition that they have a digestive function. The green globules may be the products of digestion. If this be the case it is exceedingly interesting as indicating a method of digestion in the Zoantheæ somewhat different from what is usually described as occurring in the rest of the Actiniaria.

None of the specimens examined possessed sexual organs. There were about 24–26 pairs of mesenteries in the specimens examined.

I have identified this form with Duchassaing and Michelotti's *Z. flos-marinus*, with the imperfect description of which it agrees fairly well. In many respects it comes near *Z. sociatus*, but differs markedly from it in others; such for instance as in the nature of the ectoderm and in the form of the sphincter-muscle, so that it must be regarded as distinct. From the only *Zoanthus* hitherto described from the Bermudas, *Z. Danæ* (?) of Hertwig[1] it is readily distinguished by the absence of any distinct line of demarcation between the upper and lower portions of the column.

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[1] *R. Hertwig.* Supplement to report on the Actiniaria of the Challenger Expedition. 1888.

7. Mammillifera tuberculata (Gray) (Pl. VII, figs. 5 and 6.)

Synon.—*Isaurus tuberculatus*—J. E. Gray. 1828.
Zoanthus tuberculatus—Duchassaing and Michelotti. 1860.
Antinedia tuberculatus—Duchassaing and Michelotti. 1866.
Zoanthus (Monanthus) tuberculatus—Andres. 1883.
Antinedia Duchassaingi—Andres. 1883.

This form was first described by J. E. Gray,[1] from specimens in the British Museum, whose locality was unknown. He adopted for the genus Savigny's name *Isaurus*. In 1860, Duchassaing and Michelotti rediscovered it, and, though apparently unacquainted with the earlier description of Gray, applied to it the same specific name, but placed it in the genus *Zoanthus* on account of the absence of sandy incrustations on the column walls. In their second paper these authors placing importance on the tuberculation of the column walls erected for its reception the genus *Antinedia*. Andres in his most useful monograph has assumed that the form described by Gray is different from that which Duchassaing and Michelotti obtained at St. Thomas and Guadeloupe, relying probably on the discrepancies between the poor figures given by the latter authors and the more correct one which Gray has given. He consequently retains the specific term *tuberculatus* for Gray's form, proposing for Duchassaing and Michelotti's the name *Duchassaingi*. There is little room for doubt, however, that the two forms are identical: my observations have shown that the species is to be referred to the genus *Mammillifera* as defined by Erdmann.

The specimens from the Bermudas were either solitary, attached to a piece of rock by a base only very slightly expanded, or else were grouped together in twos or threes in which case they were united by a slightly-developed, flat or slightly-tubular cœnenchyme. In none had the cœnenchyme any such tubular or stolon-like form as is shown in the figure given by Duchassaing and Michelotti. Judging from the specimens I studied, the tendency to form a cœnenchyme is slight.

The polyps (Pl. VII, fig. 5) vary in height from 1·3–2·7 cm.; their diameter being about 0·7–0·9 cm. The column is marked by six or eight distinct annular grooves, and by from twenty to twenty-five longitudinal ones. In the lower part of the column the ridges formed by these longitudinal grooves are entire, but higher up they begin to be divided into a series of tubercles, a row of these corresponding

[1] *J. E. Gray*—Spicilegia Zoologica. London. 1828.

to each ridge. These tubercles increase in size towards the margin and several become grouped together upon elevations of the column wall, giving rise to mulberry-like protuberances. Near the margin the tubercles suddenly cease, forming, in contracted specimens, a strong ridge bounding the dome-shaped area which forms in such specimens the summit. This dome-shaped area belongs to the column, the animal being strongly contracted, and though without tubercles shows clearly the continuation upwards upon it of the longitudinal furrows, and is, accordingly, marked by a series of radiating ridges.

In structure the tubercles of the column are solid, being elevations of the mesoglœa. This tissue throughout the column is very thick, measuring on the average 1 mm. in thickness. It presents numerous anastomosing canals filled with cells, as well as the delicate canals, which have been described by Erdmann and others, very distinctly. These canals are without doubt processes from the large canals, and the structure of the zoanthan mesoglœa may be compared to that of a bone, such as a frog's femur, the anastomosing canals being compared to the lacunæ and the delicate canals to the canaliculi. My preparations of *M. tuberculata* seem to show that the lacunæ arise from both the ectoderm and endoderm. In some of my sections deep bays can be seen running from the endoderm up into the mesoglœa, and from their ends and sides numerous canaliculi can be seen branching out. These bays can be found in various stages of enclosure by the mesoglœa, the cells which they contain being in some cases continuous with the general endoderm, in other cases almost separated from it and finally quite so. So too with the ectoderm. The lacunæ which have just been formed in this manner are much larger than the majority of those scattered through the mesoglœa, these frequently consisting of only a few or even a single cell, and further the newly-formed lacunæ usually contain zooxanthellæ, whose presence is rare in the older ones. It would seem as if many of the newly-formed lacunæ become divided into smaller portions which separate from each other, except by the delicate canaliculi, and at the same time undergo an alteration in the histological structure of their cells, the zooxanthellæ disappearing and the cells becoming filled with refractive deeply-staining granules. It seems not improbable that these altered cells are concerned in the formation of the mesoglœa, their granules being particles which will later on be added to the matrix of the mesoglœa.

Upon the outside of the column is a thin cuticle (Pl. VII, fig. 6, cu.) similar to what occurs in *Z. sociatus* and *Z. flos-marinus*. Andres[1] considers this to be merely a differentiation or hardening of the external layers of the mesoglœa, but I cannot agree with this view. It is a clearly defined layer external to the mesoglœa, and appears quite different in composition and behavior to staining fluids from that tissue. Below this cuticle comes a layer of mesoglœa for which Andres' term subcuticula may be employed. The distinction between the cuticle and this layer has been overlooked by most authors. It was recognized by Kölliker,[2] however, who believed it to be a portion of the cuticle. Andres recognized its true nature considering it simply a continuation of the mesoglœa.

Below the subcuticula is the ectoderm (Pl. VII, fig. 6, ec.) which forms a layer 0·08 mm. in thickness. It is not continuous, however, but is divided into more or less cubical masses by columns of mesoglœa extending from the general mass of that tissue to the subcuticula. A peculiar feature of the ectoderm of this species is the presence in it of zooxanthellæ. In adult actinians these structures are usually confined to the endoderm, but I have observed them in the ectoderm in free-swimming larvæ, in which layer they also occur according to H. V. Wilson[3] in the embryos of the coral *Manicina*. It is possible that their presence in the ectoderm of *M. tuberculata* is due to the thick cuticle and subcuticula preventing a rapid aeration of the ectoderm cells and so, by favoring the accumulation to a certain extent of carbon dioxide, producing favorable conditions for the growth of the parasitic algæ. The ectoderm thus buried in the mesoglœa evidently corresponds with what Kölliker, in the admirable account he has given of the zoanthan mesoglœa,[4] terms "eine zusammenhängende Schicht drüsenartiger Körper" and which he believed to correspond to the ectoderm.

The endoderm consists of low cells containing numerous zooxanthellæ. In the upper part of the column, extending from the margin to the upper row of tubercles, is a single strong sphincter

[1] *A. Andres.* On a new genus and species of Zoanthina malacodermata (Panceria spongiosa, sp. n.)—Quart. Journ. Micros. Sci. N. S. Vol. xvii. 1887.

[2] *Kölliker.* Icones Histologicæ. Leipzig. 1865.

[3] *H. V. Wilson.* On the development of Manicina areolata. Journal of Morphology. Vol. II. 1888.

[4] *A Kölliker*, loc. cit.

muscle imbedded in the mesoglœa, and occupying nearly its whole thickness.

All the specimens were in a state of strong contraction, and I was not able to see the tentacles. Duchassaing and Michelotti state that they are small tubercles. My sections show that they are ar-arranged in two cycles. It is also evident that they are short, but they can scarcely be termed tubercles. Their mesoglœa is thick, especially toward the base, thinning out somewhat towards the apex. Its outer surface is thrown into rather strong muscular processes.

The surface of the stomatodæum is thrown into numerous rather high folds, the ectoderm being elevated on slender processes of the mesoglœa.

The mesenteries are arranged on the microtypus and number twenty-two pairs. Towards their base the mesoglœa is very thick diminishing gradually towards the distal edge. Just at the base there is a sudden diminution of the thickness, so that they are attached to the column wall by a thin pedicle. The basal portion contains the usual canal, and in addition there are numerous lacunæ similar to those of the column wall in every respect. *M. tuberculata* is hermaphrodite, and I am able to add this particular to the definition of the genus given by Erdmann.[1] I could not make out any regularity in the arrangement of the reproductive elements on the different mesenteries, nor did there seem to be any definiteness in their position in any one mesentery. Sometimes a mesentery would possess ova only, but usually each one presented both ova and spermatozoa.

8. Corticifera ocellata (Ellis).

Synon.: *Alcyonium ocellatum.* Ellis and Solander, 1786.
Palythoa ocellata. Lamouroux, 1821.

A number of small colonies of a *Corticifera* were obtained at Shelly Bay, and were accompanied by a label referring them to the above species. The term *ocellata* was first given by Ellis and Solander to a form which, however, was very poorly characterized, so much so that certainty of identification is impossible. The only statement in the description of which use may be made is that the polyps are rust-colored. Later authors simply copied Ellis and Solander's description until Dana,[2] evidently relying on the figure which accompanies the earlier description adds the characteristic that the polyps, though imbedded in cœnenchyma throughout the

[1] *Erdman A.* loc. cit.

[2] *J. D. Dana*, Zoophytes. United States Exploring Expedition. 1849.

greatest part of their extent, are yet free above. Duchassaing and Michelotti in their paper of 1860 describe a form under this name which differs somewhat from the original type species, and is probably to be considered, as Andres has done, a distinct form. In their later paper they make this form identical with a form they name *Palythoa mammillosa*, a name taken from a second imperfectly characterized form mentioned by Ellis and Solander. In fact so much confusion is introduced by Duchassaing and Michelotti as to render it very difficult, if not impossible, to ascertain what forms they are really describing.

Under the circumstances I have thought it well to retain the name which accompanied the specimens, and trust that the following description will sufficiently characterize them to allow of the identification in the future.

The polyps are grouped together in small masses, and project decidedly above the surface of the cœnenchyme. Their height measured from the lower surface of the cœnenchyma is 1-2 cm. and their breadth, measured at the summit, about 0·7 cm. in the fully grown individuals. The polyps and cœnenchyma are densely incrusted with particles of sand and other foreign bodies, and are of a grayish sandy color, sometimes deepening to a rust color.

Upon the outside of the column is a rather thick cuticle, but I was not able to discover whether or not a layer of mesoglœa intervened between this and the ectodermal cells. The outer portion of the mesoglœa for about half its thickness has imbedded in it foreign bodies, and when decalcified is fenestrated by the numerous cavities previously occupied by them. The internal portion of the layer presents the structural features found in other Zoanthidæ, but it is to be noticed that foreign bodies occur in the so-called "nutritive canals" or lacunæ. The sphincter muscle is imbedded in the mesoglœa, is single, and consists of a single row of cavities containing muscle fibres.

The tentacles are arranged in two rows and are apparently fifty-six in number in the specimens examined. Their outer muscular layer is weak and the mesoglœa is homogeneous except upon the outer face of the tentacles where it contains a number of granular cells similar to those occurring in the column mesoglœa in this and other forms already described. Zooxanthellæ occur in the ectoderm.

The ectoderm of the disc is peculiar. It consists of high much-vacuolated cells which contain, like the ectoderm of the tentacles,

zooxanthellæ. I have found this peculiar structure of the disc ectoderm in no other Zoanthids. Unfortunately the preservation of the specimens was not sufficiently good to allow of the histological details being studied. The gonidial groove of the stomatodæum is rather broad and the mesoglœa lining is thickened and truncated upon the endodermal side, the macrodirectives being inserted into each angle of the truncation.

The mesenteries are arranged on the microtypus, there being about twenty-six pairs. The basal canal is large, and contains foreign particles similar to those found in the lacunæ of the column, The mesoglœa is thickened towards the base of the mesenteries and contains in addition to the basal canal, several others nearly circular in section and completely filled with spherical granular cells. The endoderm throughout contains zooxanthellæ. No reproductive organs were present.

9. Corticifera glareola, Les.

Synon.: *Corticifera glareola.* Lesueur. 1817.
Palythoa glareola. Milne-Edwards. 1857.

The identification of this form depends mainly on the coloration, which Professor Heilprin informs me is sufficiently similar to Lesueur's description.

The polyps form encrusting masses, and are so deeply imbedded in the cœnenchyme, that in contraction a slight depression alone indicates the position of the various individuals, or in some cases a slight annular elevation. The species is by this peculiarity readily distinguishable from *C. ocellata*, as well as from *C. flava* of the Bahamas, which stands in an intermediate position as far as the projection of the polyps above the cœnenchyme is concerned. The form described from the Bermudas by Erdmann, and named *C. lutea* by Hertwig resembles *C. glareola* in this respect, but appears to differ from it in other points.

The mesoglœa is, with the exception of a narrow band immediately adjoining the endoderm of the polyps, richly supplied with imbedded foreign bodies, so that the entire colony is very hard, almost stony in its consistency. *C. ocellata* is much less richly provided with foreign particles, and the same is the case with Hertwig's *C. lutea.* Whether this is a characteristic of sufficient importance for specific distinction can only be ascertained by the examination of numerous specimens of some species, obtained from different localities and living under different conditions. In fact our knowledge of the his-

tology of the zoanthidæ is not yet sufficiently advanced to enable us to ascertain what features are of systematic importance and what are liable to extensive individual variation.

The sphincter muscle resembles closely that of Hertwig's *C. lutea*. It is imbedded in the mesoglœa and is single, consisting of a single row of cavities which are entirely confined to the portion of the column which is invaginated during contraction. All the cavities contain muscle cells and there are none of the empty spaces with clearly defined walls such as occur in *C. flava*.

The mesenteries are arranged in the microtypus, and in the specimens examined there were about eighteen pairs only. The mesoglœa is delicate, and is not dilated towards the base as in *C. ocellata*, and in consequence, the basal canal is elongated. Notwithstanding that the specimens were very much macerated it was possible to perceive that a digestive area, similar to that described as occurring in *Z. flos-marinus* was present, just below the stomatodæum. No reproductive organs were present.

The stomatodæum presented the pyriform, truncated shape which has been described for other members of the genus.

It seems not improbable that the form described by Hertwig as *C. lutea* may be identical with this. Alcoholic specimens of *C. glareola* show no trace of the coloration of the living forms but are of a universal sandy color. In the very slight prominence of the polyps above the cœnenchyme, in the structure of the sphincter muscle, and in the slenderness of the mesenteries there is agreement between the two, and these are points which will probably prove to be of systematic importance. On the other hand there is dissimilarity in the extent of the incrustation by foreign bodies, in the pigmentation of the endoderm which is wanting in *C. glareola*, and apparently in the extent of the development of the longitudinal muscles of the mesenteries, which cannot be said to be well developed in *C. glareola*. This last character is probably of importance, but the first two are probably subject to variation depending upon the conditions of life and the food.

The evidence then, seems to be in favor of the identity of the two forms, in which case the name here used has the priority. It seems to me very doubtful indeed if Hertwig's identification of the Bermuda form with Quoy and Gaimard's *C. lutea* from the Fiji islands is correct. The only point of correspondence, judging from the

description and figures given by Quoy and Gaimard,[1] is the slight prominence of the polyps above the cœnenchyme when in contraction.

10. Gemmaria Rusei, Duch. and Mich. (Pl. VII, fig. 7–9.)

Synon.: *Gemmaria Rusei.* Duchassaing and Michelotti. 1860.

I was pleased to find in the Bermuda collection several specimens of a form which evidently belongs to the same genus as the form from the Bahamas which I described as *Gemmaria isolata.* Several anatomical features are common to the two, and I am now able to give other characteristics which may serve to distinguish the genus more definitely than was done in my former paper.

The polyps of *G. Rusei* (Pl. VII, fig. 7) are solitary, being attached to pebbles without the development of any cœnenchyme. The specimens were obtained at North Rock, and are five in number. The upper portion of the column is larger than the lower, so that the polyps have the shape of a short stout club; the lower portion is transversely wrinkled even in the expanded condition, as is noted in the label accompanying the specimens. The height of the column is about 2·5 cm. in the largest specimens; the diameter of the upper part is 0·65 cm. and of the lower 0·5 cm. The color is stated on the label to have been "cinereous throughout."

The column wall is rather thin, and is occupied throughout nearly its entire thickness by foreign bodies. The ectoderm is covered externally by a cuticle, but I was unable to ascertain whether a layer of mesoglœa intervened between this and the surface of the ectoderm. The structure of the thin layer of mesoglœa unoccupied by foreign bodies is as in other zoanthidæ and calls for no special comment. The sphincter is single, and imbedded in the mesoglœa; it consists for the most part of a single layer of cavities, but thickens somewhat towards its upper end. All the cavities contain muscle cells, there being none of the empty cavities described in *G. isolata.*

The tentacles are arranged in two cycles, and have only a very weak ectodermal musculature, as is also the case in *isolata.* Towards the base and upon the outer surface the mesoglœa contains peculiar granular cells, and occasionally enclosures of foreign bodies, and this likewise occurs in *isolata.*

The disc is traversed by a number of ridges which radiate from the peristome to the margin, a ridge corresponding to each tentacle of the outer cycle. The elevations are produced by thickenings of the mesoglœa (Pl. VII, fig. 9), and along each ridge the ectodermal

[1] *Quoy and Gaimard,* Zoologie du Voyage de la corvette l'Astrolabe. Paris. 1833.

muscle cells are more numerous and larger than elsewhere. *Isolata* presents similar structures. Zooxanthellæ occur in the ectoderm of the disc, and tentacles in both forms. The enclosures in the mesoglœa of the disc, which I thought might possibly be muscle cells in *isolata*, are seen in *Rusei* to be comparable to the lacunæ of the column wall.

The mesoglœa of the stomatodæum in both species of *Gemmaria* has enclosures of granular cells (Pl. VII, fig. 8), as a rule one such enclosure opposite the insertion of each mesentery, especially in the upper part of the stomatodæum, the arrangement being lost in the lower part. The gonidial groove has the same shape as that of *G. isolata.*

The mesenteries are arranged in thirty-one pairs and are on the microtypus. The mesoglœa thickens towards the base so that the basal canal is almost circular and not elongated as in *G. isolata.* No reproductive organs were present.

The description given by Duchassaing and Michelotti of *Gemmaria Rusei*, with which I identify this form, is very imperfect, but so far as it goes it applies to the Bermuda species. The form described by Gray[1] as *Triga philippinensis* is very similar in external form and is in all probability a *Gemmaria.*

Of the forms described above, no less than seven, viz: *Condylactis passiflora, Phymanthus crucifer, Zoanthus flos-marinus, Mammillifera tuberculata, Corticifera ocellata, C. glareola* and *Gemmaria Rusei*, are represented in the West Indian fauna, and of the other three, the genera *Aiptasia* and *Phyllactis* also occur in the islands to the South, leaving only the genus *Diplactis* as a characteristic form of the Bermudas. No doubt a systematic search for Actinians in the Bermudas would lead to the discovery of a greater number of West Indian forms, but the proportion of common forms given above is sufficient to show that the Actinian fauna of the Bermudas has been derived from that of the West Indies.

Explanation of Plates.

bc.=basal canal.
c.=column wall.
cm.=circular muscles.
cu.=cuticle.
d.=disc.
en.=endoderm.
fr.=fronds.
m.=margin.
p.=tentaculiform fronds.
sp.=sphincter.

[1] *J. E. Gray.* Notes on Zoanthinæ with descriptions of some new genera. Proc. Zool. Soc. London. 1867.

di.=digestive region of mesenterial filament.
Ec.=Ectoderm.
sp[1].=lower sphincter.
t.=tentacle.

Plate VI.

1. Transverse section through the middle region of the sphincter of *Aiptasia* sp. (?) × 350.

2. Longitudinal section through the upper half of the column wall of *Aiptasia* sp. (?) × 40.

3. Transverse section through the outer edge of the longitudinal mesenterial muscles of a specimen of *Condylactis passiflora* from the Bermudas. × 42.

4. Longitudinal section through the margin and adjacent parts of *Diplactis bermudensis.* × 24.

5. Longitudinal section through the margin and adjacent parts of *Oulactis fasciculata.* × 21.

6. Transverse section through the longitudinal mesenterial muscles below the stomatodæum in *Diplactis bermudensis.* × 40.

Plate VII.

1. Perfect mesentery of *Diplactis bermudensis.* Natural size.

2. Portion of transverse section of sphincter of *Diplactis bermudensis.* × 100.

3. Transverse section of mesenterial filament of *Zoanthus flos-marinus* just below the stomatodæum. × 120.

4. Transverse section of perfect mesentery of *Zoanthus flos-marinus* slightly below the stomatodæum. × 50.

5. *Mammillifera tuberculata.* Natural size.

6. One-fourth of a portion of a longitudinal section through the column wall of *M. tuberculata.* × 200.

7. *Gemmaria Rusei.* Natural size.

8. Transverse section through the gonidial groove of *Gemmaria Rusei.* × 65.

9. Transverse section through upper part of column of *Gemmaria Rusei.* × 24.