

30. *On some new or imperfectly known MADREPORARIA from the CORAL RAG and PORTLAND OOLITE of the COUNTIES of WILTS, OXFORD, CAMBRIDGE, and YORK.* By ROBERT F. TOMES, Esq., F.G.S. (Read June 20, 1883.)

[PLATE XXII.]

INTRODUCTION.—I much regret that in the preparation of the present paper I have not, as on the occasion of my former contribution towards the history of the Madreporaria of the Jurassic formation, had the advantage of repeated personal investigations of the strata from which the specimens were obtained. This expression of regret, however, may perhaps seem unnecessary after the appearance of the very ample and able paper on the Corallian rocks of England by Messrs. Blake and Hudleston *; but I would observe that as their conclusions were drawn rather from the study of the Mollusca and Echinodermata than from that of the Corals, we are yet in ignorance respecting the exact stratigraphical position of the latter. Consequently it is not by any means certain that the conclusions arrived at by these geologists might not have undergone some modification if the Corals had received more careful examination. Possibly more than one Coralliferous period might have been observed in the Corallian beds, just as more than one has been pointed out in the Inferior Oolite; and as some Madreporarian forms are peculiar to the Coral Rag, it would be interesting to know more fully than we at present do their range in time.

It has always been a matter of some surprise that while the Coral Rag of this country fulfils so completely the conditions of a Coralliferous deposit, and is in so many places crowded with Corals, the number of species should be so small. MM. Milne-Edwards and Haime † give ten genera and fourteen species, and this meagre list has not since been added to, nor has our knowledge of the species been augmented. Although Prof. Duncan has increased the number of Great-Oolite Corals, he has made no addition to our knowledge of those from the overlying Coral Rag; and the very restricted number of species at present known becomes the more remarkable when comparison is made with the numbers which have been described from beds of a corresponding period in France and Germany. It is only necessary to turn to the works of MM. de Fromentel, Becker and Milaschewitch, and Quenstedt, to see how comparatively poor in species is our Coral Rag.

Possessed of but little additional information, I must content myself with giving a section of the Coral Rag of one locality, and determining the position of the Madreporaria therein, with alluding to certain other localities, and noting the species therefrom, and

* Quart. Journ. Geol. Soc. vol. xxxiii. pt. i. p. 260 (1877).

† Brit. Foss. Cor. pt. ii.

calling attention to some hitherto unrecorded genera and species. One or two of the Coral-Rag species, fully recognized, but not, as I think, well understood, will also be mentioned; and finally some remarks will be offered on the well-known *Isastræa oblonga* of the Portland Oolite.

A large proportion of the Corals from the Inferior Oolite, and a still greater number of those from the Great Oolite, admit of no internal examination, being little better than crystalline casts. The latter, however, often have their external details beautifully retained; while those from the Coral Rag, on the contrary, very rarely exhibit satisfactory external characters, though their internal structure is well preserved and may be successfully studied by means of polished sections or weathered fractures.

The genera now added to the Coral-Rag Madreporaria of England are *Astrocænia*, *Dimorpharæa*, and *Latimeantræa*, which are already known, and *Crateroseris*, which I now introduce as a new genus.

Highworth Section.

	ft. in.	
1. Coral Rag, a true Rag, and exposed on the line of dip from Highworth along the road to Shrivvenham, about	6 0	<i>Rhabdophyllia Phillipsi</i> , <i>Isastræa explanata</i> ?, <i>Astrocænia major</i> , <i>Thamnastrea concinna</i> , <i>Latimeantræa corallina</i> .
2. Rubby limestone of a yellowish or ferruginous colour	1 6	<i>Thecosmilia annularis</i> abundant.
3. Fine laminated yellow sand with oolitic grains, mostly in layers, and sometimes indurated	5 0	
4. Fine-grained sand, sometimes passing into dark clay, used for brick-making	6 0	
5. Coarse oolitic stone in thin layers....	6 6	
6. Ferruginous sandy stone in irregular thin layers	0 8	<i>Thecosmilia annularis</i> abundant.
7. Limestone in layers, more or less oolitic	3 0	
8. Very dense stone, with a sandy fracture	2 0	
9. Soft white sand, sometimes containing calcareous lumps.....	6 0	

The foregoing section is to a certain extent a compiled one, bed No. 1, that is the Coral Rag proper, not being visible in direct connexion with those below, which are exposed in near proximity to the town of Highworth. The Rag is observable at several places on the road from Shrivvenham to Highworth, more especially in an extensive but shallow quarry near the road which leads to Warnford Place. In this excavation all the Corals mentioned in this paper as occurring in this district have been found; but as they were chiefly taken either from the heaps of quarried stone, or from the débris left behind, I can only determine their exact position by their appearance and colour, and observe that the large and massive *Thamnastreae* and *Astrocæniae* occur in the middle and

upper part of the deposit, and that *Rhabdophyllia Phillipsi* and *Latimæandraræa corallina* are found near to or at the bottom. Another but much smaller opening in the Rag exists on the same level, but much nearer to Highworth; and in the mottled clay in the bottom of this pit I found a prostrate and worn specimen of *Thecosmilia annularis*, in all respects resembling those found in bed No. 2.

In a brickyard on the same road, and quite near to the town, several feet of fine yellow sand passing downward into bluish clay may be seen. This is the third bed of the section.

Passing through Highworth, we come to the brickyard and adjacent quarry, which together furnished the section published by Messrs. Blake and Hudleston, and which presents all the beds below the true Rag which are here alluded to. Bed No. 2 contains *Thecosmilia annularis* in great abundance, all the specimens being much broken up and worn, and consequently prostrate. No other species is associated with them. In the succeeding beds, numbered 3, 4, and 5, there are no traces of Corals; but in No. 6 the same species of *Thecosmilia* is very abundant, and is in the same broken and rubbed state. This bed, as well as those numbered 7, 8, and 9, are well shown in the adjacent and recently excavated road to the Highworth Railway Station, now in course of completion.

Of the exposure of Coral Rag at Headington, which I have visited, I regret that I can say but little, excepting to observe that it contains nearly the same species of Madreporaria as the Coral Rag of Highworth. The following are the species collected by me at that well-known locality:—*Thecosmilia annularis*, *Astrocenia major*, *Thamnastræa concinna*, and the casts of a branching Coral, which may probably be referred to *Rhabdophyllia Phillipsi*.

It will be seen on referring to the Corals found at Highworth, and comparing them with those from Headington, that the species are identical, and, so far as I am able to judge, identical also with those from Marcham and Cumnor. But the Coral Rag of Cambridgeshire appears to present a different assemblage of species, and the same may be said of the well-known coralline deposits of Steeple Ashton.

Family *ASTRÆIDÆ*.

Subfamily *ASTROCCENINÆ*.

Genus *ASTROCCENIA*.

ASTROCCENIA MAJOR, n. s. Plate XXII. figs. 5 & 7.

The corallum is massive, large, and has an expanded or lenticular form, arising from a rather broad attachment, and sloping outwards and upwards to a rather thin outer margin, the upper surface being a little convex or quite flat.

It consists of rather numerous superimposed layers, without any

appearance of a common wall or epitheca. The calices are large, rudely hexagonal, and internally united by their walls, which are thin but distinct. The columella is about one fourth of the diameter of the calice; it is styliform and prominent. The septa are rather thin, straight, and the primaries and secondaries run into the columella. Those of the third cycle are two thirds the length of the first and second, and those of the fourth are half the length of the third. There is a tendency in the short septa to incline towards or run into the longer ones. All have their sides marked with vertical ridges, which terminate in their margins, and form papillæ which have their greatest diameter across the septa. In almost every instance those of one calice meet and blend with those of other calices at the upper margin of the wall, as in *Clausastræa*. The dissepiments are numerous, thin, and affect a somewhat circular disposition when seen directly from above. In form they are rather like synapticulæ, from which, however, they are quite distinct.

Increase takes place in this species by gemmation on the walls between the calices, just as in *Isastræa*.

The diameter of the calices is about three lines, but sometimes as much as four or four and a half lines.

It occurs, and is not rare, in the Coral Rag at Headington, near Oxford, at Lyncham, Wiltshire, at Highworth, and at Marcham, from all which places I have obtained specimens.

Family *FUNGIDÆ*.

Genus *THAMNASTRÆA*, Le Sauvage.

THAMNASTRÆA ARACHNOIDES, Edw. and Haime, Pol. Foss. des Terr. Paléoz. p. 111, 1851; Brit. Foss. Cor. p. 97, 1851.

Synastræa arachnoides, Edw. and Haime, Ann. des Sci. Nat. 3^e ser. t. xii. p. 154, 1850.

Of this well-known species I have lately made an exhaustive examination, with a view to determine, if possible, whether it is a perforate or imperforate Coral, and I am now fully convinced that the septa are strictly imperforate. This will render it necessary that it should be removed from such of the *Thamnastræa* as have been shown by Milaschewitch to appertain to the Poritidæ*.

It is probable that the Middle-Lias species, which I have described under the names of *Thamnastræa Etheridgii*, and *T. Walfordi* †, as well as *T. Crickleysensis* and *T. Duncani* ‡, from the Inferior Oolite, have imperforate laminæ. These, with perhaps also *Thamnastræa Manseli* of Prof. Duncan § and some others, will most likely be found to constitute a distinct genus; for whether we

* Palæontographica, vol. xxi.

† Quart. Journ. Geol. Soc. vol. xxxiv. p. 179, and vol. xxxviii. p. 95.

‡ Ibid. vol. xxxviii. pp. 435 and 436.

§ Suppl. Brit. Foss. Cor. pt. iii. p. 20.

include the perforate *Thamnastrœæ* in the Poritidæ or the Fungidæ, we at any rate can scarcely deny that the difference between perforate and imperforate septa is a character of sufficient importance to be regarded as generic.

But there are other peculiarities in the present species which may be mentioned. The first is, that the imperforate septa are connected by true synapticulæ, and not by "oblique cross floors," or tabular synapticulæ; and another is, the tendency to pass from a turbinate to a digitate form, each of the finger-like processes having its surrounding wall and terminal calicular surface. Specimens having the divided form exhibit a distant resemblance to the genus *Epistreptophyllum* of Milaschewitch*, which genus is, however, characterized by the presence of a single terminal calice, and by the existence of both dissepiments and synapticulæ.

For the present I refrain from further remarks, excepting to repeat my belief in the necessity of separating the imperforate *Thamnastrœæ* from those which have their septa pierced, and the pores of which have a distinct arrangement in the different species or groups of species.

THAMNASTRÆA CONCINNA, Milne-Edwards and Haime, Brit. Foss.
Cor. pt. ii. p. 100. Plate XXII. figs. 1-4.

Astrœa concinna, Goldf. Petref. Germ. i. p. 64.

Very massive specimens of this common species may be met with at many places. These often exhibit forms so remarkable as to suggest specific or almost generic distinction, and they deserve special notice. After the corallum has attained to a considerable lateral growth, the upper surface throws up numerous conical processes, which have their corallites directed outwards, just as they are in ordinary dendroid *Thamnastrœæ*. The corallites by their outward and upward growth increase the diameter as well as the length of the processes, until these, by pressure against each other at their bases, become more or less angular or hexagonal, and are separated only by narrow clefts or sinuses, which by the continued growth of the corallites become ultimately closed inferiorly. When the upper surface of such specimens is afterwards worn down to a convex, or more or less flattened form, what was the centre of the conical processes still retains a certain degree of convexity, owing to the position of the central corallites, which being vertical are more able to resist the wearing process. A shallow depression surrounds this convexity, while the line of union of the outwardly directed corallites proceeding from the several processes, which was previously a narrow cleft, now becomes a prominent ridge. Such specimens, when cut through vertically, present the appearance shown in figure 1 of the Plate accompanying this paper. In these massive and worn specimens the well-developed and styli-form columella becomes very conspicuous (fig. 4), and it is very

* Palæontographica, vol. xxi. p. 210.

difficult to recognize such specimens as generically identical with those which have no columella.

CRATEROSERIS, n. g.

The corallum is composite, massive, and has a depressed turbinate form, and the calicular surface is superior and convex.

There is a common wall, which is naked and costulated. The calices are evenly distributed, round and prominent, but depressed in the middle, and they have a small well-defined fossula. The intercalicular spaces are depressed.

The septa are imperforate, their margins are moniliform, and they are continuous with the septal costæ, which pass from one calice to another without interruption.

Both septa and septal costæ are connected by well-developed synapticulæ.

The method of increase is by gemmation, which takes place in the depressed intervals between the calices at the outer margin of the corallum.

There is very little difference in the form of the calices of this genus and those of *Confusastræa*, to which genus it might be referred, were it not for the wide difference in its internal structure.

CRATEROSERIS FUNGIFORMIS, n. s. Plate XXII. figs. 11-14.

The corallum is flatly turbinate, slightly peduncular, and attached by a small surface. The mural costæ are uniform in size, small, and may be traced without interruption from the peduncular region to the calicular margin, over which they pass, and are continuous with the septa of the outer calices. They are rather delicately but obscurely papillated. There is no epitheca.

The calicular surface is more or less convex, and the calices are evenly distributed. They are round, well defined, and prominent, with their middle part depressed and open, and there is a small, round, and well-defined fossula. The intercalicular spaces are depressed.

The septa and the septal costæ are regular, uniform in size throughout, rather thick, very closely placed, and many of them anastomose. All their margins are ornamented with thickly placed tubercles, which are a little flattened, and have their greatest diameter across the septa. There are from thirty-five to forty-three septa, of which from seventeen to twenty reach the fossula; all the others are irregular in length, and many of them run into the larger ones. The cycles are not traceable.

The synapticulæ are well developed and abundant, but they are rather small.

Diameter of the calices from two to three lines; distance from centre to centre of the calices from three to five lines. Height of the corallum two inches, and its greatest diameter three inches and six lines.

Two examples of this coral have come under my observation, both of which were obtained from Steeple Ashton. One of these is in Dr. Wright's collection, and the other is in my own.

ZOANTHARIA PERFORATA.

Family *PORITIDÆ*.

Subfamily P O R I T I N Æ.

Genus DIMORPHARÆA, De From.

DIMORPHARÆA, sp.

I have received several hollow casts of a species of *Dimorpharæa*, from the Coral Rag of Upware, Cambridgeshire, which furnish very good impressions of the calicular surface, and in one of them are some portions of the corallum itself. These show the synapticulæ and the perforations of the septa distinctly, and enable me to determine the genus satisfactorily; but without more perfect specimens I prefer to defer a description of the species for the present. Better preserved examples are desirable for this purpose; but I may observe that it differs from all the *Dimorpharææ* I have seen in having a much greater number of calices. The inner circle, which surrounds the central calice, is only about two lines distant from it, and all the other circles are only that distance from each other. In the circles the calices are very closely placed.

From the number of fragments I have seen I should suppose that it is common at Upware.

Genus LATIMÆANDRARÆA, De From.

This genus was created by M. de Fromentel in 1856 for some corals from the Corallian of France, for which the name of *Mæandraræa* was proposed three years afterwards by M. Etallon*. The former name has the priority; but I am not aware that it was made known until the publication of M. de Fromentel's valuable little work on fossil corals in 1858-61†. The genus is characterized by not having a visible wall, by the presence of synapticulæ, which structurally resemble those of *Disaræa* and *Microsolena*, by calices which are shallow but distinct, and separated by somewhat elevated but obtuse ridges, confluent septa, a rudimentary columella, and a thin but well-developed epitheca.

By the kindness of M. de Fromentel I have now before me some specimens of *Latimæandraræa corallina*, from the Corallien Inférieur of Champlitte, and with their assistance I have been enabled to determine the generic position of the two species I am about to describe. I must add that in one of these there is very distinct marginal gemmation, and a leaf-like growth, just as in the Astræacæan genus *Phyllogyra*, to which, excepting for the presence of synapticulæ and distinctly perforate septa, it might be referred.

At page 440 of my communication on the Corals of the Inferior Oolite of Gloucestershire‡, I have observed of some species of the

* Etud. Paléont. Haut. Jura, p. 123 (1859).

† Etud. Polyp. Foss. p. 247 (1858-61).

‡ Quart. Journ. Geol. Soc. vol. xxxviii. (1882).

genus *Orosaris* that gemmation takes place in the outer prolongations of the septal costæ. This is exactly what also takes place in the genus *Latimæandraræa*, to which genus such species as *Orosaris concentrica* are very closely affined, if, indeed, they should not be placed in it.

LATIMÆANDRARÆA CORALLINA, E. de From. 'Introd. Etud. Polyp. Foss.' p. 247.

A single specimen was found by my friend Mr. T. J. Slatter, F.G.S., amongst the débris of the large quarry between Shrivenham and Highworth*. It differs from specimens received from M. de Fromental in being more massive in its form, in having the septa and septal costæ thinner, their perforations larger, and the synapticulæ more developed.

Its greatest diameter is three inches six lines, and it has a height of one inch six lines.

LATIMÆANDRARÆA DECORATA, Bean, sp. Plate XXII. figs. 7-10 & 15.

Meandrina decorata, Bean, MS.

The corallum is fungiform, and has a thin lobular and somewhat overhanging margin. It is supported on a short peduncle, which has the form of an inverted cone. All the under surface, including the peduncle, has thin, straight and simple mural costæ, which are not very distinct.

The whole of the upper or calicular surface is formed by the outward growth of leaf-like expansions, originating in a central elongated leaf, and forming calicular furrows, which are short, broad, and open. There are six of them, besides the central or parent leaf; and they have a somewhat radiate arrangement, and, running quite to the outer margin of the corallum, give to it an undulating outline. The greatest number of calices in a furrow is two; but gemmation is seen to be going on actively around the outer margin of the corallum, in the extreme edge of the leaf-like expansions. There is no evidence of gemmation taking place on the central part of the upper surface.

The septa are thin, regular, and uniform in thickness throughout, and when unworn have their margins moniliform. A great many anastomose, especially near the outer boundary of the furrows, where they may be regarded as septal costæ.

There are from twenty to twenty-four septa to each calice, and they all pass into the centre of the visceral cavity, and are attached to the columella, which is irregular both as to size and shape, and has a papillated summit.

The perforations of the septa are not very numerous, and the

* Since the above was written, I have discovered a young *Thecosmilia* attached to the specimen above mentioned. This must be taken as additional evidence of its occurrence quite at the base of the Coral Rag proper.

sloping tabular synapticulæ resemble those of *Thamnastræa*, but are not much developed*.

Height of the corallum about nine lines; its greatest diameter one inch seven lines.

A second specimen consists of the peduncular portion only, and has the form of an ill-formed and inverted cone, the margin of which presents a slightly lobular outline.

Both these specimens were sent to me some years since by the late Mr. Bean, of Scarborough, and labelled "*Meandrina decorata*, Bean, Coralline Oolite, Malton."

Corals from the Portland Oolite.

ISASTRÆA OBLONGA, Edw. and Haime. Pol. Foss. des Terr. Paléon. p. 103 (1851); Brit. Foss. Cor. p. 73, pl. xii. (1851). Plate XXII. fig. 6.

Lithostrotion oblongum, Fleming, Brit. Anim. p. 508 (1828).

Polished specimens of this, the only coral found in the Portland Oolite of this country, are extremely pretty and ornamental objects, and they are to be seen in the lady's drawing-room as well as in the cabinet of the geologist. In such specimens so much difference in internal structure may frequently be observed, as greatly to favour the impression that more than one species have been confounded under the name of *Isastræa oblonga*. But such is not the case, the only real difference being in the state of fossilization; and this difference is so great that the real characters of the species have been overlooked.

All the figures of this Coral given by MM. Edwards and Haime in their 'History of British Fossil Corals,' have been taken from specimens in which the stony tissues of the corallum have given way to and been replaced by a dark-coloured siliceous matter, the very depth of the colour of which has effectually obscured some characteristic details of structure. Their figure 1 *f* represents a specimen in which the inner parts of the interseptal loculi, instead of being filled with the usual light-coloured calcareous deposit, remain open, and show the conformation of the septa and the dissepiments very distinctly. But in this figure, as well as in the other on the same plate, the outer parts of the loculi are filled with the same dark siliceous material as the walls with which they are in contact; and as this dark part is not distinguishable from the wall itself, the latter appears to be of twice its natural thickness.

By selecting specimens in which the silicified corallites are less deep in colour, the details of structure are more readily seen, and the wall is observed to be thin, and to be lined within with a considerable quantity of dissepimental tissue, through which the septa

* For a full description of these peculiarly formed synapticulæ, see the paper by Milaschewitch, in the twenty-first volume of the 'Palæontographica.' When seen from the outside, they exhibit a cuneiform figure, and I have on several occasions described them as cuneiform synapticulæ.

pass and from which they are very clearly distinguishable. This tissue assumes a concentric arrangement, something like a series of rudimentary walls, one within the other, as in *Lithostrction*, in which genus it was placed by its first describer. Sometimes the inner ring of endotheca is more fully developed than the others, simulating an inner wall; but this is not constantly the case, or it would furnish grounds for the creation of a new genus.

There are two species of Corals figured by Reuss from the Cretaceous bed of Gosau, under the names of *Prionastræa Hornesi* and *Isastræa profunda**, in which the same kind of dissepimental structure appears as in the present species. Both of these have been subsequently referred to the genus *Isastræa* by MM. Milne-Edwards and Haime†; and the similarity of structure between these Cretaceous species and the Portland one is so considerable, that the latter is most likely quite as nearly affined to the Cretaceous as to the Oolitic forms of *Isastræa*.

In the series of papers which I have prepared on the Madreporaria of the Jurassic formations of this country, and which have been read before this Society, the following new genera have been proposed:—*Tricycloseris*, *Phyllogyra*, *Phylloseris*, *Bathycænia*, and *Crateroseris*. Eleven other genera, not themselves new, but before unknown in the Jurassic deposits of England, have been made known. They are *Epismilia*, *Donacosmilia*, *Cyathophyllia*, *Confusastræa*, *Chorisastræa*, *Thecoseris*, *Oroseris*, *Dimorphuræa*, *Lati-mæandræa*, *Enallohelix*, and *Favia*. *Goniocora*, before unknown, excepting in the Coral Rag, has been found in the Inferior Oolite; and *Astrocænia* has been added to the list of Great-Oolite and Coral-Rag genera.

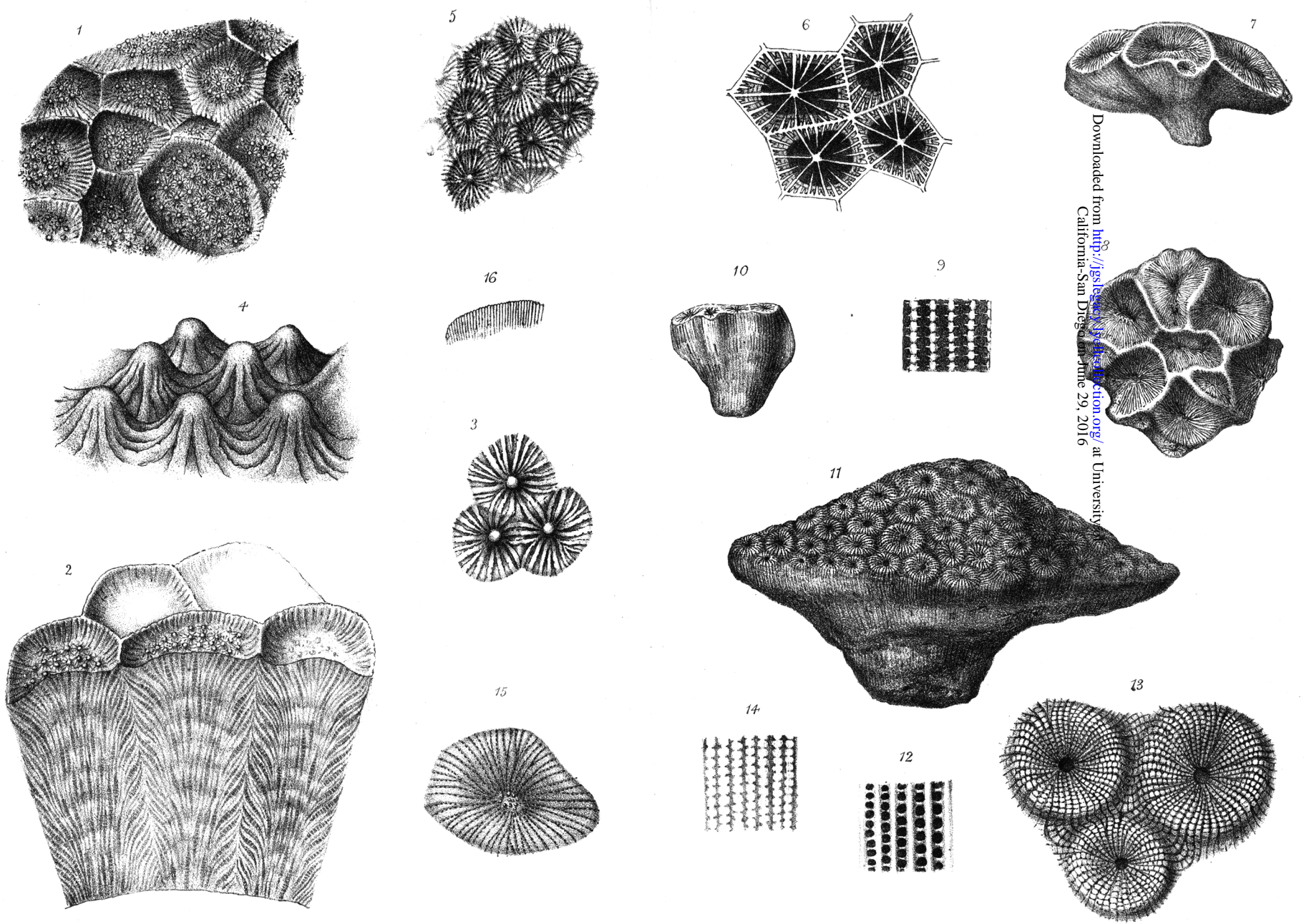
With the present communication ends a series of papers, which have been a long time in hand, and are the results of a protracted and often repeated examination of a very extensive collection of specimens, mostly of my own collecting, and about the locality and stratigraphical position of which there cannot therefore be any uncertainty; but I am sorry to be obliged to add, in conclusion, that I have not myself as yet had the opportunity of collecting in many of the localities from which the Coral-Rag species have been obtained.

DESCRIPTION OF PLATE XXII.

- Fig. 1. *Thamnastræa concinna*: a portion of a worn corallum of the natural size, seen from above.
2. ———: a vertical section of a tall portion of a corallum, natural size, showing the arrangement of the corallites.
3. ———: some calices, magnified.
4. ———: some calices much worn, showing the prominent columella, magnified.

* Beitr. Kreidesch. Ostalpen. p. 116.

† Hist. Nat. Corall. t. ii. pp. 530 and 534.



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CORALLIAN AND PORTLANDIAN CORALS.

Hanhart imp

- Fig. 5. *Astrocænia major*: some calices a little magnified.
6. *Isastræa oblonga*: some corallites of a polished specimen, magnified, showing the thin walls and interlocular dissepiments.
 7. *Latimæandraræa decorata*: the corallum, natural size, showing marginal gemmation.
 8. ————: natural size, seen from above.
 9. ————: magnified portions of the outer margins of some septa, showing their perforations and peculiar synapticulæ.
 10. ————: a smaller specimen showing the peduncular portion.
 11. *Crateroseris fungiformis*: the corallum, natural size.
 12. ————: the weathered outer margins of some septa, showing the synapticulæ.
 13. ————: some calices, magnified.
 14. ————: some of the mural costæ, magnified.
 15. *Latimæandraræa decorata*: a furrow, magnified and showing the columella.
 16. *Astrocænia major*: a septum magnified, showing its lateral ornamentation.