A Revision of the Families and Genera of the Sclerodermic Zoon-tharia, \( Lm. \) \& \( H. \), or Madreporaria (M. Rugosa excepted).

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Errata.—Page 125, lines 13 and 16 from bottom, for Cormophyllia read Comophyllia.
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[Read April 3, 1884.]

CHAPTER I.


Introduction.—The state of confusion of the classification of the Sclerodermic Zoantharia, or the Stony Corals (the Madreporaria of Edwards and Haine), has become very intense during the last few years, and a revision of the great groups, families, and genera is really required.

No work dealing with the classification of this important Sub-order, as a whole, has appeared since the 'Histoire Naturelle des Coralliaires' by Milne-Edwards and Jules Haine, in 1860. That great work, following that of Dana on the Zoophytes of the Wilkes Exploring Expedition (1846), formed an epoch in the zoology of the Corals. It was a work of vast labour, and its
merits have been recognized by every competent critic. It revised the genera up to the date of 1857–1860, and contained descriptions of every species and its synonymy.

Since the publication of this standard work M. de Fromentel has brought out a book* which relates to fossil forms only; but all the other additions to the knowledge of the suborder have appeared in reports, monographs, and multitudes of essays, which are scattered amongst the scientific publications of Europe, America, India, and Australia. The number of new genera and species recorded has been great; and although those relating to the deep-sea and reef-building faunas have been numerous, they have been surpassed by the forms from nearly every geological formation in every quarter of the globe.

Careful morphological investigations have increased the knowledge of the minute structures of the Madreporaria; and Dana, J. Haime, L. Agassiz, Verrill, Lacaze-Duthiers, and especially H. N. Moseley, have so enlightened the views of naturalists, that very considerable changes have already been made in the primary classificatory groups of the Corals. Paleontologists and naturalists have endeavoured to assist classification by examining the solid structures; and the researches of Pourtalès, E. Pratz, Lindström, Klunzinger, and Koch have necessitated serious revision of old conceptions. It is evident, however, that the purely classificatory work has too often been attempted by some paleontologists who have not studied the recent faunas, and occasionally by naturalists who have not had experience in the details of the extinct forms.

It is proposed in this revision to omit all reference to the group of Corals called the Rugosa by Edwards and Haime.

As the synonymy of the genera which had been described up to 1860 was given by Edwards and Haime in their great work, this revision will only take it up from that date.

Only the principal sections, families, and genera are considered in this revision; species are not included. A few subgenera are admitted in the classification, and the plan of linking genera under alliances has been adopted. A certain number of alliances will be found in each subfamily or family, and usually they are fairly natural, and rarely too artificial in their nature. It will be found that some of the great groups of the Madreporaria

* 'Introduction à l'étude des Polypiers fossiles,' Paris, 1858–61
The word colony has been used to describe a compound corallum.
An explanation of the morphological and structural terminology is placed at the close of the revision.

The Suborder ZOANTHARIA SCLERODERMATA, Ed. & H.
The Sclerodermic Zoantharia of Milne-Edwards and Jules Haime† are a suborder of the class Anthozoa, type Coelenterata. According to the authors just mentioned, there are five sections of the suborder:—The Madreporaria Aporosa, Perforata, Tubulosa, Tabulata, and Rugosa.

It must be admitted that there is no difficulty in accepting two of these sections, with certain new limits to them, namely the Madreporaria Aporosa and the Madreporaria Perforata. The section Tubulosa no longer exists, and the section Tabulata has been eliminated by H. N. Moseley. The section "Rugosa" is not considered in this memoir.

Section Madreporaria Aporosa, Ed. & H.
In typical forms of this section the walls of the corallites are solid and the greater part or all of the septal laminae also. There is no communication between the visceral cavities of neighbouring corallites through the theca or wall.

Section Madreporaria Perforata.
In typical forms of this section the walls and sometimes the septa are perforate, and the soft parts of one corallite

* Genera date from their time of description, not from that of simple delineation. Hypothetical genera are not recorded.
† 'Histoire naturelle des Coralliaires' (Paris, 1857–1860), vol. i.
communicate with those of their neighbours through the wall or with the outside medium.

The arrangement of the soft parts of both of these sections is not very different, and it presents a very close resemblance in most instances.

According to Milne-Edwards and Jules Haime the great family Fungidae (Dana) is intermediate between the two sections mentioned above, and it was classified with the Aporosa. Here the difficulty of the classification of the great group begins, and I make the family Fungidae into a section Fungida.

Dana’s beautiful illustrations and Moseley’s investigations show that the soft parts of the Fungidae differ from those of the Aporosa and Perforata; and many years since L. Agassiz stated that a genus of the Astræidae, according to Edwards and Haime, and one of the Aporosa had the soft structures of a Fungid and part of the hard ones also. This genus Siderastræa has tentacles unlike normal Astræidae and endothecal dissepiments in addition to synapticula, and in this last respect only does it link the Aporosa and the Fungida proper together. Palæontology has shown that the genus Thanannastræa and others must be linked with Siderastræa. Hence a group of old Aporosa is placed with the section Fungida. Moreover, a genus of the recent Perforata, Coscinaria, has been shown to have synapticula, and many fossil forms require to be dissociated from the Perforata and placed in a group amongst the Fungida.

Hence the former family Fungidae of Edwards and Haime becomes a section Fungida, and has associated with it two transitional families—one the Siderastræan group, or the family Plesiofungidae, and the other the Cyclolites and Microsolena group, the family Plesioporitidæ. Zittel and E. Pratz have paved the way largely for this suggested classification.

Section Madreporaria Tubulosa, M.-Edw. & Haime.

The third section of the Madreporaria, according to Milne-Edwards and Jules Haime, is that of the Madrepo-

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* Dana, Zoophytes, Exploring Expedition, 1846.
‡ Zittel, ‘Handbuch Palæontol.’
§ E. Pratz, ‘Palæontographica,’ 1882.
Families and Genera of the Madreporaria.

Families Tabulosa. Jules Haime established it in 1850, and it was fully considered by Milne-Edwards in the last volume of the 'Histoire Naturelle des Coralliaires,' 1860.

Milne-Edwards evidently had great doubts about the affinities of the two genera which were included in this section, namely Aulopora and Pyrgia, and he noticed their structural resemblances to certain Bryozoa. In 1871, after due consideration, I removed these genera out of the Zoantharia Sclerodermata, and I still hold that they are not corals.*

Section Madreporaria Tabulata, Ed. & Haime.

The fourth section of the Madreporaria, according to MM. Milne-Edwards and Jules Haime, is that of the Tabulata. The researches of L. Agassiz and H. N. Moseley† have eliminated the majority of the genera of this section, and have ranged them amongst the Hydrozoa and Aleyonaria. Some genera remain, but cannot form a homogeneous group, and require consideration. Milne-Edwards divided the Tabulata into four families—the Milleporidae, Seriatoporidae, Favositidae, and Thecidae. Of the first family the genus Battersbyia was eliminated by myself in 1867‡; and H. N. Moseley, during the voyage of the 'Challenger,' and in the publication of the Report on the Corals in 1876–1879, completely revolutionized the zoology of the remainder. His researches render it necessary to eliminate all the nine remaining genera.

The Favositidae, criticized upon the data given by H. N. Moseley, have all their genera removed from the Madreporaria except some of those of the subfamily Pocilloporinae.

The family Seriatoporidae has to be broken up, and the genus Seriatopora is removed from the Tabulata.

Finally the Thecidae, although the genus Columnaria has well-formed septa, must follow the Tabulata in the direction urged by H. N. Moseley.

So the great section Tabulata disappears, and such evidently Aporose genera of it as Pocillopora and Seriatopora should enter, according to Verrill, the Oculinidae, or rather form a family of

‡ Phil. Trans. 1867, p. 613 (P. Martin Duncan).
the Aporosa, in consequence of Moseley's discoveries of their remarkable mesenteries. Research has shown that many Madreporaria Aporosa and Perforata have tabule, with or without ordinary dissepiments, for instance species of Lophohelia, Cyathophora, Astreopora, Favositipora, Alveopora, and Madrepora.

With regard to the section Madreporaria Rugosa, it is necessary to eliminate certain genera of deep-sea corals, and some genera from the Secondary rocks, and to place them in the Aporosa and Perforata.

After considering the relations of the Madreporaria Aporosa, Madreporaria Perforata, and the old family of the Fungidae, I have no hesitation in classifying the Sclerodermic Zoantharia as follows:

Section I. MADREPORARIA APOROSA.

II. MADREPORARIA FUNGIDA.

III. MADREPORARIA PERFORATA.

IV. MADREPORARIA RUGOSA *.

The Great Divisions of the Sclerodermic Zoantharia or Madreporaria.

Class ANTHOZOA. Suborder ZOANTHARIA SCLERODERMATA or MADREPORARIA.

Sections:—Madreporaria Aporosa, Fungida, Perforata.

Section MADREPORARIA APOROSA.

I. Family Turbinolidae (pars), Ed. & II.

II. " Oculinidae (pars), Ed. & H.

III. " Pocilloporidae.


Section MADREPORARIA FUNGIDA.

I. Family Plesiolfungidae.

II. " Fungidae, Dana (pars).

III. " Lophoserdidae.

IV. " Anabaciadæ.

V. " Plesioporitidae.

Section MADREPORARIA PERFORATA.

I. Family Eupsammidæ.

II. " Madreporidæ, Ed. & II.

III. " Poritidæ, Ed. & H.

* This section is not considered, and probably most of its genera are not Madreporarian.
Description of the Section Madreporaria Aporosa.


The diagnosis given by these authors is positive and negative in its characters, and this was necessary, for the sections Tabulata and Tubulosa were defined at that time.

They state:—"The corals of this section are of all the Madreporaria those in which the corallum is the most perfect. A complete wall is always associated in them with a well-developed septal apparatus. The sclerenchyma which composes the corallum grows in a continuous manner, and forms laminae of a compact tissue, in which the points corresponding with elementary nodules often project more than the rest, but are hardly ever separated by spaces even of the narrowest kind. The calices are distinctly stellate, and only present six septa when young. During development the rays formed by the upper edges of the septa become twelve in number, subsequently twenty-four, &c.; but the hexameral type remains almost always recognizable by the predominant size of the early or first septa over those of later age. The interseptal loculi are either open down their whole depth or more or less completely closed by synapticula and 'traverses.' These last may subdivide and form a series of superimposed loculi, but each one is independent of the others and they never unite to form disk-shaped laminae, which may extend across the visceral cavity and shut it off in a series of stories as in the Madreporaria Tabulata and Rugosa".*

Now it is evident that in some genera of this section, the septa are cribriform, and that the calices of many are polygonal or serial, or unsymmetrical in shape. Moreover the hexameral arrangement of the septa is not constant; it may be pentameral, heptameral, octameral, or decameral. It is true that tabulæ are found in a few species and genera, and that synapticula exist in genera which were not thought to have them by Edwards & Haime.

The following is the diagnosis of the MADREPORARIA APOROSA as now limited:—

Madreporaria with simple or colonial forms. Hard structures

usually solid and imperforate. Theca or wall solid, may be epithecate. Septa solid near the wall, and usually, but not invariably, solid at the further part. Interseptal loculi open throughout, or closed more or less by endotheca in the form of dissepiments, tabule, and stereoplasm. Calices of different shapes.

Soft parts:—One or more rows of tentacles in relation to the septa and interseptal loculi. The disk with one or more oral openings or mouths; a mesentery usually in each interseptal loculus. Septa usually in multiples of six, or variable in the number of their orders.

The sclerenchyma, or hard calcareous part of the Madrepora Aporosa, may consist of the theca or wall of the corallite, sometimes of a common colonial wall, of septa, pali, costae, of a columella, of endotheca or dissepiments, tabule or synapticula, or stereoplasm, and of exotheca, epitheca, and peritheca. There may be basal expansions or mural or epithecal rootlets. The epitheca may be free or united to the wall, or may be indistinguishable from it.

Reproduction by ova, also by gemmation from different parts of the corallum or colony, and increase may occur by fissiparity and serial growth.

Milne-Edwards and Jules Haime divided the section Madrepora Aporosa into eight families—the Turbinolidae, Dasmidae, Oculinidae, Stylophoridae, Astraeidae, Echinoporidae, Merulinaceae, and the Fungiæ.

Of these families the Turbinolidae, Oculinidae, and Astraeidae are retained. The first includes the old Dasmidae; the second takes in those Stylophoridae which remain after the elimination of the true Stylasters according to H. N. Moseley. The Astraeidae absorb part of the Echinoporidae and the Merulinaceae.

Another family is required, that of the Pocilloporidae, which includes the genera Pocillopora and Seriatopora of the old Tabulata, and is established upon the work of H. N. Moseley and Verrill.

The subfamilies of the Turbinolidae of Milne-Edwards and Jules Haime, depending on the presence or absence of pali, are absorbed in this revision, and so are the two great divisions of the Astraeidae, which only depend upon the entire or dentated condition of the edges of the septa.
Section MADREPORARIA APOROSA, Ed. & H.


Corallum simple or in colonies, in the first instance reproducing by ova and in the second by gemmation from the wall or from an expansion of the basal structures. Wall solid. Septal loculi open to the base. Endotheca very rarely present.

I. Subfamily Turbinolidae simplices.  
Corallum simple, reproducing by ova, rarely by deciduous buds.

II. Subfamily Turbinolidae gemmantes.  
Colony increasing by gemmation; buds free above their origin; no exotheca uniting the corallites.

III. Subfamily Turbinolidae reptantes.  
Colony growing from basal expansions or stoloniferous growths; exotheca absent.

The following are the alliances of the family Turbinolidae:—

Alliances:—Smilotrochoida, Flabelloida, Placotrochoida, Turbinoloida, Trochocyathoida, Discocyathoida, Haplophylloida.

The genus Dasmia stands alone.

Subfam. Turbinolidae simplices.

I. Alliance SMILOTROCHOIDA.

Simple Turbinolidae with a wall, costæ, and septa, rarely with pali. Columella absent. Epitheca present or absent.

Genus Smilotrochus, Ed. & H.
Subgenus Blagrovia, Duncan.  
Genus Onchotrochus, Duncan.  
Genus Desmophyllum, Ehr.
Subgenus Javania, Duncan.  
Genus Schizocyathus, Pourtalès.
Genus absorbed:—
Microtrochus, T. Woods.
Genera becoming subgenera:—
Blagrovia, Duncan; Javania, Duncan.

* This family was divided into two subfamilies by Milne-Edwards and Jules Haime on account of the presumed morphological value of pali or paluli. The presence of pali having been shown not to be of primary importance (for they
The generic characters of *Smilotrochus*, according to Milne-Edwards and Jules Haime, were too specific. The shape of the corallum and the nature of the ornamentation are most variable quantities. The genus includes the simplest corals, and the corallite consists of a wall, costae, and septa only; sometimes there is an epitheca.

**Genus Smilotrochus, Milne-Edwards & Jules Haime,**


The corallum is simple, free in adult age, very variable in shape, base small; body straight or curved, cylindrical or conical, or cuneiform, or turbinate, compressed or not. Septa slightly exsert and free at their inner edge. Axial space vacant, there being no columella. Costae well developed, not cristate. Epitheca usually does not exist.


**Subgenus Blagrovia, Duncan.**

The corallum is turbinate or subturbinate, adherent; the calicular fossa is very deep; the costae are covered with an epitheca, and the septa are very numerous.

**Distribution.**—**Fossil.** Eocene of Sind.

This subgenus absorbs the genus *Blagrovia*, nobis, Pal. Ind. ser. xiv., Foss. Corals and Alcyonaria of Sind, p. 28 (1880).

**Genus Onchotrochus, Duncan, Monog. Brit. Fossil Corals,**

_Pal. Soc._ part ii. n. 1, p. 4.

The corallum is simple, adherent when young, free when adult, tall, slender, tubuliform, straight or hooked, or clavate. The septa are few in number, and some unite axially. The costae are small and almost rudimentary. The epitheca is pellicular and striated. There is no columella.


exist in corals otherwise exceedingly closely allied, and do not appear to be of physiological importance), the subfamily Caryophyllinae of Milne-Edwards and Jules Haime is absorbed and abolished.

About 67 genera have been arranged in this family. On revising them I find it necessary to reduce to subgenera or abolish 25, so that this family now consists of 42 genera.
The genus *Desmophyllum* was established by Ehrenberg, Corall. des Roth. Meer. p. 76 (1834). It contains many recent and fossil species, and is eminently Smilotrochoid. There is great variation in the shape of individuals of some of the species, and abnormal growths are produced around the base and from the wall by the irritation of parasites and any instability of the surface of attachment. The forms may grow to a considerable size, may adhere by their sides and form groups, and the same species will present short, long, broad-based, narrow-based, large and small caliced, costulate or non-costulate individuals.

In some instances the base extends as a film of hard matter on the supporting body, and in others there are rootlets.

The majority of species have no epitheca; but a recent form which cannot be separated from the genus has it. Moseley notices that his great *Desmophyllum ingens* is covered with an abundant dense epitheca*; and some forms of *Desmophyllum crista galli*, Ehr., sp.†, have it and others have not. But the epitheca is not separable from the wall.

Ehrenberg’s definition, as given by M.M. Milne-Edwards and Jules Haime ‡, is too contracted in some parts, and not sufficiently elaborate in others. As amended the genus may stand as follows:—

**Genus Desmophyllum, Ehr. 1834, amended.**

The corallum is fixed by a large or small base; the body may be long or short, straight, or slightly curved and twisted, with or without “rootlets” springing from the wall. Calice widely open, fossa deep; axial space vacant. Septa numerous, exsert, unequal in height, often overhanging the margin. Costae visible near the calice, irregular, often as crests, nodules, or ridges here and there on the wall. Epitheca may or may not exist. Surface usually smooth or granular.

**Distribution.**—**Recent.** Atlantic and Pacific Oceans, Australia, Western Patagonian seas, and Mediterranean.—**Fossil.** Upper Tertiary strata of Europe.

**Subgenus Javania, Duncan, Proc. Zool. Soc. Lond. 1876, p. 434.**

The base is broad, the calice compressed, the larger septa are

† Duncan, Proc. Royal Society, p. 133 (1877).
‡ Hist. Nat. des Corall. vol. ii. p. 76.
exsert; the tertiaries have costae larger than they are. The epitheca is dense near the base and pellicular near the calice, and festooned.

**Locality.** Japanese seas.

There is no coral closely resembling a *Smilotrechus, Onchotrechus*, or *Desmophyllum* which has pali. But the genus *Schizocyathus*, Pourtalès, so interesting from its budding within the calice and producing the death of the parent, comes within this Alliance.

**Genus Schizocyathus, Pourtalès, Deep-Sea Corals, Zool.**

Results of the Hasslar Expd. 1874, p. 36.

Corallum simple, without epitheca or costae; no columella; pali in front of the last cycle of septa, united in front of the penultimate; propagating by internal gemmation.

**Locality.**—Recent. Caribbean sea: Atlantic, Josephine Bank, 100-760 fms.

This remarkable genus has but one species, *Schizocyathus fissilis*, in which the growth of the bud splits the parent.

The shape of the solitary species is long, conical, almost cylindrical, and the wall is marked outside by lines corresponding to the primary septa and by rows of dots corresponding to the interseptal chambers.

Lindström has described a specimen of *Schizocyathus fissilis*, Pourt., which he states has an epitheca. He states "that the wall proper between the septa consists entirely of the same sort of thin epitheca which surrounds the whole outside of the coral, or, in other words, there exists no wall as a separate formation distinct from the epitheca." It appears that there is a wall which every Turbinolian must have, and that it resembles epitheca, there being, however, no true epitheca. There is more or less stereoplasm in the interseptal loculi. The same author states that the growth is not a gemmation but an interrupted and then continued growth of the same individual*.

The genus *Microtrechus*, T. Woods, was founded upon one specimen of a very young coral. It can hardly remain in the classification, and had better drop until further evidence comes to hand regarding its mature form.

II. Alliance FLABELLOIDA.

Simple Turbinolide, fixed or free, with or without rootlets, more or less compressed and flabelliform or cuneiform. Calice elongate elliptical or short. Septa large, exsert or not. Columella parietal. Costae variable, often crested or spined. Epitheca pellicular or membranous. Rarely increasing by deciduous gemmation from the wall.

Genus FLABELLUM, Lesson.
Subgenus BLASTOTROCHUS, Ed. & H.
Genus RHIZOTROCHUS, Ed. & H.
Genus THYSANUS, Duncan.
Genera absorbed:

VASILIUM, T. Woods; PHYLLODES, Philippi; ULOCYATHUS, Sars.

Genus placed as a subgenus:

BLASTOTROCHUS, Ed. & II.

Genus FLABELLUM, Lesson, Illustr. de Zool. 1831, amended.

Syn. VASILIUM, T. Woods; PHYLLODES, Philippi; ULOCYATHUS, Sars.

The corallum is simple, straight or bent, more or less compressed, fan-shaped. The calicular fossa is narrow and deep, usually long, rarely widely open. The columella consists of a few trabeculae from the inner ends of the septa. The septa are numerous, and reach up to or beyond the wall. The costae may be crested, spined, or simple. The base may be attached or may become free, broad or pedunculate. Rootlets from the wall occasional. Epitheca pellicular, rarely dense.


This large genus is closely allied to the compressed forms of Desmophyllum. It may be divided into sections, which are not of subgeneric value however:

1. Corallum flabelliform, subpedicellate, and becoming free. Wall nearly smooth on the two faces, and with small crests on the sides.
2. Faces of the wall with crests as well as the sides.
3. Wall with smooth faces, but with stout spines on the sides of the corallum.
4. Wall smooth, neither crests nor spines.
5. Largely fixed when young and becoming free; having spines on the sides.

6. Corallum always fixed.

Some of the deep-sea species described by Moseley have widely open calices and angular outlines. The Eocene forms ally the genus to Smilotrochus. Vasillum, Tennison Woods, a genus with one species, appears to be so closely allied to Flabellum that it should be absorbed.*


Corallum simple and fixed; calice elliptical; columella rudimentary and produced by trabecula from the septal ends. Septa non-exsert. Epitheca smooth. Soft parts pink and red. Budding occurs at the sides between the calicular margin and the base, and the buds fall off and grow.

Distribution.—Recent. Philippines.

The parent seems to be fixed, and probably the buds get fixed after separation.

The species which have been included in the next genus are rather difficult to classify satisfactorily.

In 1848 MM. Milne-Edwards and Jules Haime described the genus Rhizotrochus as follows:—The corallum is simple, subpedicellated, and adheres by the means of root-like prolongations, which come from the surface of the epitheca and reach down after the fashion of adventitious roots. There is no columella. The septa are broad and not exsert, and they unite with those of the opposite side of the calice by their inner ends.

The typical species was Rhizotrochus typus, Ed. & H., from Singapore (op. cit. vol. ii. p. 98). It has a succession of hollow rootlets, an epitheca which permits the costæ to be seen under it, and a very deep compressed calice.

In Rhizotrochus affinis, nobis (Madrep. Deep-Sea, H.M.S. "Porcupine," Trans. Zool. Soc. Lond. vol. viii. pt. v. p. 323, 1873), the epitheca comes up to the very margin, is striated and coarse, yet is inseparable from the wall and, indeed, not to be distinguished from it. The radicles are large and are offshoots of the epitheca. The coral without the radicles is very closely allied to the broad-based, slightly compressed Flabellum rubrum from New Zealand.

**Rhizotrochus fragilis**, Pourtalès (Deep-Sea Corals, Illstr. Cat. Mus. Comp. Zool. Harvard, 1871, No. iv. p. 17). The septa of the 1st and 2nd orders meet in the centre of the deep fossa, and the corallum has an exquisitely fine pellicular epitheca ornamented with curves and vandykes, which is not to be distinguished from a wall. There is no theca in the ordinary sense. The rootlets are small, and their cavities are continuous with those of the interseptal loculi.

**Rhizotrochus tulipa** of the same author (Hasslar Corals, 1874, p. 39) has exsert septa besides the rootlets; otherwise it resembles the other species.

Now the species are clearly divisible into those with a well-developed rough epitheca and those without one, and in the latter instance the wall is really epithecate. It is by no means sure that the rough epitheca is not mural.


Corallum simple, tall or short, cylindrical, compressed more or less, and with a compressed or circular calice. Calice with a deep fossa and thin septa, which are usually not exsert and never much so. The columella is absent, and the septa either unite by a few trabeculae or join across the axial space. The wall is very thin, and resembles pellicular or opaque epitheca. Costæ rudimentary or absent. The epithecate wall is produced in the form of rootlets, which are hollow and communicate with the visceral cavity. Corallum attached by the rootlets and base.

**Localities.**—Recent. Mediterranean; Florida seas; Pacific.


Corallum simple, becoming free with age. Elongate, compressed, low, pedicellate at one end of the long base. Calice long, narrow, shallow, elongate, elliptical. Septa numerous, radiating more or less from the end of the calice, which corresponds with the basal pedicel, granular, minutely spinulose. Columella small, parieta! Costæ well developed, converging to pedicel, granular, minutely spined. A groove may or may not traverse the base. Epitheca variable.

**Distribution.**—Fossil. Miocene: West Indies.
III. Alliance PLACOTROCHOIDA.

Simple Turbinolids, free or attached, compressed, with an essential, more or less lamellar or elongate columella, rarely with pali.

Genus Placotrochus, Ed. & H.
Genus Sphenotrochus, Ed. & H.
Genus Nototrochus, Duncan.
Genus Placocyathus, Ed. & H.
Genus Platytrochus, Ed. & H.


The corallum is simple, straight, cuneiform, flabelliform, and compressed or cornute, or more or less cylindrical and compressed. The columella is essential and is lamellar, horizontal, sharp, and entire at the surface, or crenulated. Septa exsert or not. Costæ developed, and often in crests or spinulose.

Localities.—Recent. Chinese seas, Philippines, N. Australia.—Fossil. Miocene of West Indies, Australia, Europe.

This is a well-marked genus, and some of the species are much compressed and extended laterally; others are deltoid and compressed; and one Sicilian form is cornute, with an epitheca. The lamellar and essential columella is very characteristic.


The corallum is free, straight, cuneiform, compressed. Septa exsert or not; the principal reach the essential lamellar columella, which is lobed or knobbed at the free surface on the floor of the elliptical calice. Base bluntly pointed, truncate, or emarginate. Costæ projecting straight or more or less in zig-zag. Lateral costæ crested or not.


The species described by M. de Fromentel from the Cretaceous of France would appear to be more like a Placotrochus than a Sphenotrochus.

There is a common little simple coral in the Tertiaries of Australia which has given the Rev. T. Woods and myself much
trouble. It was at first placed in the genus *Turbinolia*, then in *Deltocyathus* and in a new genus of Mr. Wood’s, *Notocyathus*. Fortunately some excellent specimens have lately come to hand, and there is no doubt that the projection of the tertiary septa in front of the secondaries is not a palus but a paliform lobe. There is a decided columella with nodules upon it. The form *Caryophyllia viola*, Woods and Duncan, must come under a new genus, *Nototrochus*.

**Genus Nototrochus, gen. nov.**

*Syn. Notocyathus, Woods.*

The corallum is cuneiform, compressed, free, with a widely open elliptical calice. Columella formed by the septal ends and by intermediate solid tissue, elongate, more or less lobed or nodular where free. Septa unequal, arched near the margin; primaries longest; secondaries shorter than tertiaries, joining these last by lateral processes and by inner end also. Tertiaries uniting in front of secondaries, and joining with an offshoot of the columella, which is produced as a paliform lobe. Paliform lobe before primaries also. Costæ vary in length, trifurcating low down, subequal at the calice; interseptal spaces wide.

**Distribution.**—Fossil. Tertiary: Australia, New Zealand.


The corallum is simple, free or fixed, pedicellate, or with a broad adherent base. Shape more or less flabellar, curved or straight, compressed. Septa exsert or not. Columella lamellar. Pali in more than one crown, usually only before the penultimate and antepenultimate cycles, but occasionally only before the larger septa, and before all the cycles except the last. Costæ visible or not; with or without epitheca.


The genus, as amended, combines all the species of *Placocyathus* very naturally.


**Linn. Journ.—Zoology, Vol. XVIII. 2**

The corallum is simple, straight, cuneiform, and non-adherent. The collumella is essential, elongate, and fascicular, and has a free papillary edge. The septa are broad and exsert. The wall is naked, and there are two kinds of costae: those on the middle of the broad surfaces of the corallum enlarge towards the calice, and those on the edges of the corallum near the base are extended and large. The compressed base is with or without a conical point.

*Distribution.*—*Fossil.* Eocene: Alabama.—*Recent.* Australian seas?

This genus was founded to include two species from Alabama which had been placed by Lea amongst the Turbinolians, and one of them in the genus *Endopachys* by Lonsdale. The forms are remarkable, and very Placotrochoid in appearance. There is, however, a lamellar fascicular columella, and the extension of the costae is almost unique.

IV. Alliance TURBINOLOIDA.

Simple Turbinolide, free or attached, straight, conico-cylindrical, rarely cornute. Septa uniting more or less with a styliform columella which projects. Some forms with pali, with or without a columella.

Genus *Turbinolia*, Ed. & H.
Subgenus *Stylotrochus*, E. de From.
Genus *Stylocyathus*, d'Orb.
Genus *Conocyathus*, d'Orb.
Genus *Bistylia*, Tennison Woods.
Genus *Trematotrochus*, Tennison Woods.

*Stylotrochus* becomes a subgenus.


The corallum is simple, free, straight, and conical, rarely curved or cornute. The calice is circular in outline. The collumella is essential, and projects in the calice like a stylet. The septa are exsert. The costae are lamellar and project, are straight and perfect. Intercostal spaces with or without fossettes.

*Distribution.*—*Fossil.* Eocene: England, France. Oligocene: Germany.—*Recent.* Caribbean Sea?
There is a very marked facies in all the species of *Turbinolia*, which are eighteen in number, eleven having lived on the English area during the Eocene. There are three species recorded from the Lower Oligocene of Germany.

The number of septa is not great, and the species may be grouped under four heads:—Those with four cycles incomplete; those with three cycles; those with three cycles of septa and the costæ of a fourth cycle; and those with the third cycle of septa incomplete. The columella is a stylloid process arising from the base within, and some septa always unite with it.

The genus is comparatively isolated; some species of the genus *Sphenotrochus* resemble some of the *Turbinoliæ* with stout costæ, but the other distinctions are evident.

There is a genus of M. de Fromentel's, which was established from a single specimen of one species. It only differs from *Turbinolia* in having a curved cornute corallum and no "fossettes" between the costæ. This last character is not invariable in the genus *Turbinolia*. This genus *Stylotrochus* (Pal. Franç., Zooph. Crét. pl. viii.) is of Cretaceous age, and I place it as a subgenus.

Sismondi names a species from the Italian Tertiaries.

**Genus Stylocyathus, d'Orbigny, Note sur les Polyp. foss. p. 5 (1849).**


The corallum is subturbinate, subpedicellate, curved, and free. The columella is styliform or compressed. The septa are exsert, and there are pali before all the cycles except the last. An epithea is well developed, and extends more or less to the calicular margin.

*Distribution.—Fossil*. Cretaceous, Eocene, Oligocene: Europe.

*Pleurocyathus*, Kefst., is not generically distinct from the above. It is straight, free, has costæ which are smooth, and a styloid columella. The only distinction is the presence of the epithea in *Stylocyathus*, d'Orbigny. Reuss named *Pleurocyathus* *Stylocyathus*, having been unaware of d'Orbigny's genus (see also pages 26 and 27 of this Revision).

There is a great difficulty in placing the next genus with any of the alliances of the Turbinolidæ; and it had better come in as one of the Turbinolian alliance.
Genus Coноothrus, d' Orbigny, 1849.

The corallum is free, conical, trochoid, straight, the costæ are sublamellar, the septa are exsert and strongly echinulate on the sides. The columella is absent; and there are pali before the penultimate cycle of septa.

**Distribution.**—Fossil. Miocene of Mayence; Cainozoic, Australia.—Recent. South-Australian and New-Zealand seas.


Corallum simple, conico-cylindrical, attached. Columella a double style.

**Distribution.**—Fossil. Tertiary deposits of Australia.

There is much difficulty in placing the next genus; and indeed it would be insuperable were it not for the admirable drawing of one of the species. The description of the genus Trematotrochus by Tennison Woods is very short; but the light thrown on it by the illustration is very, but not perfectly, explanatory.

Mr. Tennison Woods differentiates as follows:—


"Corallum free; visceral chambers free. Septa distinct, only united in the middle. Pali exsert. No endotheca or synap ticula. Wall perforated."

The figure and the description of the species indicate that the septa are stout, not perforate, and that the perforations are perfectly symmetrical, and in the intercostal spaces only. The "pali" are not more than paliform lobes or dentations around the circular axial space which is bounded by the united inner (not middle) ends of the septa. The appearance is that of a species of Turbinolia or Conocyathus, with the costæ not so projecting as is usual. The intercostal dimples of the Turbinolía of the Eocene of Bracklesham do not perforate; and they are on either side of a line running down the intercostal spaces; but the wall is very thin, and often wears away during fossilization. The arrangement of the septa in Trematotrochus is, however, different from that of any species of Turbinolia.
The form described by Mr. Tennison Woods may then be thus described generically:—

**Genus Trematotrochus, T. Woods, amended.**

Corallum simple, regularly conical, elongated, free. Calice circular, with a well-developed margin. Columella none. Septa few, short; those which are large and equal extend close to the axial space, and form a tube-like space. A cycle of rudimentary septa corresponds to costae which are nearly as large as those of the other septa. Paliform nodules on the primary septa. Intercostal spaces regularly fenestrated? Neither endotheca nor synapticula exist.

*Distribution.*—Fossil. Miocene or Cainozoic: Australia.

V. Alliance TROCHOCYATHOIDA.

Simple Turbinolidae, with wall, costae with or without epitheca. Pali in one or several crowns, or absent. Columella fasciculate. Shape variable.

**Genus Trochocyathus, Ed. & H.**
Subgenus Tropidocyathus, Ed. & H.
Subgenus Thecocyathus, Ed. & H.
Subgenus Blanfordia, Duncan.

**Genus Deltocyathus, Ed. & H.**

**Genus Odontocyathus, Moseley.**

**Genus Leptocyathus, Ed. & H.**

**Genus Paracyathus, Ed. & H.**

**Genus Heterocyathus, Ed. & H.**

**Genus Caryophyllia, Lmk.**
Subgenus Acanthocyathus, Ed. & H.

**Genus Stenocyathus, Pourtalès.**

**Genus Ceratotrochus, Ed. & H.**

Genera absorbed:—

**Apolocyathus, d’Orb.; Stephanocyathus, Seguenza;**
Platycyathus, E. de From.; Bathycyathus, Ed. & H.; Dunocyathus, T. Woods; Blastocyathus, Reuss; Conotrochus, Seguenza; Epitrochus, E. de From.; Pleurocyathus, Moseley, Keferstein, and E. de Fromental; Crispatotrochus, T. Woods.


The Trochocyathoid alliance is a large one, and contains genera which have persisted from the age of the Lias to the present time;
others which have endured from the Cretaceous age to the present day, and some which flourished during the Eocene and still exist. Some genera are dwellers in the deep sea. Any turbinate-shaped species of the genus *Trochocyathus* and any form of the genus *Ceratotrechus* may be taken as the types of the two great groups of the alliance, the one with and the other without pali.

**Genus Trochocyathus, MM. Milne-Edwards & Jules Haime,**


Syn. *Aplocyathus,* d'Orb.; *Stephanocyathus,* Seguenza; *Platyctathus,* E. de From.

The corallum is simple, pedunculate or subpedicellate, or merely shows the trace of a former adhesion. The shape may be elongate, turbinate, subturbinate, straight, curved, compressed or not, or more or less discoid and flat. The calice is deep or widely open. The septa are long and usually some are exsert. The pali are in two crowns. The columella is formed of trabeculae, is essential, and may or may not be papillary. The costae may or may not be well developed, crested, spined, or simply projecting. Epitheca variable.

**Distribution.**—Fossil. Lias to Recent. Fossil forms worldwide.—Recent. West Indies, South-Australian seas.

The genus is a large one, and should include some subgenera. Its species have been divided into the following groups by Milne-Edwards and Jules Haime:—*Trochocyathus striati,* with the wall marked with but slightly projecting costae; and *Trochocyathus armigeri,* with the costae well developed, crested, spined, or warty. In both of these divisions the shape of the coral is very variable.

**Subgenus Tropidocyathus, Ed. & H.**

The corallum is compressed; the wall is naked, and has a basal expansion. Pali before all the cycles except the last, and they form more or less marked chevrons.

**Subgenus Thecocyathus, Ed. & H.**

The epitheca surrounds the wall and reaches the calicula margin. Corallum with a fixed and broad base, or not fixed.

Corallum cyclolitoid or nummiform in shape, with a flat base. Calice open, axial space shallow, and columella deep and small. Septa numerous, close. Pali before all the septa except those of the last order, small; union of the septa very usual, on both sides of a long primary. Epitheca pellicular, binding the costæ to the discoid base.

*Distribution.*—*Fossil*. Eocene: Sind, Asia.

This subgenus includes a remarkable form which commences upon a Nummulite, and the epiteca is very pronounced.


Corallum simple, discoid or cup-shaped, free, and without trace of former adhesion; calice subplane; columella fasciculate. Pali well developed, exsert, unequal, before the cycle of septa except the last, arranged in chevrons or deltas. Septa usually exsert except the last cycle. Costæ exceedingly variable in their development, especially the primaries spined or not.


Corallum deep saucer-shaped, with straight sloping sides and a broad flat base, free, but with a scar of former adhesion. Columella fasciculate. Pali in three crowns. The broad base is composed of fused radiating tuberculate spines, which project like the spokes of a wheel all round the base of the wall.

*Distribution.*—*Recent*. West Indies.


Corallum simple, very short, subdiscoid, free, and without trace of former adhesion. Wall with simple costæ. Calice circular and excavated in the centre. Columella papillary. Septa exsert; and there are denticulate pali before all the septa.


Corallum simple, subturbinate or variable in shape, fixed with a broad base; calice circular or elliptical, open. Columella fasciculate, papillary at the surface, depressed centrally, raised where its outer papillae are with difficulty distinguished from the pali. These are numerous, and before all the cycles of septa except the last, and the youngest are the largest, often bilobed and projecting, often granular. Septa close, subequal, not very exsert, granulated. Costæ indistinct or fairly developed. Rudimentary epithea rarely present.


The genus Platycyathus, E. de From. Pal. Franç., Terr. crét., is a discoid Trochoyathus, and is therefore absorbed.


Corallum simple, the base growing more or less entirely over a small shell upon which it is fixed. Calice as large as the base, subcircular. Columella feebly developed, and composed of slender points. Septa very exsert, thick, and unequal, in four cycles with an incomplete fifth. The septa of the last cycle more developed than the penultimate septa; and they diverge slightly from their neighbours of the higher orders. Pali very slender, denticulate, before all the septa. Wall with distinct equal costæ. No epithea.

Distribution.—Recent. Philippine, Corean, and East-African seas.

Semper states that there are fossil species (Die natuur. Existenz. der Thiere, pt. ii. p. 167, 1880).

The figure given by the authors of the genus indicates that a Sipunculid worm lives in the base of the coral, communicating with the outside by means of small openings. Some forms grow upon dead Cerithium-shells which are occupied by a Sipunculid.


Corallum simple, with a broad or narrow adherent base, or
bluntly or sharply pointed at the non-adherent base; shape variable, low and broad, cornute, compressed or not, cuneiform, turbinate, subturbinate, elongate, often enlarging near the calice. Calice circular or elliptical, deep or moderately deep. Septa variable in the number of cycles. Pali well developed in one crown. Columella fascicular, twisted, often ending in blunt processes. Costæ distinct or not, crested or spined rarely. Epitheca pellicular or absent or dense. Endothea very rarely exists.


The essential generic attributes are the simple corallum, fascicular trabeculate columella, and a single crown of pali. Groups of individuals are sometimes found; but the apparent compound corallum is produced by the accidental adhesion of ova to the outside of the corallum of the parent.

Subgenus *Acanthocyathus.* Forms with spines on the lateral or larger costæ.

The genus *Bathycyathus,* Ed. & H., is absorbed in *Caryophyllia.* *Blastocyathus,* Reuss, is a *Caryophyllia* with accidentally adherent buds.


In the determination of the species it is mentioned that the edges of the septa are denticulate, or set with irregular lobes and points. Columella papillary. Diameter 2 millim.

**Distribution.** Port Jackson.

I think that the description of the solitary specimen of the very small coral can hardly be of sufficient value, and that the genus must be absorbed.


Corallum simple, free, very elongated, and of nearly equal dimensions throughout. A single crown of pali. A columella of one or more twisted processes. Epitheca absent.

**Distribution.—** Recent. Caribbean Sea and Azores.

The genus has some of the features of *Onchotreochus,* but
differs decidedly. The costal tubercles are hollow, and communicate with the visceral cavity. There is some doubt about the epitheca, some specimens having it according to Lindström (see his elaborate morphological description, op. cit. p. 19.)


Syn. Conotrochus, Seguenza; Epitrochus, E. de Fromontel; Crispotrochus, T. Woods; Pleurocyathus, Moseley; Koilotrochus, Woods.

The corallum is simple, subpedicellate, and free in the adult state, cornute, long or short, compressed or not; calice circular or elliptical. Septa large and usually exsert, or not appearing above the calicular margin. Columella fasciculate. The costae are distinct to the base, and are ornamented or spined or plain, or are hidden and are not ornamented. Epitheca present or absent.

Distribution.—Fossil. Eocene, Miocene, Pliocene: Europe.—Recent, widely distributed.

This genus is a Smilotrochoid with a columella fasciculate in character; and it would resemble many Trochocyathi were their pali removed.

Conotrochus, Seguenza, is merged into Ceratotrochus by general consent.

The genus Epitrochus, E. de From., Pal. Franç., Zooph. Crét., diagnosed to receive a single specimen of one species, appears to be a young Ceratotrochus, and should lapse.

Crispatotrochus, T. Woods, is probably a Ceratotrochus.


The calicular fossa is deep and wide.

Locality not given by Rev. T. Woods; but as he refers a form called Smilotrochus vacuus, T. Woods, to this genus, probably it is a fossil form. Australian Tertiary.

It appears that this is an aberrant type of Ceratotrochus.

Moseley gives the generic name Pleurocyathus to a form from
Families and Genera of the Madreporaria.

Banda Island, East Indies, 60 fms., which he allies with *Duncania*. The species was described from one specimen only*, which, however, is well preserved. The following is the generic diagnosis:—"Corallum conical, attached by its side; entirely covered by a thin, plicated, coloured, bark-like epitheca, which rises higher than the margin of the calicle. Wall of the calicle very thin, except near the margin, where a zone of stereoplasma is developed, soldering together the outer regions of the septa where they arise from the wall. The lower part of the calicle devoid of stereoplasma or other filling. The columella composed of several flattened pillars."

In the description of the species we learn that the epitheca, in its upper region, is thrown into a series of longitudinal costal folds, which are equally developed and only very slightly prominent. The rounded edges of the primary and secondary septa can just be seen above the level of the margin of the calicle. The wall is very thin. The columella is formed of four flattened pillars, fused together below, but free at their tips, and it projects in the fossa. Height of specimen 8 millim.

Stereoplasma is a name given by Lindström to a substance which connects septa (environing their free edges in some Palæozoic corals), stretches across interseptal loculi irregularly, and sometimes fills up the lower part of the inside of the corallum, constituting a solid mass there. It is to be distinguished from the true endotheca. Its presence as thin, solid, membrane-looking layers is excessively variable in the same species, and it is only of classificatory importance when it fills up the bases of corallites or accumulates near the wall in the interseptal loculi, to diminish the calibre of the coral within, and to add to the strength and thickness of the walls.

The presence of an epitheca is not of generic value; and the longitudinal folds mentioned in the description of the species above are in the position of costa.

The adhesion by one side is remarkable, and is often the case in *Guynia*, but it is not generic.

Keferstein and E. de Fromentel have both utilized this generic name.

The generic characters of the form are the conical and pedun-

cylate shape, the barely exsert numerous septa without pali, and the essential fasciculate columnella. It is not separable from Conotrochus; and one of the species of this genus, now merged into Ceratotrochus, has in some of its individuals stereoplasma joining the septa near the margin, and a bark-like epitheca. The reasons for joining Conotrochus and Ceratotrochus are evident; and I place Moseley’s interesting form, so beautifully figured by him, in Ceratotrochus, Ed. & H.

VI. Alliance DISCOCYATHOIDA.

Simple Turbinolidae, discoid in shape, not increasing much in height with growth. Free or not. With or without pali in one crown. Columella variable; epitheca also.

Genus Discocyathus, Ed. & H.
Genus Brachytrochus, Duncan.
Genus Sabinotrochus, Duncan.
Genus Stephanotrochus, Moseley.
Genus Discotrochus, Ed. & H.
Genus Cycloocyathus, Ed. & H.
Genus Brachycyathus, Ed. & H.
Genus Anthemiphyllia, Poutalès.
Genus Fungiacyathus, Sarq.

Whilst admitting the necessity of recognizing discoid species of the genus Trochocyathus, there are still several genera which can hardly come within that genus or its alliance, and which contain discoid, low, cup-shaped forms, with and without pali in one row.

The genera Discocyathus, Cycloocyathus, Discotrochus, Brachycyathus, Brachytrochus, Sabinotrochus, and Stephanotrochus form an alliance, the Discocyathoid; and their very common facies is not interfered with by the fact that one genus has no columella and another a lamellar one, three others having them essential and fasciculate.


The corallum is simple, free, and discoid, with a flat horizontal wall covered with a concentrically folded epitheca. The septa
are broad and exsert; the pali are in one crown; and the columella is essential and lamellar.

**Distribution.**—**Fossil.** Inferior Oolite: England and France.

In 1865 Reuss found a small broad-based coral in the Oligocene sands of Nieder Kaufungen, for which he proposed a new genus, *Brachy trochus* ("Zur Fauna des Deutschen Oberoligocäns," Sitzungsb. der math.-naturwiss. Classe der kais. Akad. der Wiss. Wien, 1865, p. 619). The specimens were not of mature forms, and were very small; so that *Brachy trochus Speyeri*, Reuss, is a doubtful species, and the genus must lapse. I have utilized the name, however, as follows:—


The columella is short and shallow, cup-shaped, with a rounded free base. The calice is circular in outline, widely open and deep centrally. The septa are close, moderately exsert, and papillose near the axial space, and slightly dentated on the free margin. There is no columella. The costæ, profusely granular, are moderately developed, and are not seen on the centre of the base. The base is usually deformed and perforated, as it is the home of an annelid.

**Distribution.**—**Recent.** Gaspar Straits, 12 fms.

The papillary endings to some of the septa in this genus simulate pali, and the costæ are not very prominent structures.

**Genus Sabino trochus, Duncan, Madrep. of Deep Sea, Trans. Zool. Soc. vol. viii. pt. v. p. 320, pl. xii. figs. 6–9 (1871).**

Corallum simple, flatly turbinate, adherent by a delicate peduncle. Calice open, circular, fossa shallow, margin festooned by the projecting septa. Columella formed by growths from the septal ends. Septa exsert, granular; tertiaries usually unite with the secondaries close to the columella. Costæ unequal, extending mostly to the peduncle, more numerous than the septa.

**Distribution.**—**Recent.** Atlantic, 994 fms.


Corallum dense and compact in substance, cup-shaped or saucer-shaped, with a trace of early attachment, usually with
well-developed costæ, bearing a succession of small spines with widely open capacious fossa. Septa usually extremely exsert, the exsert quinaries, or quaternaries where these are not present, lying next to the primaries, higher than the tertiaries, or equal to them. Columella short, or little prominent.

Distribution.—Recent. South Atlantic, Azores, Sydney.

This well-marked genus has very decided spines on the costæ in some species, and it has shallow forms and moderately tall ones. It is allied to the two genera Brachytrochus and Sabinotrochus, but is distinct.


The corallum is simple, free, discoid. The calice is subplane; and the columella is fascicular and papillary. The septa are slightly exsert beyond the calice. The wall is horizontal and costulated.

Distribution.—Fossil. Eocene of Alabama; Miocene of Turin.


The corallum is simple, free, adherent when young, with a horizontal wall and very thin epitheca. The septa are subcrenulate, and the pali are large and before the penultimate cycle. The columella is fasciculate and papillary.


The corallum is simple, very short, subpedicellate, and free. The septa are exsert and narrow; and the pali, in one crown, are large, broad, and entire. Calice circular and subplane. Columella fasciculate, and of cylindrical processes, papillary. Costæ indistinct.


The West-Indian Miocene form is not of the genus.


Corallum flat or low, free or pedicellate. Columella spongy and coarse, flat above, and fasciculate. Spines of septa trans-
versely flattened. Wall dense. Epitheca well developed, concealing the costæ up to the calicular margin.

_Distribution._—Recent. West-Indian Seas.

The late M. de Pourtalès placed this genus near _Discotrochus_. The remarkable genus _Fungiacyathus_ of G. O. Sars comes in here, in spite of its Fungoid appearance.

**Genus Fungiacyathus, Sars, Remarkable Forms of Animal Life from the Great Deeps off the Norwegian Coast:** Christiania, 1872, p. 58, pl. 5.

Corallum simple, free, without trace of former adhesion. Base discoid, nearly circular in outline, thin, nearly horizontal. The septa rise from the base, forming a convex calice, and there is a wide and deep central cavity bounded by the inner ends of the septa. Septa numerous, thin, brittle, often wavy at the free edge, more or less vertical, arched above, tallest externally, lowest near the central depression, converging from the calicular edge inwards, not anastomosing; in six systems, with 6 to 8 orders in each system. Columella formed by septal ends, small. There are no pali. Edge of basal margin with dentations, each one corresponding to a septum. Costæ small, radiating from the centre of the imperforate base. There is no epitheca. In the soft parts, which are of brilliant vermilion colour in the species, numerous small tentacles surround the mouth near the inner edge of the septa.

_Distribution._—Recent. Lofoten Islands, 300 fms.

The species of this genus resembles a _Stephanophyllia_ or _Bathyactis_ in shape, but the septa do not anastomose. There is only a basal wall, and there do not appear to be endotheca or synapticula. The genus is evidently one of the Turbinolidae, or simple corals without endotheca.

**VII. Alliance HAPLOPHYLLOIDA.**

Small simple Turbinolidae, with irregular or more or less quadrate septal arrangement. With or without stereoplasma.

_Genus Gynia_, Duncan.

_Genus Duncania_, Pourtalès.

_Genus Haplophyllia_, Pourtalès.

These are three genera of corals which belong to the fauna of the recent deep sea, and which have given much trouble to the classificatory zoologist. They present some affinities with the
indefinite group of Palæozoic corals called the Rugosa, and especially with the Cyathaxonidæ. Writing in 1850, MM. Milne-Edwards and Jules Haime (see also Hist. Nat. des Corall. vol. iii. p. 329) state that the little group of Cyathaxonidæ recalls the family Turbinolidae of the Aporose Madreporaria. The Cyathaxonidæ have, however, a septal fossula and a styliform columella. The genus *Polycoelia*, King, = *Calophyllum*, is also simulated. It is a Permian group. Nevertheless there are many points about the genera *Guynia*, *Duncania*, and *Haplophyllia* which ally them to the Aporose Madreporaria, amongst which they are here included as an Alliance.


The corallum is simple, attached, long and narrow. The wall is thick and solid, and has a delicate epitheca and flat costæ. The septa are well developed, unequal, and extend from base to calice. There are four systems of septa; one septum may be longer and larger than the others. The columella is essential, and may be attached to the larger septa. Growth-rings occur. Occasionally the hexameral arrangement of septa occurs, or it may happen in the same corallum with the quadrate.

*Distribution.*—*Recent.* Mediterranean and West-Indian seas.

**Genus Duncania, Pourtalès, Zool. Results of Hasslar Exped. 1874, p. 44*.**

Corallum attached, cylindrical, covered with a thick wrinkled epitheca, rising over the border of the calice. Interseptal chambers filling up solidly from the bottom; septa showing no definite systems; pali sometimes present; a multiple-pillared columella.

*Distribution.*—*Recent.* West-Indian seas.

The septa are 18, 20, 21 in number, and the tentacles are about 25 to 30 in number. The length of the species is 20–25 millim., diameter 10–11 millim.


Corallum simple, fixed by a broad base covered with a thick epithelium. Columella styliform, strong, very thick at the base.

Interseptal chambers deep, uninterrupted by dissepiments or tabulae, but filling up solid at the bottom.

In the description of the species, Pourtalès notices that the columella is formed of two smooth conical processes, and that they tend to fill up the coral. There are eight large septa uniting with the columella, and eight smaller reach it at a lower level, and there is a further cycle. 16 tentacles. Height of specimen 1.5 centim., diameter 1.2 centim.

*Distribution.*—Florida sea, 324 fms.

The next genus to be considered is unique, and its species are usually stated to have each septum divided into three parts. I cannot agree to this view, and believe that the septa are in sets of three. It forms a group.


The corallum is simple, free, subturbinate, pedicellate. The costae are very broad and separated by deep grooves. Septa in groups of three, with projecting granular ornamentation. Each costa corresponds to three septa.


*Dasmia* is represented in the Neocomian of France, and De Fromentel figures *Dasmia Neocomiensis* from Saint-Dizier (Haute Marne). The appearance of the calice is as if there were 12 groups of 3 septa and a septum between each group (‘Polyp. de l'étage Néocomien,’ pl. 1. figs. 1 & 2, Paris 1857).

The type of the genus is *Dasmia Sowerbyi,* Ed. & H., from the London Clay.

2. Subfam. **Turbinolidae gemmantes.**

In the genus *Caenocyathus,* Ed. & H., gemmation occurs from the living parent and from the buds arising from it also. The budding is not like that of the subgenus *Blastotrochus,* or like that which may be seen in *Caryophyllia,* where the ova have accidentally settled upon the parent, for each bud in the species under consideration communicates by its base, or has communicated with the visceral cavity of its parent through the wall. A bush-shaped corallum or colony results; and in the instance of the genus *Caenocyathus* it attains a considerable size and grows symmetrically.

Colony bush-shaped, more or less ramified; corallites long, conico-cylindrical; calices circular, deep. Columella small, and consists of a few twisted processes. Pali in one crown. Wall thick and smooth, or granular or costulate.

*Distribution.* — *Fossil.* Oligocene, Miocene, Pliocene: Europe.— *Recent.* Mediterranean.


Colony small and bush-shaped. Parent conico-cylindrical, with a broad adherent base. Calice deep; columella rudimentary. Septa stout, not reaching far inwards. Costæ hidden by a well-developed epitheca. Buds ascend in growth, and join others by their epitheca.

*Distribution.* — *Recent.* Northern shores of the Mediterranean, littoral.


The corallites of the colony grow from an expansion of the basal structures of the parent or assemblage. There is no epitheca, and the septa are plain.

The forms thus differentiated represent the Astrangiaceae of MM. Milne-Edwards and Jules Haime of their group Astræaceae.


Colony of close or rather distant corallites, cylindro-conical in shape. Calicular margin wavy or angular. Septa irregular, exsert. Pali before the secondaries and tertiaries larger than the ends of the small septa, bilobed or not. Columella deeply seated, small, papillary or spinulose. Costæ subequal, granular. Epitheca well developed.

*Distribution.* — *Recent.* South Atlantic, St. Helena.


There is no epitheca. The costæ are well developed. The colony incrusts, or the stoloniferous expansions are large.

*Distribution.* — *Recent.* St. Helena and Persian Gulf.

This subgenus is taken from the genus *Agelecyathus*, nobis.
CHAPTER II.

The family Oculinidæ restricted to its definite limits. The discoveries of Milne-Edwards and J. Haime, Verrill, and H. N. Moseley. The necessary abolition of the Stylasteridæ as a group of Zoantharia Sclerodermata. The soft parts of typical Oculinidæ. Alliances of the family. Descriptions of genera.

The family Pocilloporidæ. The necessity for its foundation.

The genera Pocillopora and Seriatopora.

Family OCU LINIDE, Ed. & H. (pars).

The next group of the Madreporaria Aporosa to be considered is one which has been greatly extended by Verrill* and restricted by Milne-Edwards and Jules Haime†, and which requires great modification in consequence of the discoveries of Prof. H. N. Moseley, F.R.S.‡

The Oculinacea of Verrill cover much more ground than the Oculinidæ of Milne-Edwards and Jules Haime, and the family of the Oculinidæ now to be established is very restricted, the Hydrocorallinæ of Moseley having been of course removed. Verrill considers his Oculinacea a suborder; but the group as now restricted can only be of family importance.

Verrill§ includes seven families in a suborder—the Oculinacea, some of which can hardly remain thus associated owing to recent advances in morphology. He gives some most valuable information regarding the soft parts of the corals, and very aptly places the genus Pocillopora, generally classified with the Tabulata, in his suborder. He also associates the genus Stylophora with the suborder.

Milne-Edwards and Jules Haime|| described a group of genera which they formed into a family, the Oculinidæ, and it contained three subgroups, one of which now belongs to the Hydrocorallinæ, Moseley, and it omitted some of the groups included subsequently by Verrill.

In the suborder Oculinacea of Verrill the polyps, when expanded, rise above the calice, and may be long and exsert, the

* 'Notes on Radiata,' 1868–71, p. 512.
§ 'Notes on Radiata,' 1868, p. 512.
|| Hist. Nat. des Corall. vol. ii. p. 102 (1857), and previously in 'Comptes Rendus,' 1849.
mouth protruding. The tentacles are from 10 to 48 and sometimes more in number, elongated, the tips usually, if not always, swollen or capitate, their surface being covered with small wart-like clusters of urticating cells (ap. cit. p. 512). This structure of the tentacles is much relied upon by Verrill.

For a good representation of a Caryophyllia, which would be included by Verrill, drawn from nature by Peach, see 'Monog. Brit. Foss. Corals,' 2nd ser., Pal. Soc. Lond., 1866, Duncan, plate ii. figs. 9-20. The swollen ends of the tentacles are shown, but they are not persistent characters in the genus.

It is clear that the Oculinidae (Stylasters omitted) of Milne-Edwards and Jules Haime are closely allied to the family Turbinolidae, and, although I cannot associate them in one family, they are neighbours. The family (not suborder) which should now be admitted, must exclude the Stylasteridae, the Stylinidae, Astrangidae, and Caryophyllidae, which were included by Verrill in his suborder, and should include the Oculinidae proper of Edwards and Haime and some Stylophoridae, Ed. & H.

The examination of a large series of specimens of the Oculinidae of Milne-Edwards and Jules Haime has impressed me with the general truth of their assertion that the visceral chambers fill up by a deposit within, and are intruded upon by the growth of the wall. The growth of the mural structure, which is difficult to distinguish from a solid cænenchyma, is very characteristic and is often excessive.

II. Family OCULINIDÆ, Milne-Edwards & Jules Haime (pars).

Oculinacea, Verrill (pars).

Corallites in colonies in the form of branches, espaliers, irregular ramifications on a thick stem, or massive, or incrusting. Increase by gemmation, which is usually lateral and often symmetrical; fissiparity very rare. Interseptal loculi usually open to the base, but dissepiments or tabulae sometimes occur. Internal space diminishing on account of growth of stereoplasm. Walls of corallites often increasing in thickness, exogenously, with age and becoming a solid mass by union with others. Solid intercalicular or intercorallite cænenchyma usually present. Septa entire or not at their free edges, sometimes rudimentary. Polyps, when expanded, rising above the wall, or long and exsert, the mouth protruding; the tentacles 10 to 48 or more, elongated, tips usually swollen or capitate.
The very considerable changes in the definition of the family Oculinidae prevent its being a large one in spite of the additions made by palæontologists and those naturalists who have described the corals of the deep sea.

There are, after revision, 21 genera. Eleven genera disappear and one becomes a subgenus. A genus is relegated to the Astræidæ.

The 21 genera are included in 5 Alliances—the Baryhelioida, the Lophohelioida, the Oculinoida, the Prohelioida, and the Stylophoroida.

I. Alliance BARYHELIOIDA.

Oculinidae with massive or incrusting colonies. Columella absent and pali also, or a false columella may be present. Septa variable in arrangement. Cœnenchyma well developed between the calices.

Genus BARYHELIA, Ed. & H.
Genus NEOHELIA, H. N. Moseley.
Genus DIBLASUS, Lonsdale.


Colony massive. Calices slightly projecting or not, small. Septa few, entire, thick and short. Columella and pali absent; a large open fossa existing in the axis of the corallites. Cœnenchyma moderately developed, smooth or finely granulated. Dissepiments rudimentary.


Genus NEOHELIA, Moseley, Report on 'Challenger' Corals, p. 176, plate x. figs. 7, 7a (1881).

Colony with a very abundant and diffuse cœnenchyma incrusting the stems of Gorgonoids with very short branches only. Calices with the septa arranged in five systems, which are often fused together by the cœnenchyma; a deep fossa exists, but no columella. Gemmation irregularly dichotomous.


It may be noticed that the surface of the cœnenchyma which separates the calices is marked by very slightly elevated rounded ridges, which traverse it irregularly but with a general longitudinal direction, and are continuous at the margins of the calices with the short costæ. The primary and secondary septa meet in the fossa.

Colony incrusts and is very irregular in shape. The calices are wide apart and project; the columella is formed by the junction of the larger septa, and is parietal and rudimentary. The septa are dentated, crowded and granular laterally. Pali absent. The costae are granular, equal or subequal, and often extend across the cenenchyma to neighbouring calices.

Gemmation marginal and intercalinal.


II. Alliance LOPHOHELIOIDA.

Oculinidae with dendroid and bunch-shaped colonies. Corallites often coalescing; gemmation alternate. Septal arrangement irregular. Columella absent or rudimentary, tubercular, or spongy, or styliform. Tabulae or dissepiments present or not. Mural structures thickening with age. Septa entire or subentire, often exsert.

Genus Lophohelia, Ed. & H.
Genus Amphihelia, Ed. & H.
Genus Enallohelia, d'Orb.
Genus Euhelia, Ed. & H.
Genus Acrohelia Ed. & H.
Genus Astrohelia, Ed. & H.
Genus Dendrohelia, Etallon.


The colony is dendroid, and its gemmation is subterminal and irregularly alternate; the granulated wall is thick and increases in thickness with age. The calices are very deep; the septa are well developed, exsert, entire, and unite more or less at the bottom of the calicular fossa. Arrangement of septal orders irregular. Columella absent or false; costae near the calicular margin. Dissepiments may exist, and often well-developed tabulae, which close in the calice inferiorly. Internal cavity not filling up much with age.

Distribution.—Fossil. Miocene, Pliocene: Europe.—Recent. Atlantic, N. & S.; Caribbean Sea; Mediterranean; East Indies; Philippines.

This genus has given much trouble in its classification, and some time since I was disposed to place it in the Astræidae; but its proper position appears to be here.
Genus Amphihelia, Milne-Edwards & Jules Haime, 1849 (pars);

Syn. Diplohelia, Ed. & H.

The colony is bush-shaped, and the gemmation is alternate, marginal, and often double. The wall, with or without cœnenchyma, increases in thickness at the lower part of the colony, and often includes formerly free corallites. Corallites free, immersed or coalescent. Columella exists. The septa are entire or subentire, in six systems; but there are few cycles. Costal striae very variable in amount and direction. Ornamentation of the wall granular or absent. Internal cavities do not fill up; dissepiments absent.


This genus absorbs Diplohelia, Milne-Edwards & Jules Haime, 1850.

The genus Enallohelia, d'Orbigny, 1848, was insufficiently diagnosed as follows:—"Ce sont des Oculines, dont des calices saillants sont latéraux et alternes de chaque côté des branches. Calices pourvus de côtés en dehors." This description is not distinctive. MM. Milne-Edwards and Jules Haime added to the description, and slightly altered the name; and M. de Fromentel has made some very important additions to the characters of some species. The presence of paliform lobes on some septa, and the subentire condition of the septa were asserted by M. de Fromentel, but they are doubtful points. The existence of hexameral, octameral, and decameral types in the genus is extremely interesting.


Colony dendroid or bushy, or low compressed, and branches uniting; gemmation alternate and distichous. Calices small and shallow, often oblique. Columella styliform, but often small and even rudimentary. Septa few, slightly exsert, subentire, some swollen at inner end, arranged in systems of six or eight or ten. Costæ visible near the calice; wall-cœnenchyma considerably developed.


Colony dendroid; gemmation distichous and at right angles with the margins of the parent calice. Corallites subturbinate. Septa entire where free. Columella rudimentary. Costae sub-equal and project near the calice. Surface granular. Often one bud aborts.

*Distribution.—Fossil.* Jurassic: Europe.


Colony dendroid. Calices with extremely exsert septa, entire, lanceolate in shape, and they unite by their inner margins at the bottom of the calicular fossa. Columella and pali absent. Costae in the neighbourhood of the calices only. Gemmation regularly spiral in direction.

*Distribution.—Recent.* Fiji.


*Distribution.—Fossil.* Miocene: Europe, North America.

There is no doubt that the genus Dendrohelia of Etallon (‘Lethaea Bruntrutana,’ p. 358, 1860) is unsatisfactory. Milne-Edwards and Jules Haime considered the typical species of Etallon to be a doubtful member of the genus *Stylina.* The balance of evidence is in favour of the species *Dendrohelia coalescens,* Etall., being one of the Oculinidae. But Etallon is very much in error when he compares the genus with the modern *Acrohelia,* to which it has only a remote family likeness.

Etallon considers the genus *Dendrohelia* to include some species of *Helicœnia=Stylina;* but it must be remembered that the species of the genera just noticed are represented by much-worn or considerably altered specimens.
Genus Dendrohelia, Etallon, Lethæa Bruntrutana, 1864, p. 358, pl. 1. fig. 4.

Colony mammillated or branched, coalescing. Cœnenchyma well developed and compact, especially on the parent stem. Calices irregularly placed, sometimes in a subspiral manner, costulate near the margin. Stem granular. Columella styliform. Septa unequal, entire, or non-exsert. Gemmation irregular.

Distribution.—Fossil. Oolite of Europe.

III. Alliance OCULINOIDA.

Oculinidæ with arborescent or tufted, alternately, oppositely, or dichotomously gemmating colonies. Gemmation rarely from one side only. Septa entire, subentire, or spinulose where free. Pali before one or more sets of septa. Columella various. Fissiparity very rare.

Genus Oculina, Ed. & H.
Subgenus Agathelia, Reuss.
Genus Cyathohelia, Ed. & H.
Genus Synhelia, Ed. & H.
Genus Trymohelia, Ed. & H.
Genus Sclerohelia, Ed. & H.
Genus Bathelia, H. N. Moseley.
Genus Haplohelia, Reuss.


Colony arborescent or in tufts. Corallites arranged more or less distinctly in ascending spiral series, or scattered irregularly, prominent or sunken, often arising from an incrusting base. Cœnenchyma solid and smooth or finely papillose. Calices circular, oval, prominent or depressed. The columella either well developed and papillary at the surface, compact at the base, or rudimentary. The septa are well developed, entire or slightly spinulose where free, some exsert. Pali exist before all the septa except those of the last cycle. Costæ as striations, or decided projections extending a short distance from the calicular margin. In rapidly growing forms there is no cœnenchyma independent of the buds. Endotheca may exist.

There are two sections of the genus. In the first, which contains the majority of the recent forms, the growth is by gemmation; and in the second, which contains recent and fossil forms, there is also fissiparous division.

Distribution.—Fossil. Eocene: Europe, Asia. Miocene:
Europe and America.—Recent. Indian Ocean, Pacific (?), Florida and Caribbean seas, Bermudas.


There is one specimen of a species only, and it is so probable that further research will relegate the form to the genus *Oculina* that it is recorded here but not formally placed. The bases of some pali-bearing Oculinacea spread out and incrust before the upward growth occurs.


Colony covering some space, gibbous and lamellar, with the corallites widely and unsymmetrically scattered. Cœenchyma compact and granular at the surface and noncostulate. Calices conical, projecting, deep. Septa thin, unequal, denticulate, barely exsert. Columella of very delicate trabeculae (Stäbchen). Pali before the first two cycles out of the three.


Colony dendroid, like a dichotomous cyme. Corallites free to a considerable extent except on the side, whence they bud, subturbinate or subcylindrical. Parent corallites compressed between the bases of the buds. Calices elliptical, shallow, compressed laterally. Columella well developed, papillose, elongate rather. Septa subentire, numerous, exsert. Pali large, distinct, higher than the columella, in two crowns, the outer in front of the teriaries, absent before the last cycle of septa. Costæ visible near the calicular margins only. Surface of the greatly thickened walls granular. Gemmation opposite.

*Distribution.*—Recent. Japanese and Corean seas, Moluccas, to 825 fms.


Colony dendroid, gibbous on the surface. Calices irregular
on the stem, more or less spirally placed on the branchlets, superficial and circular. Columella solid, with a solitary styliform tubercle. Septa crenulated and stout; some of the smaller septa unite, and before them are pali or paliform lobes. Costae well marked, radiating and often uniting with those of other calices.


Colony dendroid. Calices arranged in more or less spiral lines, shallow, and with a low margin. There is no columella. Septa thick externally, subentire at the free edge. Pali before the primaries and secondaries, and these last the largest; they unite laterally to form a vertical tube with thick walls, which fills up below. Costae equal and in striations, which are directed towards the base of the colony. Cœnenchyma greatly developed, granular.


Colony dendroid, branches often coalescing, incrusting often at first. Calices circular, immersed or slightly prominent on the stem, or projecting and gemmating, situated irregularly on the numerous terminal branchlets. Cœnenchyma well developed on the stems, glistening or very minutely granular, marked but little by costal striae. Columella solid in three or many lobes, often consolidated together. Septa well developed, subentire, laterally granular, unequal. Pali moderately developed and placed before the secondary septa, often irregular. Dissepiments occur.

*Distribution.*—*Recent.* South Atlantic, St. Helena.


Colony arborescent; calices disposed alternately in nearly straight rows on either sides of the several branches, with very prominent margins. Cœnenchyma white, compact, and dense, with its surface covered entirely by curved striae continuous with
the costæ. Calices deep and widely open, with four cycles of septa and a single crown of pali. Columella large, composed of numerous trabeculae. Gemmation alternate.

Distribution.—Recent. Off Rio de la Plata, 600 fms.


Colony branching. Calices on one side of the stem. Columella small, papillary. Septa in three cycles, and papillose pali before the primaries and secondaries. Costæ as long lines of long granules with intermediate depressions running along the whole branch.

Distribution.—Fossil. Miocene: Europe.

IV. Alliance PROHELIOIDA.


Genus Prohelia, E. de Fromentel.
Genus absorbed:—Stylangia.

Genus Prohelia, E. de Fromentel, Introd. à l'étude des Polyp. foss. p. 177 (1861).

Syn. Stylangia, E. de From.

Colony branched, espalier-like. Calices projecting, placed in two parallel series along the sides of each branch, and all are directed forwards; they spring from the posterior part of the branches and twist to the right or left to come to the front. Columella styliform. Septa entire. Costæ rudimentary. Coenenchyma very developed, compact and strongly granulated.

Distribution.—Fossil. Jurassic and Cretaceous: Europe.

This genus absorbs, according to M. de Fromentel, his genus Stylangia.

V. Alliance STYLOPHOROIDA.

Oculinidæ with arborescent, palmate, or incrusting colonies. Septa few, 10 or 12 or 24, unequal. Columella styliform. Coenenchyma sub-compact, compact, or cellular, granular. Costæ developed, short or absent. Dissepiments present. Gemmation irregular.
Genus *Stylophora*, Ed. & H.
Genus *Stylohelia*, E. de From.
Genus *Madracis*, Ed. & H.


Colony arborescent, or palmate, or incrusting. The calices are rather deep, and present a styliform columella. The septa are unequal, six being well developed and six rudimentary. Cœnenchyma between the corallites subcompact and granulated, and often ridged. The costae are rudimentary. Dissepimental endotheca present, and the internal cavity often obliterated. Gemmation irregular and lateral.


Colony massive or dendroid. Calices very projecting as truncated cones, strongly costulate near the calices, but granular over the rest of the cœnenchyma, which is foliated and more or less dense. Columella strong and styliform. The larger septa unite with the columella by means of horizontal trabeculae regularly placed. Septa in three cycles, the last rudimentary.

Distribution.—Fossil. Oolite: Europe.


Syn. *Axohelia*, Ed. & H.

Colony arborescent or incrusting more or less. Calices small, shallow, with a sharp styliform, sometimes compressed columella, and ten or twelve equal, exsert, subentire septa. Gemmation spiral more or less, or irregular. Cœnenchyma nearly compact
and strongly echinulate or cellular, often with an intercalicular ridge. Costæ absent. Internal cavities filling up more or less.

Distribution.—Recent. Madeira, Florida, Caribbean sea, Brazils, Isle de Bourbon, Indian Ocean, (Adriatic?).

This genus absorbs Axohelia, Milne-Edwards & Jules Haime, 1849, which was placed by those authors in the Stylasteraceæ (Hist. Nat. des Corall. vol. ii. p. 126); and as the other Stylasteraceæ have been shown by Moseley to be Hydrocorallinæ, the sub-family disappears entirely from the Zoantharia Sclerodermata.

Milne-Edwards and Jules Haime introduced their genus Areacis into the group which associated Stylophora and Madracis; but its species must be relegated to the Astræidæ with a cellular coenenchyma and ill-developed visceral tabulae.

In this arrangement of the Oculinidæ the following genera are absorbed or are not considered, in consequence of unsatisfactory definition or evident synonymy:

- Diplohelia, Ed. & H.
- Stylangia, E. de From.
- Psammohelia, E. de From.
- Axohelia, Ed. & H.
- Phyllopora, T. Woods.
- Tiaradendron, Quenst.

The genus Aegthelia, Reuss, becomes a subgenus of Oculina. The genus Areacis, Ed. & H., is removed to the Astræidæ.

III. Family POCILLOPORIDÆ.

Colonial Aporose Madreporaria with tabulæ, septa small and rudimentary. Columella well or ill developed. Corallites filling up with steroiplasma. Intercorallite structure coenenchymal and solid. Animal with disk, tentacles, and a single pair of long mesenterial filaments.

Verrill stated, in his 'Notes on Radiata,' p. 523, that Pocillopora, although a tabulate coral, must enter the section in which he placed the Oculinidæ. He satisfied himself of the correctness of Mr. Bradley's observations that Pocillopora had twelve tentacles, six being upright and six held horizontally, and that it was not a Hydroid. The arrangement and form of the tentacles resemble those of the Perforate coral Porites, but the tissues are solid.
Moseley (Quart. Journ. Micr. Sci. lxxxviii. p. 391, "Notes on the Structure of Seriatopora," &c.) states that Seriatopora is Madreporarian. The polyps bear twelve short tentacles with rounded knobs in two series. The cavities of the polyps are in communication by means of a canal-system forming a network, which traverses the entire area at the surface between the polyps. The polyps of Seriatopora and Pocillopora possess only a single pair of long mesenterial filaments, and these belong to the central mesenteries of the lateral chambers. Both of the genera differ from other Madreporaria in not having their mesenteries arranged in pairs.

Genus Pocillopora, Lamarck & Verrill.
Genus Seriatopora, Lamarck.

Genus Pocillopora, Lamarck (pars); Verrill, Notes on Radiata, p. 519 (1870).

Colony of clusters of branches, or lobes, or fronds of various dimensions, which arise from a more or less compact incrusting base. Branches often with rudimentary branchlets or verrucose. Corallites crowded terminally, angular, and closely united by their walls; on the sides of branches they are more or less separated by compact coenenchyma which is sharply spinulose or granular. Calices small, may be deep or shallow, circular or angular, often filled, below the surface, by a solid deposit. The corallites are crossed by tabulae. Septa narrow, often rudimentary, especially in the crowded calices at the ends of branches, in others longer, usually twelve in number, six larger than the others. Columella when present small, solid, little prominent on the upper tabula. Tabulae often incomplete in middle. Increase by gemmation. Fissiparity very rare. Polyps with 12 tentacles, and a single pair of long mesenterial filaments.


Internal cavities obliterating almost completely with the growth of the base of the columella and walls. Traces of tabulae.

Distribution.—Recent. Red Sea, Indian Ocean, Pacific.

If Seriatopora is admitted into the Oculinidae with Pocillopora the question occurs, what is to be done with Dendropora, Michelin, Rhabdopora, Milne-Edwards & Jules Haime, and Trachypora. They are associated with Seriatopora by Milne-Edwards and Jules Haime in a family of Tabulata; and before I had read Nicholson's excellent analysis of the genera (Nicholson, 'Tabulate Corals,' p. 105, 1879), I agreed with the great French zoo-phytologists, but now I see the necessity of placing those genera amongst the Favositidae.

CHAPTER III.


Simple or colonial Aporose Madreporaria, multiplying by ova, rarely by deciduous buds; increasing in bulk by gemmation and by fissiparous division and serial growth. Interseptal loculi containing dissepimental endotheca, rarely tabulae. Septa smooth or entire at the free edge, or dentate, ragged or spinulose. Soft parts closely resembling those of the Turbinolidae: the long serial calices have several mouths in the limited disk, which is surrounded by tentacles. Tentacles contract and are hidden by the edge of the disk. A mesentery projects downwards in each interseptal loculus as far as the upper dessepiment, and sustains the ovarian organ. Corallites may unite by their walls, or costa, or exotheca, or a vesicular peritheca may exist, but true intermural solid coenenchyma is rarely seen.

The subfamily Eusmilinae and the subfamily A斯特inae of Dana
and Edwards and Haime are united, and the whole Astræidæ are subdivided into seven subfamilies.

Although it is proposed to abolish the classificatory distinction between the Astræidæ with entire and with dentated or ragged septal edges, it is necessary to keep in view the method of growth and increase of the forms. Milne-Edwards and Jules Haime founded their classification of both of the groups, now united, upon the principles of their gemmation and growth. Thus the Eusmilinae, Ed. & H., or the Astræidæ with entire septa, were classified as Simple, Caespitose, Confluent, and Agglomerate; and the Astræidæ with dentate septa, the Lithophylliaceæ, Ed. & H., were grouped almost after the same manner into Simple, Caespitose, Meandroid, Fissiparous, and to these was added the agèle of the budding Astræaceæ. These divisions or "agèles" are fairly natural, and it is only rarely that some hard and fast lines of distinction oppose the truth. Fissiparity is the rule amongst the caespitose and confluent Eusmilinae, and amongst the caespitose and meandroid Lithophylliaceæ; but it is accompanied by more budding than has been hitherto admitted. Moreover the long serial calices of the confluent and meandroid forms seem to develop by simple growth from the calicular ends quite as much as by an indefinite fissiparity. The great break was between the Caespitose and Meandroid Lithophylliaceæ with dentate and ragged septa. Thus the genera Musca, Oken, and Symphylla, Ed. & H., are very closely allied, and at one stage they must belong to the Meandroid group; but the early life of the Muscæ is often passed in a caespitose condition of growth. It is necessary to place these genera, the one at the close of the Caespitose and the other at the commencement of the Meandroid group.

In the present classification, the Eusmilinae, Lithophylliaceæ, and Astræaceæ, being absorbed in the family Astræidæ, the agèles of Milne-Edwards and Jules Haime become subfamilies, and their sections also. The simple forms of both groups are united in a subfamily Astræidæ simplices. The caespitose genera of the Lithophylliaceæ and Eusmilinae become caespitose Astræidae; and the meandroid Lithophylliaceæ and the confluent Eusmilinae become confluent Astræidae. The Astræaceæ or massive budding group become Astræidæ agglomeratæ gemmantes.

It is evident that the genera which increase by stoloniferous gemmation must form a subfamily, and that the dendroid forms
with simple gemmation, their close allies, must belong to another. Hence the three original great groups of Edwards and Haime form one family, the Astræidæ, and it is divided into seven Subfamilies. The Subfamilies are divided into Alliances, the genera of which have their species divided into tribes which are distinguished by the presence or absence of entire septa.

IV. Family ASTRÆIDÆ.

Subfamily 1. Astræidæ simplices.

,, 2. ,, reptantes.
,, 3. ,, gemmantes.
,, 4. ,, cæspitosaë.
,, 5. ,, confluentes.
,, 6. ,, agglomeratæ fissiparantes.
,, 7. ,, agglomeratæ gemmantes.

1. Subfamily Astræidæ simplices.

Simple solitary Astræidæ with entire or incised, dentate or spinulose septal edges. Propagation by ova and rarely by decidual buds. Pali may or may not exist. Endotheca always present, but variable in amount.

Alliance I. TROCHOSMILIIOIDA.
   II. PLACOSMILIIOIDA.
   III. LITHOPHYLLIOIDA.
   IV. ASTEROSMILIIOIDA.

Group V. Genus AXOSMILIA.

Each of these Alliances is divided into two tribes, one of which receives genera with entire septa, and the other contains genera with dentate septa.

There are six genera which become subgenera, and fifteen genera are absorbed.

I. Alliance TROCHOSMILIIOIDA.

Simple corals with entire or dentated, incised, ragged, or spined septa. Endotheca. Columella absent or rudimentary. Costæ distinct. With or without epitheca. Pali absent.

Tribe I. With entire septa.
,, II. With dentate, incised, ragged, or spined septa.

I. Genus TROCHOSMILIA, Ed. & H.
   Subgenus EPISMILIA, E. de From.
   Subgenus CAELOSMILIA, Ed. & H.

Genus DIPLOCTENIUM, Goldfuss.
II. Genus Montlivaltia, Lamouroux.
Subgenus Leptomussa, d'Achiardi.
Subgenus Oppelismilia, Duncan.
Subgenus Ceratophyllia, v. Fritsch.
Genus Feddenia, Duncan.

Genera absorbed:
- Ellipsosmilia, d'Orb.; Psammosmilia, E. de From.

Genera becoming subgenera:
- Epismilia, Ceolosmilia, Leptomussa, Oppelismilia, and Ceratophyllia.

Tribe I.

Syn. Ellipsosmilia, d'Orb.

The corallum is simple, and either subpedicellate or fixed by a broad base, compressed or not, often deformed. Calice circular, elliptical, elongate, or deformed. Columella absent. Septa entire, numerous, exsert or not, often lobed. Costae distinct. Endotheca present. Epitheca absent or rudimentary.


D'Orbigny founded the genus Ellipsosmilia, which he described as Trochosmilia with an oval calice and slightly enlarged base. The septa do not meet at the centre, but leave a hollow space there transverse to the columella (Eléments Zoologiques, p. 160; Cours élémentaire de Paléontologie &c., 1851; genus founded in 1848).

Milne-Edwards and Jules Haime decided not to admit the genus, and referred the species to other genera, such as Trochosmilia and Montlivaltia. Etallon resuscitated Ellipsosmilia in 'Etudes Paléont. sur le Haut Jura;' and M. de Fromentel pointed out in his 'Introd. à l'Etude des polyps. foss.' the error into which Etallon had fallen.

There appeared to be some reasons for the establishment of a genus which should absorb Ellipsosmilia and certain Montlivaltiæ which were supposed to have entire septa. But the influence of fossilization and of weathering on Montlivaltiæ, in wearing down their denticulate septal edges, does not seem to have entered the thoughts of any palæontologists who have described species of this genus, Epismilia. It is remarkable that whilst Montlivaltia has survived to the present day, Epismilia did not enter the
later Tertiary faunas. I do not consider *Epismilia* otherwise than a subgenus.


Syn. *Psammosmilia*, *E. de From.*

Corallum free or adherent, trochoid or subcylindrical. Septa large and entire. No columella; columellary space elongate. An epitheca, membraniform and complete, forming transverse ridges. Endotheca abundant.


It is to be noticed that in the typical species, *Epismilia Haiimei, E. de From.,* the septa are exceedingly numerous; that the septa of the 1st, 2nd, and 3rd cycles have the upper free edge sharp and entire, their inner edge being slightly swollen and undulating; and that the septa of the other orders have regular dentations on their inner edge. The species have large individuals as a rule. The only distinction between this genus and *Trochosmilia, Ed. & H., 1848,* is that this last has the wall covered with costæ, and a rudimentary epitheca in some instances. This last structure is not mentioned in the diagnosis of Milne-Edwards and Jules Haime, but it is as evident as it is in some Caryophylliæ.

As it is of great importance that the genera should be well defined, it is impossible to retain both of these; and hence I place *Trochosmilia, Ed. & H., 1848,* as the genus which contains, amongst others, certain species with a well-developed epitheca, belonging to a subgenus, *Epismilia.*

*Psammosmilia, E. de From. Pal. Franç., Terr. crêt. 1863,* differs from *Epismilia* in having a broad base, which is not generic. It must be absorbed.

The genus *Cælosmilia*, Milne-Edwards and Jules Haime, has a considerable number of species with a well-defined facies, but its alliance with *Trochosmilia* is exceedingly close. Formerly I had absorbed *Cælosmilia* in *Trochosmilia,* but now I propose to consider it as a subgenus. The main distinction between the two types only relates to the amount of endotheca.


The corallum is simple, fixed or pedicellate, subturbinate,


_Calosmilia fecunda_, Pourtalès, from the Florida seas, was placed by him in the genus _Parasmilia_ (pr _Corals of the Blake Expedition_, p. 109).

The genus _Brevismilia_, Bölsche, was founded on a figure given by Roemer of his _Lithodendron nanum_. It can hardly stand.


Corallum simple, exceedingly compressed, subflabelliform, with the flanks directed downwards; free, pedicellate. Wall naked, with numerous close subequal costae, which divide and subdivide. The very long calice has its axes very unequal; it is narrow and deep. Columella absent. Septa very numerous, slightly exsert, nearly equal. Endotheca well developed.


**Tribe II.**


The corallum is simple, and either fixed by a broad base or free, and in this last case pedicellate, or with a scar of former adhesion. Variable in shape, some being turbinate, sub turbinate, cylindro-conical, or discoid. Wall feebly developed, covered with a well-developed epitheca. Calice circular, subcircular, elliptical, deep or shallow, or convex in some discoid forms. No columella. Septa stout and numerous, dentate or spiny, or nodulose or lobed, often exsert. Endotheca abundant.


_Montlivaltia discus_, Wood (Australia, recent), is not a species of the genus. It has clearly synapticula, and is one of the Fungidae.

Subgenera:—_Leptomussa; Oppelismilia; Ceratophyllia._
Subgenus *Leptomussa*, *d'Achiardi*, *Monogr. der Vicentenischen Korallen*.


Corallum variable in shape, often cylindro-conical, compressed, with large costae, which are crested and spined. Epitheca scarcely developed. Septa double, very numerous and mostly equal. Endotheca abundant. There is no columella.

**Distribution.**—Fossil. Eocene: Europe, Asia.


Corallum simple, attached, conical. Calice shallow. Columella absent. Septa numerous, close and unequal. The epitheca is well marked, and reaches the calicular margin. Gemmation occurs within the calice, and the bud has an epitheca.


Milaschewitsch has described some of these forms as *Montlivaltia*, and considers the gemmation only a rejuvenescence, which it is not. The coral he describes as *Montlivaltia turbata* shows two buds from the calice, and is one of the subgenus.


**Distribution.**—Fossil. Eocene: Borneo.


The corallum is simple, free, with an irregularly-shaped base, which has enclosed a foreign body. Calice usually constricted, crowded with uniting dentate septa, ending in paliform lobes. Columella absent. Costae not directed to the sharp end of the base, but passing straightly and parallel down the sides of the wall, sometimes keeled. Epitheca, when it exists, variable, and often in broken mosaic or granular. Endotheca scanty. Granules of the septa unite here and there, forming false synapticula.

**Distribution.**—Fossil. Ranikot group, Eocene: Sind.

II. Alliance *Placosmilioidea*.

Simple corals, with entire or denticulate septa. A lamellar columella. Endotheca in variable quantity. Epitheca present or absent. Without pali.
FAMILIES AND GENERA OF THE MADREPORARIA.

Tribe I. With entire septa.
   ,, II. With denticulate septa.

I. Genus Placosmilia, Ed. & H.
   Genus Lophosmilia, Ed. & H.
   Subgenus Plesiosmilia, Milasch.
   Genus Pleurosmilia, E. de From.
   Genus Psephosmilia, Ed. & H.
   Genus Blastosmilia, Etallon.

II. Genus Spenophyllia, Moseley.

Genera absorbed:—
   Phyllosmilia, E. de From.; Oxymilia, Duchass.

   Trismilia, E. de From., a very interesting form, is placed here provisionally. Lophosmilia becomes a subgenus.

Tribe I.


Syn. Phyllosmilia, E. de From.

Corallum simple, free, subpedicellate, compressed. Calice elliptical, long or short. Columella lamellar. Septa numerous, slightly exsert or not, entire, granular laterally. Costæ well developed or fine, simple or ramified. Endotheca abundant. Exotheca variable, membranous, may be absent.


Syn. Oxymilia, Duchass.

The corallum is simple, fixed, subturbinate, straight or curved. Calice nearly circular, or slightly oval and elliptical; fossa shallow. Columella lamellar, lobed more or less, or entire. Septa entire, exsert, unequal, granulated on the sides. Costæ distinct to the base. Endotheca scanty. Epitheca absent or rudimentary.


Corallum simple, cylindro-conical, with circular accretion-ridges, free or adherent. Calice circular, or slightly elliptical, deep
centrally. Columella small, lamellar. Septa numerous, exsert at the margin, upwardly curved, and sloping to the columella, entire, granulate, granules in rows parallel with the free edge. Endotheca abundant. Epithec membrane, smooth, covering the costae here and there, not perfect.

Distribution.—Fossil. Oolite: Nattheim, Europe.
This genus is too closely allied to Lophosmilia to stand. It is clearly an epithecate subgenus.

Corallum simple, variable in shape and height, tall or short, subturbinate, conico-cylindrical. Calice circular or elliptical. Columella lamellar, projecting or not, united to a large septum, which is more developed than the others. Septa numerous, entire. Endotheca exists. Epitheca strong, covering the wall.

Distribution.—Fossil. Jurassic: Europe.
The genus Trismilia, E. de Fromentel, Introd. à l'étude &c. p. 106, is stated to be "très voisin des Pleurosmilie," but to differ by having only three primaries developed, and a columella pyramidal and triangular in shape. One species, from the Portland Oolite of France, is noticed.
At present this genus had better be associated with Pleurosmilia.

Corallum simple, adherent by a large base, and is cylindrical. Calice circular or suboval; fossa well developed, with a lamellar columella at the bottom. Septa entire, broad, arched, but very slightly exsert at the margin, striated, entire. Endotheca abundant. Epitheca strong, membraniform, complete.


Corallum simple, elongate, slightly bent at the base, and subcylindrical. Calice round and deep. Columella strong and compressed. Septa in four cycles, moderately thick and slightly
FAMILIES AND GENERA OF THE MADREPORARIA.

Families and genera of the Madepoaria.

Exsert. Costae close and subequal. Endotheca moderately abundant. Epitheca complete, with accretion-ridges hiding the costae.

Gemmation from the everted margin of the calice at certain epochs of growth. Buds become detached and leave a scar.

Distribution.—Fossil. Oolite: Europe.

Tribe II.

Genus Sphenophyllia, Moseley, Report on Corals 'Challenger' Expedition, 1879, p. 182, pl. x. fig. 1.

Corallum solitary, free, pedicellate, compressed, with septa finely denticulate at the summits, and numerous wedge-shaped costae, which are denticulate, rendering the corallum exceedingly rough. A scanty epithea at the base; no endotheca or exotheca. A well-developed lamellar columella.

Distribution.—Recent. Locality unknown.

Moseley places this form amongst the Astræidæ of Dana, in spite of his not observing endotheca. After much consideration I agree, but I am not satisfied that some endotheca does not exist near the columella.

III. Alliance LITHOPHYLLIOIDA.

Simple corals, with entire or dentate, incised or spined septa, endotheca, and a spongy or trabeculate columella. Wall costulate and naked, or with an epithea.

Tribe I. With entire septa.
II. With dentate septa.

I. Genus Parasmilia, Ed. & H.
Genus Dasmosmilia, de Poulalès.
Genus Conosmilia, Duncan.

II. Genus Lithophyllia, Ed. & H.
Genus Circophyllia, Ed. & H.
Subgenus Leptaxis, Reuss.
Subgenus Antillia, Duncan.

Genera absorbed:—

Cylicosmilia, Ed. & H.; Cœnosmilia, de Poulalès; Anomocora, Studer; Cyathophyllia, E. de From.; Smilophyllia, E. de From.; Syzygophyllia, Reuss; Cynarina, Brügg.; Scolymia, Haime; Homophyllia, Brügg.

Leptaxis and Antillia become subgenera.
Amongst the Simple Corals with plain entire septa are some which have been grouped generically, according to the presence of abundant endotheca or its comparative absence. This is not a sufficiently important distinction. Thus the genus *Cylicosmilia*, Milne-Edwards and Jules Haime, 1848, really only differs from *Parasmilia* of the same authors by its more numerous septa and well-developed endotheca. The first-named genus is of Eocene age and the other is Cretaceous.

It is necessary to absorb *Cylicosmilia* in *Parasmilia*, and to alter the generic diagnosis of the latter slightly.

Pourtales originated the genus *Cœnosmilia*, ‘Deep-sea Corals Hasslar Expedition,’ p. 39 (1874), but in the description of the corals of the ‘Blake’ Expedition he withdrew it, and placed the species in *Parasmilia*.

**Tribe I.**


Syn. *Cœnosmilia*, Pourtales; *Anomocora*, Studer; *Cylicosmilia*, Ed. & H.

The corallum is simple, fixed, subturbinate, or conico-cylindrical. Calice circular in outline. Columella spongy. Septa entire, exsert, well developed, granular laterally. The wall is naked and costulate. Endotheca exists.


Pourtales named the species *Parasmilia Lymani* and *P. variegata*, from the Florida seas; but in his last work, on the ‘Blake’ corals, he considered them very abnormal, and therefore established the genus *Dasmosmilia* for them. But he retains *Parasmilia fecunda*, Lindström (Pourtales, sp.), and notices that the gemmation is not real, but that the young forms have settled on a dead one.


Corallum turbinate, with very thin wall and false pali. Columella formed by lobes of the septa. Rudimentary epitheca.

**Distribution.**—Recent. Off Grenada, in 164 fms.
The species *Dasmosmilia variegata*, Pourtalès, has for its synonyms *Parasmilia variegata*, Pourt., and *Bathycyathus elegans*, Studer.


Corallum simple, pedicellate, conical. Calice elliptical. Columella of one or two twisted laminae, essential. Septa entire, octameral or hexameral in arrangement, arise at the margin between the costae. Costae broad, ornamented or sharp at the margin, and broad below. Endotheca sparsely developed. Epitheca absent or pellicular and ornamented.

*Distribution.—Fossil. Australian Tertiaries.*

This genus I now place amongst the Trochosmiliaceae instead of amongst the Madreporaria Rugosa.

**Tribe II.**


Syn. *Scolymia*, Haime; *Cynarina*, Brügg.

The corallum is simple and largely fixed, turbinate, subtubinate, cylindro-turbinate, cylindrical, or even prismatic in shape. The wall has well-developed spined costae. The calice is shallow, circular or subcircular. The septa are well developed, broad, numerous, very granulated on the sides, spinulose on the free edge. Columella well developed, spongy, flat above and a little sunken; its trabeculae are lamellar and twisted. Epitheca absent. Endotheca largely developed.

*Distribution.—Fossil. Miocene: West Indies and Europe.—Recent. Caribbean Sea.*


The corallum is simple, turbinate, or tall and pedunculated. The wall has fine, close, simple granular costae and a rudimentary epitheca. The calice is circular and shallow; the septa very numerous, broad, exsert, and have the free surface more or less lobed. The columella is large and papillary. The endothecal dissepiements are numerous.

*Distribution.—Fossil. Eocene: Europe, West Indies.*

The genus *Leptaxis*, Reuss, appears to be a *Circophyllia* with
an elongate columella. It is from the Lower Tertiaries and Oligocene of Europe. It requires further study. It merits the position of a subgenus.

Subgenera:—*Leptaxis*, Reuss; *Antillia*, Duncan.


Corallum simple, variable in shape, with more or less dentate and lobed, or simply dentate or simply lobed septa. A well-developed columella. Costae variously granulated, tuberculated or crested. Endotheca developed; sometimes some exotheca between the costae. Epitheca strong, folded, and reaching to various heights.


This subgenus has a well-marked facies which separates it from typical *Cirrhophyllia*.

M. de Fromentel mistakes my definition of *Antillia* (‘Pal. Franc., Terr. crét.’ tom. viii. livr. 24, p. 293), and gives *Antillia* a lamellar columella. Having established *Smilophyllia* for Lithophylliaceae with lamellar columella, he withdraws it into *Antillia*. This is an error. In no place have I given *Antillia* a lamellar columella; it has nothing of the kind. The genus *Smilophyllia* must therefore lapse in the subgenus *Antillia*, Duncan*. M. de Fromentel’s genus *Cyathophyllia* is the same as *Antillia*, which has the preference from age. The first-named genus lapses therefore.

*Syzygophyllia*, a genus established by Reuss, is the same thing as *Antillia*, and must be absorbed. Zittel unfortunately has not seen the original diagnosis of *Antillia*, and has abstracted from M. de Fromentel’s translation.

The free or attached condition of corals having the other specific or generic characters in common is not sufficient to establish a distinction. The genus *Caryophyllia* has free and adherent species; and the species *Caryophyllia clavus* has free, pedunculate, and broad-based and adherent individuals. Hence

in dealing with the present group of Simple Corals genera must not be admitted on the fact of the forms they might include being fixed, when the other structural details resemble those of well-known genera whose species are free. Hence Cynarina of Brüggemann, 1877, is a free Lithophyllia, and Homophyllia, Brüggemann, 1877, is a fixed Antillia or a young compound coral or colony.

IV. Alliance ASTEROSMILIIOIDA.

Simple Astreadæ, turbinate, horn-shaped. Calice elliptical or circular. Wall costulate. One or more rows of pali. Columella variable, elongate, spongy or lamellary or fasciculate, or none. Endotheca exists.

Tribe I. Septa entire.
   ,, II. Septa denticulated.
I. Genus Asterosmilia, Duncan.
   Genus Stephanosmilia, E. de From.
   Genus Cyathosmilia, T. Woods.
II. Genus Pattalophyllia, d’Achiardi.

Tribe I.

Genus Asterosmilia, Duncan, Phil. Trans. 1867, p. 653.

The corallum is simple, long, cornute more or less. Calice elliptical or circular. Columella solid, essential, compressed, lamellar, short. Septa numerous, entire, and exsert. Costæ irregular and often crested. Pali exsert, in several crowns, before all septa except the last cycle. Endothecal dissepiments distinct, tolerably numerous, and curved.


This genus was placed as Trochocyathus even after the endothecal dissepiments were discovered by Lonsdale (Quart. Journ. Geol. Soc. vol. xx. 1864, p. 26). In May 1867 the generic diagnosis was read before the Royal Society.

The next genus, Stephanosmilia, E. de Fromentel, is allied to Asterosmilia, Dunc., the generic distinctions being that the first named has a fasciculate columella and two crowns of pali; whilst the other has pali before all the septa except those of the last cycle, and there are four and often five cycles of septa.

There is a very remarkable manner of founding a genus illustrated in the ‘Paléontologie Française.’ A species is named and
figured years before the letterpress relating to it and the genus is published. Zoologists have long since decided against any such proceeding. The genus dates from the time of reading in or publication by a Society, or periodical, or book. Another method is more remarkable, and consists of diagnosing genera the species of which have not been found.


**Distribution.**—**Fossil.** Gault: Europe. Eocene: Borneo.

M. de Fromentel really published the genus in 1867, having figured it only, five years before. He placed it at first amongst styliform columellate *Trochosmilia*.

*Stephanosmilia,* Reuss, is a synonym of *Trochoecyathus*.

The following genus is thoroughly Australian in its strangeness.


**Distribution.**—**Fossil.** Australian Tertiary deposits.

**Tribe II.**


Corallum simple, free, cornute. Pali before the antepenultimate cycle of septa. Columella absent. The septal laminae finely and regularly denticulated. Endothecal dissepiments not very abundant.

**Distribution.**—**Fossil.** Eocene: Europe.

The figures given by d’Achiardi in vol. ii. no. 4 of the above work show a coral with a narrow pedicellate end, curving and swelling to the long elliptical calice. The costæ are seen; and there is no epitheca. The pali form a crown of lobes within the septal edges, and there is no columella.
Group-Genus **AXOSMILIA**.

Simple corals with entire septa, an essential styliform columnella, a well-developed epitheca and endotheca.

**Genus AXOSMILIA**, Ed. & H.


The corallum is simple, free in adult age, tall, turbinate or conical. Calice circular and deep. Columella essential, styliform. Septa entire, not exsert, and some unite with the columella. Epitheca complete and membraniform. Endotheca moderately developed in the deep interseptal loculi.

**Distribution.**—Fossil. Oolitic, Jurassic: Europe.

2. **Subfamily Astræidae reptantes.**

(The Astrangiaceae, Ed. & H.)

Colony composed of short corallites which arise by gemmation from stolons or basal expansions, which may or may not contain sclerenchyma. Endotheca moderately abundant. Septa both entire and denticulate. Rarely gemmation from the corallite wall.

The living polypes of a form belonging to this group, *Cylicia rubeola*, Quoy & Gaimard, stand up higher than the calices, and the disk is well rayed, and within the margin are little slender tentacles surrounding a long mouth with incised margins (Milne-Edwards & Jules Haime, Hist. Nat. des Corall. vol. ii. p. 607, 1857–60, from Quoy & Gaimard, Voy. de l’Astrolabe, Zooph.). Verrill states ('Notes on Radiata,' p. 526) that *Astrangia palifera*, Verrill, has subpellucid polyps which rise considerably above the calices: the tentacles are long, slender, and covered with white verrucæ, with a knob at the end.

The corallites may be close or rather distant; and in the first instance the bases often overlap, and the gemmation seems to have been from the very basal edge. In one group (*Canangia*) the gemmation is partly as in *Cladocora*, and is from the wall of the parent corallite, and the cavities of the bud and parent communicate.

The small colonies of the *Astræidae reptantes* are readily distinguished from any other forms of the family by their method
of growth. Eight genera were included in the subfamily by Milne-Edwards & Jules Haime; Gosse, de Fromental, d'Orbigny, Verrill, Reuss, Keferstein, T. Woods, and de Pourtalès added others to the group. Some of the genera were established on morphological
data which were not of more than specific classificatory value; and they have been absorbed.

The *Astraeidae reptantes* correspond to the *Turbinolidae reptantes* of the family *Turbinolidae*; and they have great affinities with the Oculinidae. No division can be made between the "Alliances" of the subfamily from the morphology of the septal edges; for some septa may be smooth and others denticulate in the same calice in many genera. It is an important consideration, for it lays the foundation of a doubt regarding the value of the Eusmilineline and Astraeid groups of Milne-Edwards and J. Haime.

The subfamily *Astraeidae reptantes* (*Astrangiaceae, Ed. & H.*) contained nineteen genera. But after revision eleven genera and two subgenera remain, which arrange themselves under two Alliances. Four genera are removed to other groups.

Alliances.

I. *Rhizangioida.*
II. *Astrangioida.*

I. Alliance *RHIZANGIOIDA.*

*Astraeidae receptantes* with a complete epitheca, with or without pali. Septa denticulate on the free edge, the primaries sometimes with a subentire edge.

**Genus Cylicia**, Ed. & H.
**Genus Scolangia**, T. Woods.
**Genus Cryptangia**, Ed. & H.
**Genus Rhizangia**, Ed. & H.
**Genus Bathangia**, Keferst.


Colony spread over surfaces, and composed of close or rather distant but independent corallites. These are short, subcylindrical, often oblique, with a large base. Calices subcircular and rather deep. Columella papillary and well developed. Septa thin, close, not exsert, the principal with a subentire margin, the others very
dentated. Epitheca complete. Endotheca exists. Gemmation from the base or from a short or long calcareous stolon of the parent corallite.

**Distribution.**—Recent. Cape of Good Hope, Natal, Australian seas, New-Zealand seas, Singapore.

It is probable that *Solenastræa Prestwichi*, Duncan, of the Crag, is a crowded *Cylicia* with an abnormal growth of exotheca.


Astrangiaceæ united by a calcareous stolon which covers the wall with concentric layers. Corallites inclined. No spiniform processes on the septa. No columella.


In the solitary specimen of the solitary species there does not appear to be a complete calice in the delineation given. The fossa was wide. It may be supposed that the stolon mentioned above means epitheca.


Colony budding by stolons which do not become calcareous. Corallites quite free amongst themselves, elongate, cylindro-turbinate, and with a complete epitheca. Calices circular or sub-circular; fossette well marked, deep. Columella papillary and well developed. Septa thin, dentate, moderately close. Endotheca exists. Habit: surrounded by and immersed in *Cellepora*.


The species of this genus are always found immersed in *Cellepora*; and this and their corallite shape and dentate septa of all ages separate it from *Cylicia*.


Colony forming expansions of calcareous basal structures from which corallites arise. Corallites rather close, short, sometimes very much so, subcylindrical, largely fixed by the base. Calices circular, almost superficial. Columella papillary, the outer part resembling the inner teeth of the septa. Septa numerous, rarely exsert, large, thin, subequal, granular, close, minutely denticulate where free. Epitheca complete. Endotheca exists.

**Linn. Journ.**—Zoology, Vol. XVIII. 5
Eocene: Borneo.
Lütken having found a recent species of Cladangia, states that when it is young it resembles Rhizangia, and that the stability of this last genus is lost. But it is necessary to compare adult forms in zoological argument; and the adults of the two genera differ materially.

Genus Bathangia, Keferstein, quoted in Zittel, Handb. der Paläont. 1879.

Corallites short, united to a permanent basal enlargement. Calices round and very deep; wall thick, covered with a granular folded epitheca. Columella spongy, well developed, filling the lower part of the corallites. Septa narrow. Pali in one crown.

Distribution.—Fossil. Oligocene: Europe.
It is presumed that endotheca exists. Otherwise the genus will belong to the Turbinolidae reptantes, nobis.

II. Alliance ASTRANGIOIDA.

Astræidæ reptantes with a naked and costulate wall.

Genus Astrangia, Ed. & H.
Subgenus Cœnangia, Verrill.
Subgenus Phyllangia, Ed. & H.
Genus Ulangia, Ed. & H.
Genus Stylangia, Reuss.
Genus Colangia, Pourtalès.
Genus Cladangia, Ed. & H.
Genus Latusastræa, d'Orb.

Genera absorbed:—
Hoplangia, Gosse; Pleurocœnia, d'Orb.

Genera becoming subgenera:—
Cœnangia and Phyllangia.

Genera removed:—
Psammophora, Placophora, Holangia, and Stylangia, E. de From.


Colony incrusting. Corallites short, arising from calcareous basal expansions, close, more or less turbinate or cylindrical. Calice circular, deep, and large. Columella papillary, and formed of a network of trabeculae with additions from the septal ends; outer papillae resembling those of the septa, or differing in consequence of a large paliform tooth being on some septa. Septa
unequal, not exsert, some united, granular at the sides, denticulate, and often with a paliform tooth. Costae visible on the wall near the calice especially. Epitheca absent. Dissepiments few and distant.


There is no doubt that the species formerly classified with *Astrangia*, and which are found in the Miocene or later Tertiaries of the United States (eastern coast) vary in their method of gemmation. The corallites may entirely arise from the basal expansion, or some may come from the angles between corallites, and even from the wall anywhere below the calice. Some of these buds are accidentally placed, and have no intimate union with the parent; but others appear to be true infracalicular gemmations. Verrill has formed a subgenus *Coenangia* for these forms and for *Astrangia Dana* of the Virginian fauna.


Corallites united together laterally, forming small *Astraea*-like incrusting masses, sometimes rising into lobes in the middle. Calicles angular and crowded. Septa without distinct paliferous teeth at base, those of the last cycles curved towards and usually united to those of preceding cycle. Columella small, scarcely papillose. Budding between corallites and around or below calicular margin.

**Distribution.**—Recent. Guaymas; E. coast N. America as far north as Long Island Sound.—Fossil. Miocene: Maryland.

*Pleidia*, Dana, is not mentioned in Verrill's revision of the names of the genera used in the great work on Zoophytes, Wilkes Expedition; and Dana observes ('Corals and Coral Islands,' 1872, p. 68) that it is synonymous with *Astrangia*.

The genus *Phyllangia* of Milne-Edwards and Jules Haime only differs from *Astrangia* in having exsert septa, some of which are not denticulate, others being so, with a smaller and more variable columella. It is at the most only a subgenus.


Colony incrusting, forming clusters of moderately large turbi-
nate corallites, close or rather distant. Corallites rather short. Calices circular, except where crowded, deep. Columella small or well developed, trabeculate from the septal ends; with from one to three or four pillars rising from the base and uniting and joining the trabecule; upper surface ragged or papillose. Septa well developed, numerous, unequal, some exsert, entire or minutely denticulated, granular, with or without paliform lobe. Costæ usually well developed. Epithea wanting. Endotheca moderate. Basal expansion spreading, calcareous.


Mr. S. O. Ridley has shown that Phyllangia, like Caenangia, Verrill, may sometimes bud from the wall of the parent corallite. I believe that Hoplangia, Gosse, Actin. Brit. p. 338 (1860), is synonymous with Phyllangia.


Colony scattered, basal expansion not developing sclerenchyma. Corallites distant, very low and broad, with a well-developed papillary columella and very numerous septa, the higher orders of which are very denticulate, and the others exsert and partly plain. Costæ near the calice, and an epithea near the base. Endotheca exists.

Distribution.—Recent. Panama and Philippines.


Distribution.—Fossil. Eocene: Europe.


Corallum immersed in an expanded basal epithecal membrane, forming several successive storeys following the growth of the
coral. Primary and secondary septa entire and exsert; those of the higher orders denticulate and not exsert. Well-developed pali in front of the tertiaries. Columella lamellar or papillose, and not much developed.

Distribution.—Recent. Florida seas and off Havana.


The colony arises from a common basal expansion. Corallites with septa having lobed margins. Columella parietal. An exotheca extends from corallite to corallite, giving the appearance of a vertical series of folia.

Distribution.—Fossil. Miocene: France.—Recent. India (Lütken).

There are two genera of this subfamily which are exceedingly unsatisfactory owing to the paucity of species and the very indifferent specimens. They are Latusastræa, d'Orb., and Pleurocoenia, d'Orb. Milne-Edwards and Jules Haime unite these genera.

Now Latusastræa has a species from the Oolite of Nattheim, and the specimen figured by Becker and Milaschewitsch, 'Palæontographica,' vol. xxi. plate 40. fig. 1, shows sufficient structure to prove that the genus under which it should be arranged is not Pleurocoenia. On the other hand, this last-named genus is not sufficiently defined.


Colony in disk-like or crateriform masses, thin and spreading. Base covered with a stout concentrically-folded epitheca. Corallites close, inclined in one direction, low. Calices with a projecting lip, otherwise circular. Columella absent. Septa very irregular in size and distribution. A long columellary septum reaching two thirds of the distance from one side of the calice to the other. Costæ as delicate striations down the wall. Gemmation close to the bases of the corallites from the common basal structure.

Distribution.—Fossil. Jurassic: Europe. Cretaceous: Europe?

The genus Pleurocoenia is therefore abolished, and is probably synonymous with the above.
3. Subfamily Astræidae gemmantes.

(Subgroup Stylinaceæ independentes, Ed. & H., and Subfamily Cladocoraceæ, Ed. & H., combined.)

Astræidae increasing by gemmation from the wall below the calicular margin. Buds free more or less by their sides. Septa dentate or entire. Endotheca disseptimental.

The subfamily unites the former Eusmilinae, which were grouped with the Stylineæ, with the Cladocoraceæ of the Astræidae. Five tolerably well-marked Alliances may be mentioned, and there are some genera which cannot be placed in Alliances.

Fourteen genera are retained and one lapses. The Alliances are the Cladocoroida, Goniocoroida, Dendrosmilioida, Stylosmilioida, Palæastræoida, and a solitary genus.

I. Alliance CLADOCOROIDA.

Cladocoraceæ or Astræidae gemmantes bush-, or branch-shaped, or fasciculate, with a papillary columella and pali. Endotheca present.

Genus Cladocora, Ed. & H.

Genus Pleurocora, Ed. & H.

The genus Anomocora, Studer, placed by that author in the Cladocoraceæ, is, according to E. Pourtalès, a Parasmilia with buds on a dead parent. This may be the case, but the genus is described by Studer, Obersicht der Steinkorallen &c. Gazelle Reise, Monatsber. Berlin, 1877, p. 641, pl. 9.


Colony bush-shaped or branched or fasciculate. Corallites variable in length, erect, often flexuous, cylindric, and free laterally. Calices circular and shallow. Columella well developed. Septa exsert, subequal, rounded, and finely dentated and granulated laterally. Pali exist before all the cycles except the last. Wall compact, moderately thick. Costaæ simple, granular, or finely echinulate, straight. An incomplete epi-theca, which often gives rise to horizontal collarettes, may extend from one corallite to another. Endotheca scanty. Gemmation lateral and often in pairs from the same height on the stem.


Colony subdendroid, espalier-like, or massive. Corallites cylindrical, short, united to the stems, whence they bud for a distance, free at their summits for a variable extent. Calices circular and shallow. Columella papillary, and there are pali before all the septa except those of the last cycle. Septa hardly exsert, subequal, thin, close, denticulate, and granular. The wall is compact, very thick, and the costæ are distinct along the whole height, and are close, separated by deepish grooves, straight near the calice and more or less vermiculate elsewhere. Gemmation lateral. Endotheca exists. Epitheca absent.


II. Alliance GONIOCOROIDA.

Astræidæ gemmantes with a dendroid or fasciculate form. Columella rudimentary, granular costæ. No epitheca. Endotheca exists.

Genus Goniocora, Ed. & H.
Genus Rhabdocora, E. de From.


The colony is dendroid. Parent corallites tall, cylindrical. Offshoots by gemmation free laterally, and forming different angles with the parent according to the species. Calices circular and columella rudimentary. Septa not numerous, spinulose. The wall is naked and has granular costæ, straight and distinct over the whole surface.


Colony dendroid, in close bush-shapes. Corallites free to a variable extent and generally well costulated. The calice is circular and shallow. There is neither columella nor pali. Septa dentated.

III. Alliance DENDROSMILIOIDA.

Astræidæ gemmantes with small subdendroid forms. The corallites short. Columella spongy or parietal. Septa entire. Endotheca present.

Genus PouRTALOSMILIA, Duncan.
Genus Dendrosmilia, Ed. & H.

Genus PouRTALOSMILIA, Duncan.


Colony formed by repeated gemmations from the wall of the parent corallite, and occasionally from the walls of buds. Corallites conico-cylindrical, long, bent, except the straight parent, and parallel with this last. Calices circular, deep. Columella rudimentary, or as trabecula from the septal ends. Septa entire, thin, slightly exsert; they project but slightly into the calice, except the primaries and secondaries. Costæ rudimentary and only exist near the calices. Wall thin, with a granular epitheca closely attached. Dissepiments wide apart.

Distribution.—Recent. Mediterranean.

It must be noticed that the parent corallite survives with the buds and does not die, as in Anomocora and Caenosmilia.


Colony small, subdendroid, increasing by lateral and alternate gemmation. Corallites subturbinate, short, free by their sides. Calices suboval. Columella spongy, well developed. Septa entire, thin, close, very unequal and granulated on their sides. Costæ broad, simple, and granular. Endotheca present. No epitheca.


IV. Alliance STYLOSILIOIDA.

Astræidæ gemmantes with fasciculate, tufted, dendroid forms. The septa entire or dentated. The columella stout, styliform, or papillary.

Genus Stylosmilia, Ed. & H.
Genus Stylocora, Reuss.
Genus Stylocora, E. de From. 1872.
Genus Placophyllia, d'Orb.
Genus Donacosmilia, E. de From.


Colony in tufts which are fasciculate. Gemmation lateral.
Corallites cylindrical, close, long, flexuous, and coalescent in places, free elsewhere. Calices circular. Columella well developed, styliform and projecting. Septa entire, few, slightly exsert, joining the columella by means of horizontal spiniform projections. Epitheca present or not. Endotheca simple and scarce.  

**Distribution.**—Fossil. Oolite, Cretaceous: Europe.

**Genus Stylocora, Reuss, Zittel, Paleontol. p. 256.**

Colony subdendroid. Corallites cylindrical, short, free at the sides. Calices circular. Columella styliform. Septa dentate, unequal; the primaries the largest, exsert and granulate laterally. The inner ends of the larger septa with a paliform lobe in contact with the columella.  

**Distribution.**—Fossil. Cretaceous and Miocene: Europe.

It is a misfortune that M. de Fromentel should have chosen the name *Stylocora* for a genus with a papillary columella. I have not been able to find *Stylocora*, Reuss, and do not therefore know the date of its diagnosis and publication.

**Genus Stylocora, E. de Fromentel, Pal. Franç., Terr. crêt. p. 430 (1872).**

Colony dendroid, with slender branches, free to a great extent. Calice circular. Columella well developed and papillary. Pali absent. Costae well pronounced. Septa dentate, well developed and close.  


**Genus Placophyllia, d’Orbigny, Note sur les Polyp. foss. p. 8 (1849).**

Colony fasciculate or astreiform, increasing by sub-basilar or lateral gemmation. Corallites nearly entirely enveloped in a strong folded epitheca, and often united together without the presence of costae or exotheca. The columella is strong and styliform. Septa well developed. Endotheca abundant.  

**Distribution.**—Fossil. Oolite: Europe.

The next genus is a very doubtful one, the specimens being in a very miserable condition, and I place it here provisionally.

**Genus Donacosmilia, E. de Fromentel, Introd. à l’étude des Polyp. foss. p. 146 (1858–61).**

Colony fasciculate, reaching to a considerable height. Wall
covered with a complete epitheca, forming strong circular ridges, wanting here and there; Calices round. No columella (?). Septa broad, slightly exsert, uniting at the axis. Endotheca well developed. Gemmation lateral, and buds pass up parallel with the parent.

Distribution.—Fossil. Oolite: Europe, England?

V. Alliance PALÆASTRÆEOIDA.

Astræidæ which increase by gemmation from the wall of the parent, and also from the calice. Septal number irregular. Costæ occasionally remarkably developed.

Genus Heterophyllia, M'Coy.
Genus Battersbyia, Ed. & H.


Colony of long and slender corallites, free. Gemmation around the calicular margin. Septa either irregular in number and arrangement, or are only six in number and regularly placed. Costæ well developed, may be tubercular, spined, and flexuous. Wall thick. Endotheca dissepimental. Epitheca absent. Columella absent or produced by junction of the septa.

Distribution.—Fossil. Carboniferous limestone: United Kingdom.


Colony fasciculate. Corallites tall, distant, or close and crowded, free, except when arising from a parent, very variable in dimensions in the same colony, or else subequal. Calices and corallites, on section, circular in outline. Columella absent or produced by union of septa. Septa very unequal in size and number, from 6, 12, to 52 in number. Endotheca vesicular and abundant. Gemmation from the walls of corallites, and the buds have five septa or more; also by budding from the inter-septal spaces of those buds, of gemmules which develop six septa. There is no epitheca. Corallites without cænenchyma around them, but often surrounded by Stromatopora.

Solitary genus.


Colony fasciculate in close tufts. Corallites free to a great extent, but usually close and polygonal in outline. There are only six septa, which start from the angles of the walls, and one more developed than the others reaches the centre of the calice. Epitheca strong, folded, and reaching to the summit of the colony.


The genus *Isocora*, Etallon, is insufficiently determined, and should lapse.

In 1867 a division of the Astridæ was suggested in order to receive the two Palaeozoic genera *Heterophyilia*, M'Coy, and *Battersbyia*, Ed. & H.* I now place this division as an Alliance in those Astridæ which bud between the calicular margin and the base.

4. Subfamily *Astridæ cæspitose*.

(*Euphylliaceæ cæspitose*, Ed. & H. (pars), and *Astraceæ cæspitose*, Ed. & H., combined.)

Astridæ in which the corallites are isolated in all their terminal portions, being free at their sides, springing from a common parent, increasing by fissiparity, separation occurring rapidly or serial growth persisting. Septa entire or dentate, spined or lobed. Endotheca abundant. Colonies in cæspitose tufts, often more or less foliaceous. Gemmation rare, but it exists more frequently than has been thought hitherto.

The insufficient morphological distinction between the Sections *Lithophylliacées cespiteuses* and the *Euphylliacoës cespiteuses* of Milne-Edwards and Jules Haime, Hist. Nat. des Corall. vol. ii. pp. 288 & 184, has been intensified by the fact that there is not a very great difference between the soft structures of the groups. The first section belongs to the Astræinæ, Ed. & H., with spined and dentated free septal edges, and the last to the Eusmilinæ, with smooth septal edges. These conditions of the septal edge, as already noticed, cannot be of physiological importance, and they are found combined in the calices of species of other groups of the corals. Again, the Cæspitose *Euphylliaceæ*,

the second of the sections mentioned above, run into the Euphylliaées confluentes; and this want of definition is observable in the Astræiae cæspitose and confluentes.

It does not seem possible to separate such genera as Eusmilia, Aplosmilia, and Euphylia from Dasyphylla, Trachyphylla, and Mussa, and their subfamily relationship is evident. The genus Plocophyllia, Reuss, is an Eusmiline Mussa in habit of growth.

In both of the sections the corallites spring from a small base or parent, either by budding or by fissiparity. They then increase by fissiparous division. The divided parts grow upwards, become separate, and do not unite at the sides. Sometimes this fissiparous division does not take place until the calice has become very long, and even gyrose, so that a kind of serial growth occurs before separation, and it may persist in some parts of the colony, or universally. One part of a fissiparous calice may grow faster than the other, and the calicular centres of the new corallites become evident sooner or later in all conditions, except in the long serial gyroïd calices seen in Euphylia for instance.

Seventeen genera have been noticed, but thirteen only remain after revision. Two become subgenera.

Alliances.

I. Calamophyllioida.
II. Thecosmilioida.
III. Mussaoida.

I. Alliance CALAMOPHYLLIOIDA.

Cæspitose Astracidae in colonies, the corallites of which speedily become separate, except at their lower and originally attached part. Calices more or less circular, very rarely forming short series.

Tribe I. With entire septa.

,, II. With dentated and spined septa.

Tribe I.
Genus EUSMILIA, Ed. & H.
Subgenus CAULASTRÆA, Dana.
Genus APLOSMILIA, d'Orbigny.
Genus SOLENOSMILIA, Duncan.

Tribe II.
Genus DASYPHYLLIA, Ed. & H.
Genus CALAMOPHYLLIA, Ed. & H.
Families and Genera of the Madreporaria.

Genus Pleurophyllia, E. de From.
Genus Dendrocora, Duncan.
Genus Dactylomelia, d'Orb.
Genus Hymenophyllia, Ed. & H.
Genus Rhabdophyllia, Ed. & H.

Genera absorbed:

Aplophyllia, d'Orb.; Caulastraea becomes a subgenus.

Tribe I.


The colony is cespitose in shape, and the branches are dichotomous or trichotomous. The base increases but slightly with age, and the subcylindrical corallites increase in height, multiply fissiparously, and speedily become separate. The calices are large, somewhat irregular in outline owing to fission, but are generally elliptical. The columella is composed of a lax, broad tissue, and is at the bottom of a deep fossa. The septa are entire at their upper edge, are well developed, thin, narrow, and slightly granular. The costae are subcrestiform near the calices, and may become more or less indistinct towards the base. The endotheca is moderately developed, and there is a pellicular epitheca, which does not pass far up the colony.


Eusmilia alticostata, Ed. & H., has the costae distinct at the base.


Colony cespitose, with the stems straight or twisted, subcylindrical. Calices subcircular, deep. Septa unequal, exsert, subentire, rather numerous. The outer surface of the stems striated or denticulate.

Distribution.—Recent. Pacific, West Indies?

The three species included in Caulastraea, Dana, form a very natural subgenus of Eusmilia.


The colony is cespitose, and the branches are dichotomous or
trichotomous. The base increases but slightly with age, and the coralites grow high, subcylindrical, and increase by fissiparity, separating soon. The calices are large and do not form series. The columella is lamellary. The septa are large, thin, and entire. The costae are crestiform, and are visible to the base. There is an endotheca, but the epitheca is absent.

Distribution.—Fossil. Oolite of Europe.


The colony is bush-shaped, and the coralites, which rarely unite, are cylindrical and bifurcate. Budding occurs, and afterwards fission of the terminal calices: their fossæ and columellæ are in common. The tissue between these calices is costulate, and that over the rest of the corallum granular and without epitheca. The calices increase by fissiparity, and occasionally form short series. Columella formed of laminae and of the paliform ends of septa, and is deeply situate. Septa variable in number; many reach the columella and have paliform lobes. Dissepiments common. Wall often thick.

Distribution.—Recent. N.E. and S. Atlantic, Caribbean Sea, South Indian Ocean, Philippines, Japan. To 1098 fms.

Tribe II.


The colony is fasciculate, and resembles a more or less hemispherical, dichotomous cyme in shape. The coralites grow upwards, divide fissiparously, and become free to a considerable extent rapidly. The calices are circular, suboval, or deformed, moderately deep, and there is a spongy columella. The septa are exsert and dentate, the inner teeth being larger than the outer ones. The endotheca is well developed. The wall is echinulate and costulate, and gives rise to circular expansions. The epitheca is rudimentary.

Distribution.—Fossil. Tertiary of Sind and Miocene of Europe. —Recent. East Indies, Malacca.


The colony is fasciculate, and the coralites are long and
dichotomous, free soon or almost entirely so. The calices have an irregular margin, and are more or less circular or subcircular, and they are shallow. The columella is rudimentary, or absent. The septa are numerous, and nearly equidentate. The endo-thecal dissepiments are oblique and well developed. The wall is naked, or may have a rudimentary epitheca, and is covered with equal or subequal granular costae. Circular expansions of the wall occur at different heights, and may or may not unite with those of other corallites.


Colony with small dichotomous or trichotomous branches. Corallites cylindrical, multiplying fissiparously. Calices with the septa arranged on the heptameral type, one of the seven large septa being the most developed, and reaches the axis without diminishing in thickness, and replaces a columella. The wall is covered with a thick epitheca, swollen in bourrelets here and there.

**Distribution.**—**Fossil.** Portland Oolite: Europe.


Colony bushy, branching from all parts, frequently in one plane. Branches different in length, slender. Calices terminal, round, shallow or elongate when undergoing fissiparity. Columella lax and trabecular. Septa denticulate, with pali before those of the third cycle. Costae distinct, broader than the septa of the calicular margin, and are sharply granular over the all. Wall thick. Endotheca tolerably abundant. Epitheca absent. In some branches the fissiparity is repeated to form short series.

**Distribution.**—**Recent.** Atlantic, West coast of Africa.

**Genus Dactylosmilia,** d'Orbigny, *Note sur les Polyp. foss.* p. 6 (1849).

The colony is dendroid, and has dichotomous corallites. The columella is spongy and well developed. The septa are dentate and in three or four cycles, and there are pali before all, with the
exception of the last. The walls are naked, and have distinct granular costae along their whole length.

**Distribution.**—**Fossil.** Cretaceous: Europe.


Colony in the form of a fasciculate tuft. Corallites free at their sides, and environed by a complete epitheca, which is attached to the extremity of the costae at a little distance from the wall, giving an appearance of a double wall. Calices broad, more or less deformed. Columella rudimentary or none. Septa in irregular cycles, with a paliform lobe. Endotheca very developed.

**Distribution.**—**Fossil.** Cretaceous: Europe.


Colony in the shape of a dendroid tuft; the corallites long and cylindrical in shape, bifurcating fissiparously and at different angles. The calices have rather irregular shapes, and the columella is spongy and well developed. The septa are dentate and granular. The costae are continued over the wall to the base, and are distinct and granular, may be restricted to the neighbourhood of the calice, or some are very distinct low down. The endotheca is developed, and there is no epitheca.


This genus absorbs *Aplophyllia*, d’Orbigny, 1849, which, being less well known, had better not receive the usual priority.

II. Alliance THECOSMILIOIDA.

Astraeidæ more or less caespitose, sometimes submassive. Corallites united to some extent, increasing by fissiparity, speedily separating, showing short series rarely; gemmation may occur.

**Genus Thecosmilia, Ed. & H.**

**Subgenus Cladophyllia, Ed. & H.**

The genus *Cladophyllia* becomes a subgenus, and *Cœnotherca*, Quenstedt, is abolished.

Some of the genera now about to be considered are very difficult to classify, especially *Thecosmilia*, Ed. & H. The young
of most Thecosmilians were simple forms resembling *Montlivaltia*, and growth proceeded for some time without increase, or the reverse happened. The increase was clearly not invariably by fissiparity of the parent; subdivision and upward growth from more than two centres may be noticed; and the method is indistinguishable from the results of gemmation. As growth proceeded the calice either remained unaltered, or fissiparity, or even something like serial growth, developed.

The result in these last two instances was to produce calices as varied in shape as in *Mussa* and *Symphyllia*.

Mr. Tomes, F.G.S., has introduced the genus *Chorisastraea*, E. de Fromentel, to absorb the Thecosmilia which grow at first by budding and then by fissiparity. In his essay on the Lower-Oolite Madreporaria (Quart. Journ. Geol. Soc. vol. xxxviii. p. 428, 1882), the diagnosis of *Chorisastraea* is not introduced. A figure is given of *Chorisastraea gregaria* on plate xviii. figs. 1-3, the Thecosmilia *gregaria* of Ed. & H., and M'Coy's *Montlivaltia gregaria*.

The figure, however, does not represent the characteristic groove or deep space between the walls of adjoining calices, which is the special generic character of *Chorisastraea* according to the founder of the genus, M. de Fromentel. *Chorisastraea* will be considered in its proper place.


This colony is usually cespitose, but sometimes becomes submassive, expanding at the top in consequence of the more or less complete union of a certain number of corallites together. Usually the corallites tend to isolate rapidly by and after fissiparity, and their base develops but little with age. The calicular margins are irregular. The columella is rudimentary or none. The septa are strong, more or less exsert, regularly denticate above and granular laterally. The endotheca is well developed, and the epitheca is stout and strongly folded and reaches close to the calices. Growth by fissiparity and rapid isolation, or by gemmation and subsequent fissiparity.


Colony in the form of cespitose tufts. Corallites elongate, LINN. JOURN.—ZOOLOGY, VOL. XVIII.
cylindroid, covered with a well-developed complete epitheca. The calices are circular in outline and rather deep. Septa not numerous. The columella is rudimentary or absent. Endotheca not abundant.


This was formerly a genus, but it is clearly only a division of that called Thecosmilia.

The genus Caenotheca, Quenst., is ill defined, and relates, in all probability, to peduncles of Thecosmilioida.

III. Alliance MUSSAOIDA.

Caespitose Astræidæ with very dentated or spined septa. Growth by fissiparity. Corallites free at their sides or slightly joined. Calices unsymmetrical, rarely solitary, usually in series, free.

Genus Trachyphyllia, Ed. & H.
Genus Mussa, Oken.


Colony fixed, not very tall, composed of corallites which are free amongst themselves, wavy and swollen and contracted here and there. Calices as long valleys, much twisted and deep. Columella well developed, spongy, and lax. Septa numerous, exsert, striated, and highly granular on their sides; the free edge of the larger finely dentate, and lobed towards the columella, and the smaller have larger and narrower dentations. Endotheca exists. The wall has costae, which are strong, echinulate, and sublamellar. Epitheca rudimentary or incomplete.

Distribution.—Recent. Chinese, Indian, and Red Seas.

This genus = Manicina, according to Dana, Zooph. 1846, pl. 9. fig. 1.


The colony is tall, more or less caespitose. The corallites are united in short or long series, or free, and have the walls either quite ununited or very slightly united. Calices serial or circumscribed, unsymmetrical, and their centres are distinct and deep. The columella is spongy and well developed. The septa large,
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numerous, exsert, are spined or strongly toothed, especially near the calicular margin, and the systems are irregularly developed. Costæ spined. Walls striated, and either naked or presenting a rudimentary epitheca. Endotheca well developed.

Distribution.—Recent. West Indies, East Indies, Red Sea, Pacific, China.

The young individuals cannot be distinguished from simple Astræidæ of the Antillia type. It is a large genus, and may be divided into those with the corallites free and with calices circumscribed—Mussæ cymosæ; and those in which serial growth preponderates—Mussæ gyroæ.

The principal distinction of Mussa from the genus Symphyllia consists in the perfect union of the walls in this last-named genus.

5. Subfamily Astræidæ confluentes.

Astræidæ with entire or dentate, ragged, and spined septa, increasing by fissiparity and having excess of serial growth. Gemmation may occur. Corallites united by their walls, costæ, or by intermediate tissue, or free.

Alliances.

I. EUPHYLLIOIDA.
II. Eugyroida.
III. Symphyllioidea.
IV. Monticuloida.

Forty genera have been recorded, and revision leaves thirty-three. One old genus becomes a subgenus, and six lapse.

I. Alliance EUPHYLLIOIDA.

Colony cæspitose, foliaceous, or flabelliform. Septa dentate or entire. Calices in long series, sinuous or not; not united by their walls or costæ, but free.

Genus Euphyllia, Ed. & H.
Genus Glyphophyllia, E. de From.
Genus Rhipidogyræ, Ed. & H.
Genus Teleiophyllia, Duncan.
Genus Desmocladia, Reuss.

Genera absorbed:—

Plocophyllia, Reuss; Stenogyra, E. de From.; Fromentelia, Ferry.

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Syn. Plocliphyllia, Reuss; Stenogyra, E. de From.; Fromentelia, Ferry.

The colony is cespitose or subfoliaceous. The base increasing but little with age. The corallites increase fissiparously, and either some separate or others remain united in series of greater or less length. These series are always free at their sides and their calicinal centres remain distinct, except in very long series, where they are indistinct. There is no columella. The septa are very numerous, very thin and exsert, long from the axis to the margin, and often folded a little; their sides are smooth, and the free upper edge is entire. The wall is thin, naked, almost smooth inferiorly, and costulate near the calices. The endotheca is abundant, low down, and vesicular.

The genus is divided into two groups. In the first the colony is in the shape of a cespitose bush or tuft.


The second group has the colony in the shape of meandroid laminae of greater or less length.


M. de Fromentel founded the genus Stenogyra, Introd. à l’étude des Polyp. foss. p. 153 (1858); but it does not appear to differ from the second group of Euphyllia except in the thickness and granulation of the septa. I propose to absorb it in Euphyllia; and therefore the antiquity of the genus is put back to the Jurassic age. Reuss’s genus Plocliphyllia is absorbed in the second group of Euphyllia, the species having well-marked costæ to the base.


Colony in rather thin laminae, flabelliform, and free at the sides. Calice of one large, shallow series, straight or slightly bent, broad. Columella absent. Septa large and thick, dentate or lobed, thin towards the axis, and usually alternately large and small. Costæ dentate and granular, more or less covered with epitheca.


This genus is doubtfully separable from Euphyllia.

Colony flabelliform and lamellar, and folded more or less. The corallites are in one narrow flexuous series, and their calices are confluent and not distinguishable. The wall of the series is free. The columella is lamellar. The valley formed by the series is shallow, and the septa are exert, close, and entire at their free edge. The costæ are straight, and often suberistiform near the calicular margin. Near the base, the wall is either naked or has a rudimentary epithea. Endotheca abundant.

Distribution.—Fossil. Jurassic and Cretaceous of Europe.

Genus Teleiophyllia, Duncan, Proc. Geol. Soc. Lond. Nov. 18, 1863, p. 34, pl. iii. figs. 5 a, b.

Corallum long, low, narrow, and pedicellate. Calices confluent, forming a nearly straight series. Columella long, lamellar. Septa numerous, close, granular, serrate above. Costæ free and granular. Endotheca and epitheca well developed, and some exotheca between the costæ.

Distribution.—Fossil. Miocene: West Indies.


Colony large, massive, bushy or fasciculate. Corallites very long, spring from small bases, and enlarge in series upwards. Series long, gyrose, narrow, not united by their walls. Costæ small. Columella parietal and spongy. Calicinal centres not distinct.

Distribution.—Fossil. Eocene: Europe.

II. Alliance Eugyroida.

Fissiparous Astreidae with confluent serial calices; calicinal centres indistinct, except when young. Walls united directly, or indirectly by exothecal structures, forming a massive colony.

Tribe I. With entire septa.
Tribe II. With dentate or denticulate septa.

I. Genus Dendrogyra, Ehr.
Genus Pectinia, Oken.
Genus Eugyra, E. de From.
Genus Pachgygra, Ed. & H.

II. Genus Diploria, Ed. & H.
Genus Stiboria, Etallon.
Genus Manicina, Ed. & H.
Genus Meandrina, Ed. & H.
Subgenus Cœloria, Ed. & H.
Genus Leptoria, Ed. & H.
Genus Meandrastræa, Ed. & H.
Genus Brachymæandrina, Duncan.
Genus Stelloria, d'Orb.
Genus Platgyra, Ehr., absorbed. Cœloria becomes a subgenus.

Tribe I.

Genus Dendrogyra, Ehrenberg, Corall. des roth. Meer. 
p. 100 (1834).

The colony is massive and often columnar in shape, or simply convex. The corallites form tortuous series which are completely united by their walls. The calices are confluent and subdistinct in series, and are in shallow valleys between broad, flat, compact collines or ridges. The columella is formed of a series of compact swellings, or of small interrupted laminae, and is sometimes rudimentary. The septa are very thick, unequal, and close; they are entire. The walls on the ridges are very stout, and sometimes there is a slight depression along the axis of the ridge. Endotheca exists largely. The columns appear to be prong-shaped growths from large hemispherical masses.

Distribution.—Recent. Antilles. Other localities unknown.


The colony is pedunculate or sessile, grows but little at the base, and presents a large calicular surface. The corallites are united by their walls, and sometimes with some coenenchyma. The calices are in series, are indistinct; their valleys are very long and broad; and the columella is lamellary, and reaches from one end of the calicular series to the other. The septa are entire, stout, granular, and exsert. There are accessory laminae (pali?) before the septa of the last cycle attached to the columella. Ridges (collines) well developed, may show in-
Families and Genera of the Madreporaria.

mediate structure, united walls not very stout. Costæ subequal, crested, bifurcating or plain near the base, and more cristiform near the calicular surface. Epitheca rudimentary and inferior Endotheca exists.

**Distribution.**—Recent. West Indies, Brazils.


Colony pedicellate inferiorly, convex on the upper and enlarged surface. Corallites in series, intimately united by their walls. Calicinal valleys meandroid in the centre of the colony, and radiating and straight towards the circumference. Calices indistinct. Columella absent. Septa entire, arched above. Endotheca well developed. A folded and complete epithea.


The colony is fixed by a thick peduncle, and is enlarged above. It is composed of corallites united by a costal and exothecal coenenchyma, which is dense and greatly developed, and reaches up to a certain distance below the summit of the walls. Calicinal valleys are long, flexuous, narrow, shallow series. The columella is lamellary, very thin, and continuous. Septa are entire, thin, close; and the costæ are fine, subplane, and granular. The ridges have a space along their axis, which presents the top of the intermural tissue. Epitheca rudimentary or none. Endotheca exists.

**Distribution.**—Fossil. Cretaceous and Oolitic: Europe.

**Tribe II.**


Colony massive, spheroidal, hemispherical, or convex, with a large fixed base. Corallites in long series, united by their costæ, which are greatly developed, and between which there is some exotheca. The walls are thick, and in sections their upper edges are free and distinct from those of the neighbouring series. Hence the calicular valleys are separated by rather broad, convex, depressed collines marked on either side by costæ. The calicinal centres are quite indistinct in the very sinuous valley-series, which are deep.
The columella is spongy, essential, and well developed. The septa are stout and exsert, and their dentations are close, subequal.


Colony massive, adherent by a small surface, and in the form of thin laminae. Corallites in short series, which are more or less flexuous, united below, and separated above by a groove on top of the intercalicular ridge. Ridge resulting from the incomplete fusion of the corallite-walls. Calicinal centres indistinct. Columella absent. Septa dentate near the axis. An epitheca exists covering costæ of the common plateau.

*Distribution.*—Fossil. Oolitic: Europe.


Colony massive, free or pedunculate, broad-based, subhemispherical, tall, and convex or subconical or short. Corallites with their walls fused with those of their neighbours, except in young forms. Calicinal valleys long, broad and deep, united by simple or broad and furrowed collines. Calices with indistinct centres. Columella spongy, essential. Septa close, thin, strongly granulated laterally, the principal with a paliform lobe, and with the free edge divided by fine teeth, which are regular, close, and largest near the columella. The common plateau is furnished with costæ, which are delicate and dentate, and are partly covered by an epitheca, which is readily detached. Endotheca abundant, unequal.

*Distribution.*—Recent. Caribbean Sea.


Colony massive, dense, convex, gibbose, subplane or subspherooidal, largely fixed by its base. The series of corallites unite by their walls, which are compact, and produce long, simple ridged collines. The valleys are sinuous, long, but vary in length, depth, breadth, and meandroid nature. Calices mostly indistinct, some may be circumscribed. Columella formed by masses of spongy tissue well developed. The septa are close, parallel, their inner edge thickened and enlarged transversely; upper margin denti-
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To calculate, moderately granular laterally. Union of the transverse enlargements of neighbouring septa near the columella often occurs, and gives a paliform appearance. Endotheca and epitheca exist.


A group of forms possessing very variably-shaped calices was once scattered amongst four genera, namely, *Mceandrina*, *Lmk.*, *Platygyra*, *Ehr.*, *Astroria*, *Ed. & H.*, and *Cæloria*, *Ed. & H.*

Milne-Edwards and Jules Haime united the last two genera, abolished the genus *Platygyra*, and explained the distinct character of *Mceandrina*.

Hence in the *Histoire Naturelle des Coralliaires* the forms are all placed under the genus *Cæloria*. This is correct, because the characters of *Astroria* and *Cæloria* may be recognized on the same colony. M. de Pourtalès notices how difficult it is to distinguish forms of this genus which have very long calices from *Mceandrina*. He proves that some *Cæloria* must come within the genus *Mceandrina*. On the other hand, I have shown that the internal structures of *Cæloria pachychila* do not permit it to remain in the genus *Mceandrina*.

There does not appear to be any satisfactory reason for separating the genera *Mceandrina* and *Cæloria*; and I consider the latter to be a subgenus of the former. But there is no warrant, as the late Dr. Brüggemann (Phil. Trans. vol. clxviii. p. 571) thought, for resuscitating the name *Platygyra*, *Ehr.*

**Subgenus Cæloria, (genus) Milne-Edwards & Jules Haime,**


Colony massive, light, largely fixed at the base, hemispherical, convex, rarely subplane. The corallites in series are united by their walls, forming simple interserial ridges. The length of the valleys, which are usually deep, varies greatly, even in the same colony, from that of a simple bud in which the calicinal centre is distinct to that of several centimetres. In the series the centres are indistinct. Columella parietal, and formed by trabeculae from the ends of the septa, may be spongy. Septa thin, minutely dentate, and granular laterally. Endotheca abundant. In sections the fused walls are slender.


Colony massive, very largely fixed. Corallite series unite by their walls, and the ridges at the surface are always simple, usually thin. The valleys are long, straight, or very sinuous, or both in the same colony. Calicinal centres perfectly indistinct. Columella lamellar, lobed, and projects where free in the series. The septa are slightly exsert, unite to the columella by means of trabeculae, their dentations are small and irregular. Endotheca exists.


Colony massive, convex. Corallites in series united by their costae or by their walls. Corallite ridges (or collines) at the surface rather broad, with or without a delicate groove. Valleys numerous, short. Calicinal centres distinct, but united by septo-costæ. Columella small, lamellary.


Genus Brachymæandrina, Duncan.

Syn. Coeloria (pars), Ehr.

Colony large, low, attached, but extending beyond fixed point, slightly convex above. Corallites in long series, mainly radiating from the centre. Wall between the series rudimentary, discontinuous, and consisting of series of knob-like projections. Upper surface of ridges with exsert septo-costæ, spined and dentate, the upper wall-projections being visible. Calicinal centres not distinct. Columella small, essential, and receiving trabeculae from the septal ends, projecting as little processes between the septal ends. Septa stout, short, exsert, angular in outline. Endotheca well developed, and often extending between the discontinuous parts of the walls. Common plateau without a true wall, and with a strong folded epitheca, from which spring the septa and columella.

Distribution.—Recent. Red Sea, Mergui, Ascension.

Genus Stelloria, d'Orbigny, Note sur les Polyp. foss. p. 9 (1849).

Colony massive. Corallites in series united by their walls,
producing ridges at the calicular surface; these are simple, and are arranged in a radiating manner, and commence and end at the centres of star-like areas. The series are narrow, and the calicular centres are almost completely indistinct. Columella absent or rudimentary.


III. Alliance SYMPHYLLIOIDA.

Fissiparous Astræidae, with corallites in linear series with distinct calicular centres. Walls united directly or by costæ, or only free to a certain extent. Septa dentate or spined or entire.

Tribe I. With dentated septa.
Tribe II. With entire septa.

I. Genus Symphyllia, Ed. & H.
Genus Phyllogyra, Tomes.
Genus Dimorphophyllia, Reuss.
Genus Stibastrea, Etallon.
Genus Latiphyllia, E. de From.
Genus Mycetophyllia, Ed. & H.
Genus Ulophyllia, Ed. & H.
Genus Tridacophyllia, Blainville.
Genus Colpophyllia, Ed. & H.
Genus Scapophyllia, Ed. & H.

II. Genus Pleogyra, Ed. & H.
Genus Physogyra, Quelch.
Genus Phytogyra, d’Orb.

The genera Isophyllia, Ed. & H., and Gyrosomlia, Ed. & H., are absorbed.

Tribe I.


Syn. Isophyllia, Ed. & H.

The colony is massive, convex above or subplane. The corallites are in short or long linear series, which are united by their walls completely, or having a slight groove between them, or united below by the walls and close to the surface by costæ and exotheca. Calicular centres distinct in the series. Columella spongy. Septa numerous, much spined. Collines stout, tall, may be furrowed on the top. Endotheca abundant.

The genus is divided into groups of species characterized by the amount of mural fusion. In one group the walls are so united that no groove is seen on the “collines” between the corallites. In the second there is a narrow groove there; and in the third
group the corallites are united below by their walls, and near the calices by costae and exotheca.


In thus limiting *Symphyllia*, the genus is differentiated from *Mussa*.

M. de Pourtalès has shown that the genus *Isophyllia*, Milne-Edwards & Jules Haime, Pol. foss. des Terr. paléoz. &c. p. 87 (1851), is not separable from *Symphyllia*. It really only differs in that the dentations of the septa are subequal instead of being larger near the calicular margin. The species of *Isophyllia* must therefore be considered to belong to the genus *Symphyllia*.

After due consideration, it appears that the coral named *Symphyllia Etheridgei*, nobis, Suppl. Brit. Foss. Corals, pt. 3, p. 19, pl. vi. figs. 5–8, Oolitic Corals (Pal. Soc. Lond.), is correctly placed within the genus *Symphyllia* and not in the following.


"The corallum has a more or less depressed and massive form, and is composed of a series of leaf-like expansions, proceeding laterally from a parent corallite, the curled-up margins of which unite and form sinuous cristiform ridges, the line of union of which is very distinct in the younger examples, but much less so in the older ones. Gemmations take place successively amongst the elongated septa (which must be regarded as costae rather than septa), and generally towards the extremity of the leaf, and a more or less distinct line of calices is produced. There appears to be no intercalicular gemmation. . . . When lateral gemmation has ceased, the corallum only increases in height by the growth of the single or serial corallites upwards. There is a common basal wall, which is either naked or costulate, or has bands of rudimentary epitheca. It is by the folding inwards of this outer wall, and not by the growth of inner walls, as in *Isastræa* and *Latimaandra*, that the sinuous ridges are formed."

**Distribution.**—**Fossil.** Oolite: England.

This genus, according to its author, contains some remarkable anomalies. A study of the figures given (*op. cit.* pl. xviii. figs. 5–7) of a species shows its eminently Symphyllian aspect, and the visible calices are the result of fissiparity. I introduce the genus here with doubt as to its value. Portions of a colony only have been found.

Colony low, narrowly pedunculate, thin, with an undulating margin. A central calice, with numerous septa which are confluent with those of other calices in eccentric circles; short or long, straight or curved ridge-shaped elevations pass from the margin of the colony, and are marked with costae. The ridges enclose valleys with the eccentric calices, which do not appear to have columellæ. Costæ distinct.


Genus Stirastrea, Etallon, Etudes Pal. sur le Haut Jura, 1858; _E. de Fromentel, Introd. à l'étude des Polyp. foss. p. 164._

Colony expanded, pedunculate. Calices disposed in series, more or less regular and long, around a central calice, directed to the circumference of the corallum. Series tolerably distant and united by their costae. Septa thick and dentated. Columella papillary. Epitheca strong and folded.

_Distribution._—Fossil. Jurassic: Europe.


Colony large, pedunculate, increasing fissiparously. Calices large, in series radiating from a central calice to the edge of the corallum, separate, and covered with epitheca. Columella absent. Septa large and distant. Costæ exist. Endotheca abundant.

_Distribution._—Fossil. Jurassic: Europe.


The colony is massive and fixed. The corallites are united by their very thin walls. The calices are in series in valleys, which are shallow and more or less sinuous, the interseptal loculi being almost superficial; the calicinal centres are especially indicated by the direction of the septa, which are not numerous, barely exsert, wide apart, and strongly and unequally dentated. Columella rudimentary or absent. Endotheca vesicular and very abundant. Common plateau lobed, spinulose, and has a rudimentary epitheca.


Syn. Outophyllia, Ed. & H.

Colony massive, convex, low, or subplane above. Corallites united by their walls completely, and presenting narrow ridges between the long sinuous valleys of the calices, which are not very distinct. Columella spongy and slightly developed. Septa close, slightly exsert, granulated laterally, and deeply incised at the edge with long sharp dentations, which are largest near the columella. The endotheca is well developed, and the interseptal loculi are deep. The common wall has a more or less complete epitheca.


Colony tall, structures exceedingly thin. Corallites completely united by their very thin and often incomplete walls. Calicinal valleys subsinuous, long, broad, and very deep, separated by very thin, tall, irregular ridges. Calicinal centres fairly distinct. Columella absent or very rudimentary. Septa very narrow above, slightly exsert, not close, subequal, and dentated. The dentations are delicate, ascending and subequal; those near the centre of the calices are the largest. Common wall broken or festooned where free, with distinct, slightly projecting sinuous and spinose costae. Dissepiments very oblique, convex, abundant, forming large vesicles; but the interseptal loculi are rather shallow.

Distribution.—Recent. American seas, Indian Ocean, Amboyna, Banda, China, Pacific.


Colony massive, light and fragile, with a broad base, or pedunculate. Corallites united by their costæ, the walls never fusing at the calicular surface, where they are very slender. Calicinal valleys moderately long, flexuous, large, deep, with the calicinal centres more or less distinct. Columella rudimentary or none. Septa excessively thin, long, slightly exsert, and striated laterally; their free margin is delicately toothed and slightly excised near the middle. The common plateau has small lamellar costæ, broken up by dentations which are horizontal.

Distribution.—Recent. Caribbean Sea.

Colony massive, tall, cylindrical-conical, erect, dense. Corallites united by their walls. Valleys short, very flexuous and shallow, and their calicular centres distinct. Occasionally simple calices present. Columella small, deep. Septa few in number, exsert, very echinulate laterally, the larger enlarged towards the columella, where the dentitions are the longest. Interseptal loculi deep. Dissepiments simple and wide apart. Collines variable in length, costulated, broad.

Distribution.—Recent. Chinese seas, Japan.

Tribe II.


Syn. Gyrosmilia, Ed. & H.

The colony is composed of a series of long, thick, sinuous coral-lites, which unite more or less completely by their walls. The calicinal centres are moderately distinct. There is no columella. The entire septa are exsert, large, distant, nearly smooth, and often folded a little. The interseptal loculi are broad, almost superficial, or deep, and are closed below by large vesicular dissepiments. The costæ project but little, and disappear under a great development of mural vesicular tissue. Epitheca absent or rudimentary.

The genus may be divided into three groups of species:

1. Species in which the walls are incompletely soldered.
2. Species in which the walls are completely united.
3. Species with subcrisiform costæ, a rudimentary epitheca, and endotheca deep down in the interseptal loculi. This group includes the species of Gyrosmilia, Ed. & H., 1857, which is therefore absorbed.


Corallum compound, form massive, of very light structure, having the calicles in long, sinuous, more or less meandroid
series, with their walls fused throughout, so as to form a simple, very thin line of separation between the series. Calicinal centres generally distinct, indicated by the curving of the septa. Costæ almost entirely absent. Epitheca very slightly developed. Septa thin, fragile, very prominent, distant, edge entire. Columella absent. Endotheca well developed, vesicular; the dissepiments continuous between the septa from the centre of the calicle to the wall, very convex above, rather far apart above each other, thus forming wide interseptal chambers. Owing to this great development of vesicular endotheca, the series of calicinal centres are separated by wide ridges formed entirely by the thin wall and by the convex dissepiments which stretch from the centre to this thin wall.

Distribution.—Recent. Banda.

Genus Phytogya, d'Orbigny, Note sur les Polyp. foss. p. 6 (1849); Cours Élément. de Pal. t. ii. p. 163, fig. 301 (1852).

Colony formed of rather thick, low, horizontal branches, free at the sides and below, composed of series of short corallites, whose calicinal centres are indistinct, and whose wall is naked and costulate. The columella is lamellar and continuous. The septa are entire and unequal, large. Increase by fissiparity.

Distribution.—Fossil. Jurassic: Europe.

D'Orbigny considers this genus to be a Plerogyra from its large alternate septa, but it has a lamellar columella. The figure given by him shows a trifurcate branch.

IV. Alliance MONTICULOIDA.

Astræidæ with fissiparous and serial corallites, united by their walls, which form prominent collines radiating more or less, or monticules marked by costæ.

Genus Aspidiscus, Koenig.
Genus Hydnophora, Ed. & H.
Genus Monticulastræa, Duncan.


Colony subhemispherical, free. Under surface concave, and marked by a well-developed concentrically folded epitheca. Series of corallites radiating from a short, straight, polar colline to above the margin of the base; some series long, others between them
shorter. Corallites united by their walls, which form superficial, convex, radiating collines, with the septo-costae on their flanks, and crossing over the top, which is a semiridge. Septa denticulate, not in distinct cycles, close, small, moderately unequal. Calices indistinct. Columella absent. Costæ bound the margin of the base superiorly, being directed radially.

Distribution.—Fossil. Cretaceous: North Africa, Europe?


Colony massive and largely adherent. Corallites in series, united by their walls; their surface-ridges are simple, stout, compact, and their continuity is frequently, and often regularly, interrupted, giving an appearance of monticules separated by longitudinal and transverse valleys. Monticules marked with prominent costae. Calicinal centres indistinct. Columella absent. Septa barely exsert, thin, rather close, denticulated, meeting those of the opposite side of the series at their inner end, which is slightly enlarged and bifurcate. Dentations strongest near the axis of the valleys. Interseptal loculi rather deep. Endotheca simple, nearly transverse.


Colony massive or foliated, sometimes pedunculate, irregular at its upper surface, and the base is covered with crowded radiating costae. Collines small, short or long, often very irregular and costulate. Columella continuous around the collines, lamellar, separating the septal ends. Endotheca highly developed.


Astræidae forming massive or incrusting colonies. Corallites increasing by fissiparity, and sometimes by gemmation also, united by costæ or coenenchyma, or both, or by the walls only, not forming long series, or non-serial.
Milne-Edwards and Jules Haime formed a subgroup of compound or colonial corals, which they placed between the Astræidæ which multiply by successive fissiparity and those which increase by gemmation only, the corallites in both instances being united by their walls or by intermediate structures. This group, the Faviaceæ, has genera the individuals of whose species increase by fissiparous division, and do not form series or have meandroid calices, but grow upwards independently so soon as to give the appearance of budding having taken place. The septa are always dentated and not entire. Now this group has greater affinities with the fissiparous Astræidæ than with those which increase by budding, and, moreover, a critical examination of its genera shows that it is not homogeneous.

The genus *Meandrastraea*, d’Orb., clearly belongs to the alliance in which *Coeloria*, *Meandrina*, and *Leptoria* are placed, and it has been noticed therein.

The genus *Favia*, Oken, with its intermural cœnenchyma and fissiparous and almost serial calices, is an ally of *Dichocœnia*, the distinction of the septal-edge structure being insufficient to separate the genera into subfamilies.

On the other hand, *Goniastræa*, *Septastræa*, and *Aphrastræa* should form an alliance, and be placed amongst the fissiparous Astræidæ.

Eighteen genera are recorded, but only thirteen remain after revision.

*Alliances*—Favioida, Goniastræoida.

I. Alliance FAVIOIDA.

Massive fissiparous Astræidæ. Corallites united by costæ and cœnenchyma. Calices projecting but slightly or not at all above the common surface. Series very short, or only due to imperfect separation of the fissiparity. Septa entire or not.

**Tribe I. Septa entire.**

" II. Septa dentated.

I. *Genus Dichocœnia*, Ed. & H.
*Genus Barysmilia*, Ed. & H.
*Genus Stenosmilia*, E. de From.

II. *Genus Favia*, Oken.
*Genus Favoeïda*, Reuss.
*Genus Baryphyllia*, E. de From.
*Genus Spinellia*, D’Achiardi.
Genus *Phyllastrea*, E. de From.
Genus *D'Achiardia*, Duncan.
Genera absorbed:—
*Fiscicella, Dana; Ovalastræa, d'Orb.; Ellipso-
cenia, d'Orb.; Thalamocænia, d'Orb.; Parastræa,*
Ed. & H.

Tribe I.

The colony is massive, pedunculate, hemispherical, lobed, or plane, and the large upper surface presents numerous low callices, some circular in outline, others united in short series. Columella small, sublamellar, or subpapillary. Septa well developed, entire, usually exsert. Pali before most of the septa. Costæ rather large, spinulose, and merging into the granular, dense, and highly developed intercalicular cænenchyma, and they are seen to the base. Epitheca rudimentary. Endotheca exists. Increase by fissiparity and upward growth, accompanied by cænenchymal development.

*Distribution.*—Fossil. Miocene: West Indies.—Recent. East and West Indies.


The colony consists of a basal peduncle, or stout, tall trunk, on the top of which are variable numbers of corallites, separated by a cænenchyma which consists of layers of mural and costal growth. Calices slightly projecting, free, in more or less transverse, straight, and parallel series; they are subelliptical in shape, and the long axis is perpendicular to the direction of the series. Columella rudimentary or absent. Septa close and slightly exsert, entire. Costæ visible from the base and largest near the calices. Epitheca absent. Endotheca present. Increase by fissiparity and upward growth.


Colony massive, pedunculate, large, and convex above. Calices oval, often serial and unsymmetrical, distant, free to a slight
extent. Columella lamellary. Septa non-exsert, irregular, entire. Costæ visible near the calices and over the common wall of the peduncle. Peduncle growing by accumulation of layers of coenenchyma, by which the corallites are separated. Endotheca exists. Increase by fissiparity.

*Distribution.*—*Fossil.* Cretaceous: Europe.

**Tribe II.**


Syn. *Fissicella, Dana; Ovalastræa, d'Orb.; Ellipsocænia, d'Orb.; Thalamocænia, d'Orb.; Parastræa, Ed. & H.*

Colony hemispherical, convex, lobed, rarely subplane, fixed, free or incrusting. Corallites united by their costæ and by a cellular exotheca. Calices variable in distance, with free margins, subcircular, oval, deformed in outline. The columella is spongy. The septa are exsert, cross the wall, and the septo-costæ unite with those of other calices, or are separated by a groove. The septa are dentate, and the inner teeth simulate pali. Endotheca well developed. Epitheca often exists. Increase by fissiparity, the resulting corallites soon becoming separate.


Colony gibbous or flat on the free surface, massive. Calices rather distant and irregular in shape, shallow. Columella absent. Septa not numerous, unequal, spinulose, and usually thin; they extend beyond the calicular margin as costæ, and gradually merge into the coenenchymal surface, not uniting with those of other calices. A cellular exotheca between the corallites. Endotheca exists. Increase by fissiparity of the corallites at the calices.

*Distribution.*—*Fossil.* Tertiary of Java; and Miocene, West Indies.

*Genus Bærophyllia, E. de Fromentel, Introd. à l'étude des Polyp. foss. p. 189 (1858–60).*

Colony having a tall trunk, on the top of which the corallites
are free only for a small space. Wall naked, and covered with granular costae. The trunk grows by the superposition of layers derived from the costae of the corallites. Columella none. Septa slightly exsert, and regularly dentate.

Distribution.—Fossil. Jurassic and Cretaceous: Europe.
This genus corresponds to Barysmilia, but has dentate septa.


Colony in the form of a pedunculate lamina, attached, upper surface slightly convex. Corallites in long or short series, sometimes flexuous, not united by their walls above. Columella absent. Calicular centres distinct. Epitheca well developed. Intercorallite coenenchyma developed and uniting the corallites.

Distribution.—Fossil. Eocene: Europe.


Colony tall, in the form of dendroid tufts. Corallites united together by a well-developed exotheca. Calices oval, often deformed by fissiparity. Columella lamellar and short. Septa large, in six cycles, and continued beyond the calices as short costae, which lose themselves in a granular coenenchyma, which fills the intercalicinal spaces.


Colony large, massive, cylindrical or lobate. Corallites separated by a dense coenenchyma, which is granulate or semilamellar at the surface. Calices separate, circular or deformed, rising slightly above the coenenchyma, shallow. Columella flat, variable in development, papillar or not. Septa alternately large and small, barely exsert, dentated. Pali small and before the large septa. Costae rudimentary on the calices, not found over the coenenchyma, but occasionally existing on the flanks of the colony. Coenenchyma cellular, dense. Endotheca exists. Increase by extracalicular gemmation and sometimes by fissiparity.

II. Alliance GONIASTRÆOIDA.

Massive fissiparous Astræidæ. Corallites united by their walls, without coenenchyma, not forming serial calices. Septa dentated.

Genus GONIASTRÆA, Ed. & H.
Genus LAMELLASTRÆA, Duncan.
Genus APHRASTRÆA, Ed. & H.
Genus SEPTASTRÆA, d'Orb.


Colony massive, convex or lobed, dense. Corallites prismatic, and intimately united by their walls, which are simple, compact, and thick. Calices polygonal, rather deep. Columella spongy. Septa rather exsert, denticulate. Pali before all the septa, except those of the last cycle, denticulate. Endotheca abundant. Common plateau covered by a thin and complete epitheca. Increase by fissiparity and also by gemmation.


Genus LAMELLASTRÆA, Duncan, Quarterly Journal of the Geological Society ("Fossil Corals of the West-India Islands"), vol. xxiii. p. 19, pl. i. figs. 2 a, 2 b (1867).

Colony massive. Corallites united by their walls, and polygonal in transverse outline. Calices polygonal. Columella essential and lamellar, stout. Septa unequal, dentated. Pali absent. Endotheca scanty. Reproduction by fissiparity through the columella, a portion of it remaining as a large septum; also by marginal gemmation.

Distribution.—Fossil. Miocene: West Indies.


Colony convex and very light and cellular. Calices with simple margins, polygonal. Walls very thick, but entirely vesicular. Columella spongy. Septa exsert, dentate, with pali or paliform lobes before all the cycles of septa except the last. Endotheca vesicular and very developed. Increase by fissiparity. Common plateau with a complete epitheca.

Distribution.—Recent. Indian Ocean.
Genus Septastrea, d'Orbigny, Note sur les Polyp. foss. p. 9 (1849).

Colony massive, subplane, convex or subdendroid. Corallites united by their walls. Calices polygonal, and their margins soldered to those of their neighbours, forming simple ridges, or showing a delicate furrow of separation. Septa large. Columella rudimentary or absent. Pali absent. Fissiparity of calices.


CHAPTER IV.


Massive and foliaceous colonies. Corallites increasing by gemmation from the wall, from within the calice, and from intercorallite tissue. Corallites joined by costae, exotheca, or peritheca, or fused by their walls. Septa entire or dentated. Endotheca vesicular, rarely tabulate.

The Agglomerate Stylineae of Milne-Edwards and Jules Haime (op. cit. vol. ii. p. 232) were separated from their Astraeaceae, or massive budding Astreiidae, because these last had dentate septa.

In joining these groups into a subfamily no violence is done. As a subfamily the genera collect very naturally into two groups of Alliances. In one the corallites are separate, by their walls being united by costae, exotheca, or peritheca; and in the other the walls are fused entirely, sometimes not joined at the calicular surface.

Alliance I. Orbicelloida.
II. Placocenioidea.
III. Stylinoida.
IV. Phyllocenioidea.
V. Cyathophorida.
VI. Pentacenioidea.
VII. Elasmocenioidea.
VIII. Echinoporoida.

Group-Genus Galaxea, Oken.

Leptastrea, Ed. & H.
Sixty-eight genera are recorded, but revision admits of fifty-five only.

I. Alliance ORBICELLOIDA.

Massive budding Astræide, with the corallites united by costæ, exotheca or intermediate tissue. Columella spongy or papillary. Septa dentated. With or without pali.

Genus Heliastræa, Ed. & H.
Subgenus Ulastræa, Ed. & H.
Genus Brachyphyllia, Reuss.
Genus Cyathomorpha, Reuss.
Genus Solenastræa, Ed. & H.
Subgenus Cyphastræa, Ed. & H.
Genus Phymastræa, Ed. & H.
Genus Plesiastæa, Ed. & H.
Genus Antillastæa, Duncan.


The genera Agathiphyllia, Reuss, and Amphiastræa, Etallon, are absorbed.


Colony of various shapes, convex, subspherical, subplane, short or tall, adherent, incrusted, or free. Corallites united by continuation of the exotheca, which exists between and beyond the costæ beneath the surface, rarely by the costæ themselves. Walls usually, but not invariably, stout. Calices with free circular margins, more or less crateriform and elevated. Columella well developed, spongy, and not projecting, with a plane free surface. Septa exsert or not, with well-developed laminae, thicker near the margins than near the columella, where there is often a paliform tooth, dentate. Costæ well developed, passing over the surface for some distance; where seen on the wall of a corallite,
they are lamellar and well developed, often spiny. Endotheca well developed. Exotheca between and usually beyond the costa, well developed. Epitheca may or may not exist. Gemmation inframarginal, and from the area between the calices.


This genus has but one species, which has all the characters of Heliastraea, and its septa and costae are exceedingly echinulate. The species is Orbicella crispata, Dana, = Ulastraea crispata, Ed. & H., and these are now the synonyms of Heliastraea crispata, Dana, sp. The species is recent, and from the Indian Ocean.


Colony massive, short, convex, or subplane, fixed by a large base. Corallites large, united by their well-developed costae. Calices projecting above a common surface, which is formed of much exotheca; and the costae, large, separate, shallow, circular in outline. Columella well developed and spongy, or small and papillary where free. Septa numerous and regularly crenulated. Costae well developed, crenulated, confluent. Endotheca and exotheca well developed. Epitheca absent. Gemmation lateral and subbasilar, the colony increasing at its circumference.


Colony increasing by extracalicular budding, massive. Calices circular or broadly elliptical, projecting, well separated, margins rounded. Fossa large, shallow; columellary area circular and deeper than rest of fossula. Columella papillary, not projecting. Septa numerous, close; primaries and secondaries with an inner and outer paliform lobe; tertiaries with the same in a modified
degree. Costæ continuous with the septa, passing over the outer surface of the wall, rarely confluent. A marked depression between the corallites. Endotheca exists. Epitheca often in bands. The young colony consists of a few corallites comparatively without union, except by the base of the beds.

Distribution.—Fossil. Eocene: Europe.
This genus supersedes Agathiphyllia, Reuss.


Syn. Amphiastræa, Etallon.
Colony massive, tall or very short, with a convex or plane free surface. Corallites more or less prismatic, increase by extracalicular gemmation, and are joined together by short growths from costæ or from the wall, which are placed with some regularity in vertical series; elsewhere they are separate. An epitheca exists, which may environ the growths. Calices separate, unsymmetrical. Columella present. Septa variable in number, dentated. Costæ may or may not be apparent.

Distribution.—Fossil. Jura: Europe.—Recent. Indian Ocean; Mergui.

M. Etallon described the genus Amphiastræa in 1858, and M. de Fromentel introduced it in his 'Introd. à l'étude des Polyp. foss.;' but neither had studied the recent fauna; had they done so they would have found their fossil form to be of the same genus as Phymastræa, Ed. & H., 1848. Amphiastræa is absorbed.

Klunzinger, in his excellent work on the Corals of the Red Sea, unites the genera Cyphastræa and Solenastræa of Milne-Edwards and Jules Haime. Cyphastræa, Ed. & H., has all the characters of Solenastræa, and in addition the septal laminae are perforate, trabeculate, and cribiform, except close to the wall, where they are solid. Some modern Solenastræans have this character, and hence the proposed union. The fossil Cyphastræa costata, nobis, of the West-Indian Miocene has exceedingly cribiform septa, so that the distinction is not modern. The character has nothing to do with fossilization or with wearing, and it is general over the whole of the corallites of the species. But some fossil Solenastræans have solid, non-cribriform septa. There is not a generic distinction between the two forms; but Cyphastræa, which is more recent than Solenastræa, had better become a subgenus.

Colony massive but light, convex above, incrusting or tall, often gibbous, rarely plane. Corallites long or short, united by a well-developed exotheca, which extends beyond the small costae. Calices with free margins, which are usually circular, but sometimes unsymmetrical in outline. Columella spongy or feebly developed. Septa thin or stout, imperforate, denticulate. Endotheca fairly developed. Gremmation extracalicinal.


The generic characters are as in Solenastrea, but the septa are cribiform.

All so-called Solenastreans with cribiform septa must enter this subgenus, and all the recorded species of the genus, according to Milne-Edwards and Jules Haime.


Colony variable in shape, massive, convex or subplane above, with a naked and costulate common wall. The corallites may have thick or thin walls, be close or distant, and in the first instance may fuse inferiorly, and in the last may have a feeble exotheca between them. Calices shallow, circular and free. Columella spongy. Septa well developed, exsert, denticulate near the calicular edge. Pali well developed and in contact with all the septa which precede those of the last cycle. Endotheca very feebly developed. Costae and exotheca usually well developed. Epitheca absent. Gremmation occurs in the intercalicular areas.


In the Tertiary deposits of San Domingo are several species of Plesiastrea-looking corals (Duncan, "West-Indian Corals," Proc. Geol. Soc., Nov. 1863, p. 37 et seq. and pls. iv. & v.). There are
the usual attributes of *Plesiastræa* present, but the exotheca is in excess and there is an epitheca. The columella is papillary and more concentrated than is shown in the drawing (pl. iv. figs. 4a & 5).

This group includes *Plesiastræa distans*, *P. globosa*, and *P. ranea*, nobis.

Another species, *Plesiastræa spongiformis*, Duncan, *op. cit.* p. 39, pl. iv. figs. 6a, 6b, requires a new generic environment.

**Genus Antillastræa, gen. nov.**

Colony very convex above, pedunculate and attached. Calices close, barely projecting; fossula shallow. Columella cylindrical and flattened in young, styliform in old calices. Septa sub-equal, few, well developed. Pali before all cycles except the last. Costæ sub-equal, projecting, ending in exotheca, which is cellular and well developed. Endotheca scanty. Epitheca rudimentary.

**Distribution.**—Fossil. Miocene: San Domingo.

II. Alliance PLACOCŒNIOIDA.

Massive budding Astræidæ, with corallites united by costæ or by exotheca. Septa entire. Columella lamellary, or a septum reaches the axial space.

**Genus Placocænia, d'Orb.**

**Genus Placophora, E. de From.**

**Genus Pleurostylina, E. de From.**

**Genus Placocænia, d'Orbigny, Note sur les Polyp. foss. p. 7** (1849); Goldfuss, *Petr. Germ.* pl. 24. fig. 2.

Colony massive. Calices large, circular, or oval, rather distant, united by costæ. Columella lamellar and well developed, or in three papillæ. Septa entire, unequal, of the decameral or of hexameral type. Costæ thick and well developed, cristiform or granular. Gemmation between the calices.

**Distribution.**—Fossil. Oolite and Cretaceous: Europe.


Colony expanded, with a subplane surface formed by close laminae, slightly granular on the surface, on which the calices are free to a slight extent. Calices round or slightly oval, distant (5–8 mm.). Columella large, lamellar. Septa well developed
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and slightly undulating (entire?). There are 36 septa, unequal according to cycles.

_Distribution._—_Fossil._ Cretaceous: Europe.

**Genus Pleurostyla, E. de Fromentel, Introd. à l'étude des Polyp. foss. p. 201 (1858–61)._**

Colony in a convex mass or in extended laminae. Calices circular or polygonal in places. Septa entire, few; one large septum reaches the centre of the calice and swells there, after the fashion of a columella. Corallites united by their walls or by epitheca, which covers the walls. Common plateau naked and costulate, or presenting a slightly developed epitheca.

_Distribution._—_Fossil._ Oolite: Europe.

There is much that is unsatisfactory about this genus. The epitheca uniting the corallites and not covering the "plateau commun" is difficult to understand. Perhaps the author of the genus meant exotheca uniting the corallites.

**III. Alliance STYLINOIDA.**

Massive budding Astraeidae, with corallites united by their costae or by exotheca. Columella styliform. Septa entire and dentated. Pali may be present or not.

**Tribe I. With entire septa.**

*Genus Stylina, Lmk.*
*Genus Psammocenia, Ed. & H.*

**Tribe II. With dentate septa.**

*Genus Columnastræa, Ed. & H.*
*Genus Stylastræa, E. de From.*

_Heliocenia_, Etallon, appears to be a subgenus of _Stylina_.

**Tribe I.**


Colony in the form of subplane, convex, gibbous masses, or dendroid. The corallites are united by their costae and well-developed exotheca, or only here and there, and terminate at the free surface in little conical elevations more or less projecting. The calices on these elevations are for the most part circular, free at their margins, and usually distant. The columella is styliform and projects. The septa are exert, well developed,
and numerous or few. Occasionally some primaries are larger than others. Cycles hexameral, or octameral, or decameral. The walls are thick. Costæ well developed. The endothecal dissepi-
ments are simple or subvesicular. Gemmation is from the wall outside of the calice and from the intercalicular space.


*Helioœnia,* Etallon (genus), appears to differ from *Styлина* in having costæ which do not extend far from the calicular margins. The columella is sometimes a little compressed. These are hardly generic distinctions, and I propose to consider *Helioœnia* as a subgenus.


Colony massive. Corallites separated by exotheca. Calices unequally close and irregularly projecting, small. Columella styliform. Septa divided into six simple systems and there are six pali. Intercalicular area granular, and hardly striated with costæ.

*Distribution.*—*Fossil.* Ligsdorf (Haut Rhin), Europe.

**Tribe II.**


Colony massive, convex, lobed, or subdendroid. Corallites united by costæ. The calices are moderately deep, circular, and projecting, and have their margins free. The columella is styliform and not much developed. The septa are thin, arched where free, denticulate. There are pali which form a single crown. The costæ are well developed. The gemmation occurs from the intercorallite tissue.


E. Pratz has shown that the septa of the species of this genus are not entire at the free edge.
The following genus is not satisfactory in the face of the possibility of *Styлина* having dentate septa:—

**Genus Stylastræa, E. de Fromentel, Introduct. à l'étude des Polyp. foss. p. 223 (1858–61).**

Colony convex, massive. Corallites circular in outline and united by a considerable development of the costæ. Calices projecting, circular. Columella round, styliform, and well developed. Septa strongly and regularly dentated. Costæ well developed, and pass towards those of the neighbouring calices without being actually confluent. Gemmation between the calices.

*Distribution.—Fossil. Cretaceous: Europe.*

IV. Alliance **PHYLLOCŒNIOIDA.**

Massive budding Astreidæ. Corallites united by their costæ, with or without the intervention of exotheca. Columella absent. Endotheca vesicular or tabulate.

**Tribe I. With entire septa.**

**Genus Phyllocœnia, Ed. & H.**

**Genus Convexastræa, d'Orb.**

**Tribe II. With dentate septa.**

**Genus Adelastræa, Reuss= Confusastræa, Ed. & H.**

**Tribe I.**


Colony convex, subspherical, with a large base, or pedunculate, or subplane. Corallites costulate and united by much exotheca, parallel or divergent. Calices circular or deformed, free at the margins, and projecting. Columella absent or rudimentary. Septa large, entire, exsert, and well developed. Costæ well developed, prominent, uniting calices. Endotheca abundant and often vesicular. Gemmation occurs between the calices.


The form described by Laube from St. Cassian is not of this genus. This is proved by the magnified view of the section. There is a double wall to the calice, one marginal and the other beyond. Neither is the form a species of *Cyathocœnia*, Duncan. It comes within the Elasmocœnioid alliance (see p. 115).

Colony convex, gibbous, or dendroid. Corallites united by their well-developed costae. The walls are cylindrical, and their calicular margin is hidden by the septo-costae, which are few in number, straight, exsert, and slightly granular. The septa are few in number, continuous with the costae, and these last do not all reach from calice to calice, and there is often an intercalicular furrow. There is no columella.


Tribe II.


Syn. Confusastrea, d'Orb.

Colony massive, with a plane or convex surface. Corallites intimately united by their costae, which sometimes are confluent. Calices large and very slightly projecting, shallow, with margins rounded off, resembling circular bourrelets. Walls of calices rudimentary. Polygonal grooves between the calices indicating the junction of corallites. Septa well developed and uniting by their inner edges without the intervention of a columella.


The unclassical word Confusastrea was abolished by Reuss.

V. Alliance CYATHOPHOROIDA.

Massive Astræidæ, increasing by gemmation. Corallites separated by coenenchyma or exotheca. Columella absent or present. Dissepiments or transverse tabule.

Genus Cyathophora, Mich.
Genus Areacis, Ed. & H.
Genus Psammophora, E. de From.


Colony massive, convex. Corallites united by their costæ and
FAMILIES AND GENERA OF THE MADREPORARIA.


Colony massive and Astræiform. Calices circular or deformed, separated by coenenchyma. Coenenchyma spongy and echinulate on the surface. Walls of corallites distinct from the surrounding coenenchyma. Septa unequal, entire, principal uniting in the axis. No columella. Endotheca rudimentary, or as well-developed horizontal tabuliform processes.

Distribution.—Fossil. Eocene: Europe, Borneo.


This genus was created for Stylophorinae with a papillary columella, before such a thing was found. M. de Fromentel subsequently found a coral in the d’Orbigny museum which presented the characters of the Stylophorinae and also a papillary columella.

The figures given (pl. 90. fig. 4) show a wretched specimen. However it has a compressed, thin, laminate form with calices on both sides. There are four cycles of septa and fine costæ. Calices wide apart.

It is not one of the Stylophorinae, and I place it here with some doubt.


VI. Alliance PENTACŒNIOIDA.

Agglomerate Astræidæ, increasing by gemmation. Corallites united by the costæ, more or less free above. Primary septa five in number.

Genus Pentacœnia, d’Orb.
Genus Acanthogœnia, d’Orb.

Genus Pentacœnia, d’Orbigny, Rev. et Mag. de Zool. p. 175 (1850).

Calices with their margins either subcircular and free, or poly-Linn. Journ.—Zoology, Vol. XVIII.
gonal and united. Five principal septa. No columella. Calices from 1 to 2 millim. broad.

*Distribution.—Fossil.* Cretaceous (Neocomian): Europe.


Colony massive. Calices circular, with free margins and a styliform columella. Septa in three cycles, but there are only five primaries.

*Distribution.—Fossil.* Cretaceous (Neocomian): Europe.

VII. Alliance ELASMOGENIOIDA.

Agglomerate Astraeidæ, increasing by gemmation between the calices. Corallites united by a second wall, with or without exothecal ceñenchyma.


Colony tall, or in a rounded mass. Corallites with two walls—one projecting and hidden by the septa, but indicated by a circular bourrelet; the other united to the walls of the neighbouring corallites separating the costæ, and variable in its outline. Columella styliform and strong. Septa entire, thick, and continuous with the costæ. Gemmation?

*Distribution.—Fossil.* Oolite and Neocomian: Europe.


Colony in thick laminæ. Corallites immersed in the ceñenchyma, which is compact. Calices circular, filling up below. Columella small, spongy. Septa spinulose, straight, the larger joining the columella, continuous with costæ which occupy the outer calicular spaces, and merge into those of neighbouring calices. Gemmation peripheral.

*Distribution.—Fossil.* European Oolite.
D'Achiardi describes a single species from one specimen, which he considers the type of this genus, *Diploceniastræa*. He considers that this genus, by having denticulate septa and a spongy columella, differs from *Diplocenia*. Unfortunately the internal structures of M. d'Achiardi's specimen are not visible, notwithstanding the perfection of the superficial septa, costæ, and columella. The form is described in 'Coralli Giurassici dell'Italia Settentrionale,' Pisa 1881, p. 41. I introduce the genus into the Alliance with a little doubt.

**Genus DiPLOTHECASTREÀ.**

Syn. *Diplocenia* (non E. de Fromentel), Duncan, West-Indian Corals, Quart. Journ. Geol. Soc. vol. xxiv. (1867), p. 20, pl. i. fig. 3.

The colony is massive. Corallites tall, crowded, polygonal, united by a well-developed common wall which projects at the calicular surface. Within the polygonal wall is a space occupied by coenenchyma of oblique vesicular dissepiments, and within that an internal wall, whence arise the septa. This calicular wall is circular in transverse outline, wavy and thin. Columella lamellar, and often joined to one of the septa. Septa wide apart, unequal; cycles imperfect. Endotheca slight, within the inner wall. Gemmation occurs from the coenenchymal space.

**Distribution.**—Fossil. Miocene: West Indies.

**Genus KOILOCENÀ, Duncan.**


Colony convex or subplane above, massive, low. Corallites with an intermediate structure which is usually a second wall to each, and which may fuse with those of others. Here and there intermediate exotheca. Calices with well-developed costæ, which in section do not touch those of other calices. Septa well developed, but short. Axial space large, hollow, and without a columella.

**Distribution.**—Fossil. Trias (St. Cassian): Europe.

This genus is founded to receive *Phyllocoenia decipiens*, Laube. It is very well defined by the absence of columella, the short septa, and the double wall, as seen in sections. Mr. Tomes mistook the superficial view for *Cyathocænia*, nobis, in a paper read before the Geological Society of London and not yet published.

Colony in stumpy or finger-shaped masses. Calices irregularly shaped and sized, surrounded by coenenchyma, on which the margins are raised and often grooved. Columella none. Septa unequal, some very thick and others very thin, entire, non-exsert, feebly granular. Coenenchyma cellular, apparently of exotheca forming the ends of feeble costae. Endotheca well developed, oblique, and uniting the ends of the larger septa around the axial space. Gremmation extracalicular.

*Distribution.*—Fossil. Eocene: Java.


The colony is convex and gibbous, or dendroid. The corallites are united by an abundant coenenchyma formed of mural expansions and exothecal dissepiments. The calices are distant, circular, and projecting. There is no columella. Septa exsert and well developed; but there are never more than 12, and often only 6, and they are unequal, there appearing to be three simple systems of them.


Colony convex, more or less massive, or sublamellar. Corallites wide apart, and united by mural expansions which are granulated and feebly striated where free, and which are formed by layers of vesicular exotheca or coenenchyma. The walls are thick; the septa are irregular and very granular. There is neither columella nor pali. Calices circular or subelliptical. Costae feebly developed.


VIII. Alliance ECHINOPOROIDA.


Genus *Echinopora* (pars), Dana.
Genus *Acanthopora*, Verrill.
Genus *Physophyllia*, Duncan.
Milne-Edwards and Jules Haime introduced a subfamily of Astreidæ to receive the genus *Echinopora*, Lamarck and Dana. Verrill has shown that this genus is not homogeneous, and that some species should be associated with the family Fungidæ, and one with the Astreidæ proper.

The following is the diagnosis of Dana as given by Milne-Edwards and Jules Haime, in whose work the early synonymy is given.


The colony is thin, adhering in the middle, and extending on all sides in foliaceous laminae which are ordinarily lobed. The common plateaus are costulate radially, and have a rudimentary epitheca. Corallites very short and greatly spined, united by an echinulate coenenchyma. The calicular margins have the shape of circular and more or less projecting bourrelets. The free edges of the septa are very spined, the strongest teeth being near the columella, where they frequently simulate pali. Columella spongy. Endotheca slightly developed.


This diagnosis still holds good for some species which should, however, enter the Astreidæ.

But *Echinopora aspera*, Ellis & Solander, has been shown by Verrill to belong to the Fungidæ; and he has established the genus *Trachypora* for it. It appears that this name had been already applied to other forms before Verrill gave it; and Klunzinger suggests the name *Echinophyllia* instead. *Echinopora horrida*, Dana, which Milne-Edwards and Jules Haime state to be a dendroid variety of *Echinopora hirsutissima*, Ed. & H., 1850, has been made the type of the genus *Acanthopora*, Verrill, because its polyps differ from those of other *Echinopora*, and because the calices become filled up as in *Oculina*.


Colony ramose, solid, the cells being filled as in *Oculina*. Costæ represented by series of spines.

This short diagnosis hardly suffices. The corallites are short, having the shape of large and strongly spined button-shaped prominences. Costæ very thick, subequal, separated by deep
spaces in which there may be small costæ. Very spinulose. Cali-
cular fossa moderately deep. Columella subpapillary. Septa exsert, with the free edge very incised. Steroplasma filling much
of the calice with age.

Distribution.—Recent. Indian Ocean.

Genus Physophyllia.

Colony large, spreading, pedunculate, foliaceous, folia united
and presenting faint broad ridges, which are crossed by septo-
coste. Corallites low, wide apart, arranged more or less in
concentric circles. Calices distant, large, sunken, deep, elongate,
forming series of 2 to 4, or circular. Fossa large and deep. Columella small, trabeculate. Septa large, exsert, spinulose,
especially near the axis, unequal, wide apart; ending in septo-
coste which are confluent with those of the calices on either
side, and some of which pass over broad ridges radially. Inter-
calicular surface large, gibbous or ridged, formed of convex
vesicular endotheca; this endotheca fills up the interseptal
locii also, and is greatly developed. Calices on one side of the
colony only. Common wall inferior, costulate to the base. Costæ
distinct, spinulose. No epitheca. Fissiparity occurs, and also
gemmation.

Distribution.—Recent. Locality ?

There is but one specimen in the British Museum of this
genus, but it is a very marked form. The late Mr. Brüggemann
gave the form a manuscript name, but did not describe it. The
classificatory position is doubtful, but I place it here.

GROUP. Massive budding Astraeidae. Corallites united by peritheca.

Genus Galaxea, Oken (1815); amended in Milne-Edwards &

Colony fasciculate and submassive. Corallites elongate, with
stout walls marked with feeble costæ. Calices circular or de-
formed. Columella absent or rudimentary. Septa usually very
exsert, lanceolate, often slightly granular on their sides, entire.
Endotheca moderately abundant. A peritheca or vesicular inter-
corallite growth is abundant, and joins the corallites and their
ends together. It reaches up to different distances from the
calicular margin, so that the upper ends of the corallites pro-
ject above. Gemmation subbasilar and from the wall.

Distribution.—Recent. Red Sea, Indian Ocean, Pacific.—Sub-
fossil in raised beaches.
FAMILIES AND GENERA OF THE MADREPORARIA. 119

Group-Genus Leptastrea.


The colony is massive, or else incrusts, and is subplane or convex at the free surface. Corallites short, with very dense muro-costal structures, which become compact and fused. Calices with distinct margins, close, shallow. Columella papillary. Septa thin, close, exsert, margin subentire, granular; inner edge trabeculate, with ascending denticles. Costæ small, visible between the calices. Endotheca feeble. Gemmation extracalicular; sometimes fissiparity occurs.

Distribution.—Recent. Indian Ocean and Red Sea.

It appears that the incrusting species extends by a kind of stoloniferous gemmation.—Duncan, Proc. Linn. Soc. 1884.

IX. Alliance Barysastreaoida.

Agglomerate Astraeidæ, increasing by marginal and submarginal (within the calice) gemmation. Walls fused, but thick, and often subcellular. Septa denticulate.

Genus Barysastrea, Ed. & H.

Genus Acanthastrea, Ed. & H.


The colony is convex or subgibbous, very dense and compact. The corallites are united by their very thick and solid walls. Calices shallow, close, small, polygonal, and barely separated by shallow grooves. Columella subpapillar above, compact and large low down. Septa very thick, close, and not much toothed. Endotheca slightly developed. Internal cavity gradually filling up inferiorly. Gemmation submarginal.

Distribution.—Recent. Locality?


The colony is in the shape of a subplane or convex mass. The corallites, short or tall and broad, are united by their walls which are subcellular. Calices subpolygonal, with broad spinous margins, with or without irregular superficial grooves. Columella parietal or rudimentary. Septa exsert, stout, and much spined, the largest of the spines being the most external. The upper part of the lamina is trabeculate below the spinous teeth. Endo-
theca greatly developed. Epithea complete. Gemmation sub-marginal and marginal.


X. Alliance ASTROCÆNIOIDA.

Agglomerate Astreideae, increasing by extracalicular, marginal, and lateral gemmation. Columella variable. Pali may or may not exist. Corallites united by their walls, with sometimes a cœnenchymal development. Septa denticulate or entire.

Tribe I. With denticulate septa.

Genus Astroccenia, Ed. & H.
Genus Cyathocænia, Duncan.
Genus Stephanocænia, Ed. & H.
Genus Narcissastrea, E. Pratz.

Tribe II. With entire septa.

Genus Stylocænia, Ed. & H.
Genus Haldonia, Duncan.

Genera absorbed:—Cœnastrea, Etallon; Stephanastrea, Etallon.

Genus described and not placed:—Bathyccenia, Tomes, probably = Stylocænia.

Tribe I.


Syn. Cœnastrea, Etallon (1864).

Colony variable in shape, massive, gibbous, lamellar, dendroid or discoid, compact, sometimes incrusting. Corallites prismatic or cylindrical, uniting by their walls, which are thick and simple; cœnenchyma rare between them. The calices are polygonal, irregular or regular in shape and size, and their margins are ordinarily simple. The columella is styliform and more or less projecting. The septa are dentated minutely, few in number, and often irregular in their cyclical arrangement. Gemmation marginal and lateral, or marginal and circumferential only.


Genus Cyathocænia, Duncan, Brit. Foss. Corals (Zone of Amm. angulatus), Pal. Soc. Lond. 1867, pt. iv. no. 1, p. 27.

Colony fasciculate or gibbous, or incrusting. Corallites
united by their walls and by more or less coenenchyma, polygonal, and often cylindrical. Calices small. Columella absent. Septa finely dentate. Costæ not confluent. Gemmation superior and marginal.


The presence of structure between the walls is decided; but it is very slight, and not sufficient, considering the other characters, to remove the genus out of this Alliance. The nature of the calicular walls and the irregular septal distribution of the genera Aplocœnia and Pentacœnia distinguish them from the above. The genus is distinct from Koilocœnia.


Syn. Stephanustrœa, Etallon, 1864.

Colony massive, convex, lobed, or pedunculate, or incrusted or dendroid. Corallites united by their walls, which are compact and thick. Calices generally polygonal, with simple margins. The columella is styliform and slightly projecting, but always well developed. The septa are slightly exsert, denticulate slightly, well developed, granular at the sides. There are pali before all the septa except those of the last cycle. Gemmation marginal and lateral.


Colony massive, composed of long, polygonal corallites united by their walls, without costæ and coenenchyma. Calices more or less deep. Septa toothed. Pali in one crown. Columella? Dissepiments abundant.


The genus will be better understood when other types of it are found. It is allied to Stephanocœnia.

Tribe II.


Colony massive, incrusted, convex above. Corallites united by their walls. Calices small, circular in outline, raised, deep, and widely open, separated by a slight depression. Columella
absent. Septa unequal, slender, not exert, low vertically, entire. Pali just within the primaries, small, distinct, narrow, granular, ridged. Costae well developed, and do not unite with those of other calices. Endotheca abundant, closing the calicular fossa as if by tabulae.


The colony is in the form of a thick lamina with the base covered with a well-developed epitheca. The corallites are united by their walls, which are thin and prismatic. The calices are polygonal, with simple margins. The columella is styliform and projecting. The septa are thin, not numerous. At some of the angles where calices join, there are erect columns, narrow-grooved and various in height according to the species. In perfect forms these columns are either pointed at the top, or bear an aborted calice, the groovings and intermediate ridges being the intercostal spaces and costae. Gemmation marginal.


Mr. Tomes has described two species of a genus which he has diagnosed and named *Bathyœnia*. The habit of the forms is that of *Stylocœnia*; and the nodular elevations between the calices are clearly in relation to gemmation. The descriptions and figures of the Stylocœniens from Sind, Pal. Indica, ser. xiv. (‘Fossil Corals and Alcyonaria from Sind,’ 1882), were doubtless unknown to Mr. Tomes. The worn condition of the calices of the *Bathyœnia*, which are very rare corals, is evident; but the columella, although ragged in transverse outline, may have been styliform.

I mention the genus, but do not place it definitely.


Colony turbinate, attached. Corallites united intimately by their walls. Investing common wall costulated, and has epitheca. Calicular surface convex. Calices more or less pentagonal, or rounded and deep. Septa entire, thin, project but little into the calice, rise in obtuse points where they meet those of other calices on the wall. Primaries meet to form a ragged columella. Calicular angles with obtuse points. Gemmation at obtuse points.

**Distribution.**—**Fossil.** Oolite: England.
XI. Alliance Isastræoida.

Agglomerate Astræidæ, increasing by gemmation within the calice Walls of corallites fused. Occasionally the fusion is deficient near the calice or low down. Septa denticulate or entire.

Tribe I. Septa denticulate.
  Genus Isastræa, Ed. & H.
  Genus Prionastræa, Ed. & H.
  Genus Placastræa, Stol.
  Genus Elysastræa, Laube.
  Genus Lepidophyllia, Duncan.

Tribe II. With entire septa.
  Genus Aplocenæa, Ed. & H.
Genus absorbed:—
  Metastræa, Ed. & H.

Tribe I.


Colony massive, convex, gibbous, subdendroid or incrusting. Corallites prismatic, and intimately united by their walls, which are simple throughout. The calices have a polygonal outline, which is simple and ridge-like. The columella is rudimentary or absent. The septa are thin, close, granular, denticulate. Endotheca fairly well developed. The common base is marked with fascicles of costæ, and has a thin epitheca. Gemmation calical and submarginal. Occasionally the calicular walls are slightly apart near the calice.


Syn. Metastræa, Ed. & H.

Colony large, massive, convex, with or without ascending lobes, subplane, hemispherical, gibbous. Corallites close, prismatic; their walls are united above but usually not below. Calices polygonal and deep, or not large; margins simple or in crests. Columella spongy, variable in development. Septa thin, narrow above, close, granular, and very finely serrate, the longest teeth
being near the columella. Endotheca well developed. Epitheca thin and complete.


The genus *Metastraea*, Milne-Edwards and Jules Haime, Hist. Nat. des Corall. vol. ii. p. 525, cannot be considered in the light of a genus when contrasted with *Prionastrea*. The only distinction is one of growth, and in *Metastraea* the walls are compact in their whole height. This compactness is seen in portions of species of *Prionastrea*.

*Metastraea* is absorbed in *Prionastrea*.


Colony massive, convex. Corallites united by their walls, which are fused. Calices irregularly disposed, close, polygonal, separated by ridges. Columella lamellar, solid, with a finely granulated upper edge. Septa numerous, close, finely denticulate and granular, confluent over the narrow calicular wall.

Distribution.—Fossil. Cretaceous of Southern India.

This genus resembles *Isastrea*, but there is the addition of a lamellar columella. The method of increase is not given by Stoliczka; but it certainly was not fissiparous, as in *Lamellastraea*, Duncan.


Colony cespitose, subplane above, composed of corallites springing from a base of greater or less width, united by their walls or by costae to a certain extent high up. Calices irregular in shape, usually united to their neighbours by a broad surface. Columella rudimentary or spongy. Septa unequal, flexuous, serrate. Endotheca abundant. Gemmation within the calices. Epitheca exists.


Colony flat or tall, with corallites overlapping but joined by their walls. Calices more or less circular and deformed, widely open. Columella absent. Septa dentate. Gemmation in the centre of the calices. Epitheca distinct. Endotheca present.


Tribe II.


Colony thin, with a convex surface. Corallites united by their walls, and prismatic. Calicinal walls very thin, and in zigzags. Calices superficial, unequal, large. Axial space empty and small. Septa thick, unequal, straight, smaller internally, entire; systems irregular.

Distribution.—Fossil. Eocene: Europe.

XII. Alliance LATIMÆANDROIDA.

Agglomerate Astræidæ, increasing by calicular gemmation. Calices single or multiple, in valleys. Corallites united by their walls completely or incompletely at the surface. Septa denticulate. Endotheca present.

Genus Latimæandra, Ed. & H.
Genus Heterogyra, Reuss.

Genera absorbed:—Chorissastra, E. de From.; Microphyllia, d'Orb.; Cormophyllia, d'Orb.


Syn. Microphyllia, d'Orb.; Cormophyllia, d'Orb.; Chorissastra, E. de From.

Colony massive, variable, convex, with a broad or narrow base, or pedunculate or subturbinate, subplane, or subdendroid. Corallites united by their walls, fusion not always perfect. Calices some circumscribed, others in short series with their centres distinct. Columella rudimentary. Septa numerous, thin, close, laterally granulate; dentations fine and subequal. Common wall costulate, without epitheca. Endotheca scanty. Gemmation calicinal and submarginal.

The genus *Latimæandra* is a very large one, and follows the rule which is noticed under such circumstances; it is ill defined from some others. During the growth of vigorous individuals remarkable changes occur in the arrangement and relation of the calices. The union of the elongate calices by their walls with their neighbours is the completion of the generic definition; but it sometimes does not occur everywhere in the same large corallum or colony, and here and there the walls are not united, there being a distinct crevice between them. Were a fossil specimen to be broken and part of it to retain the true Latimæandroid structure and the rest to show the incomplete union, the latter would be considered generically distinct from the former by M. de Fromentel, and would be called *Chorisastrea*.

Now A. E. von Reuss described and figured, in his description of the Fossil Anthozoa of the strata of Castelgomberto*, beautiful specimens of *Latimæandra circumscripta*, *L. marchelloides*, and *L. daedalea*, in which the true character is present; and also equally well-preserved types of *L. discrepans* and *L. dimorpha*, in which the walls are separate (plates 5–8). No one can doubt that all these forms belong to one genus, and that there is no necessity for the experiment of introducing *Chorisastrea* to separate the last from the first.

The same author carried the matter further, for he describes (op. cit. p. 20, pl. v. figs. 2–3) a type in which there are calices of the true Latimæandroid type, others separate and Chorisastrean, and many others which are circular in outline and free all round to a considerable depth, looking like a combination of *Thecosmilia*, *Latimæandra*, and *Chorisastrea*. The specimens are large, and their habit of irregular growth and irregular calicular junction is most suggestive in a classificatory sense, because there is a constant springing up of independent buds which sooner or later become serial in their calices, and at last unite by their walls. The colony is never entirely Latimæandran, Chorisastrean, or Thecosmilian.

It is the independence of the circular calices, which is so unlike anything Latimæandran, that characterizes amongst other things *Heterogyra*, Reuss. The type *H. lobata*, Reuss, cannot possibly come within the genera already mentioned.

M. de Fromentel writes (‘Introd. à l'étude des Polyp. foss.’ p. 163), “Nous avons séparé des Latiméandras des fossiles qui présentent bien comme celles-ci des calices réunis en séries, mais dont les séries restent libres par leur côté et ne sont même pas unies des côtés. Nous avons réuni les quelques espèces qui présentent ce caractère sous le nom générique de Chorisastræa.”

Hence it is only to corals with serial calices that Chorisastræa can apply.

In the Pal. Franç., Zooph. Terr. crét. p. 445, M. de Fromentel states that the genus Chorisastræa, E. de F., 1858, includes the Syrrastræans which increase by budding, but whose series rest free at the summit, and are not united dorsally or by their costæ.

It is remarkable that M. de Fromentel should classify Latimæandra with corals having serial calices. E. Pratz has pointed out that this is an error. Latimæandra has not what M. de Fromentel calls a Syrrastræan type of growth, but a Disastræan or Polyastræan (see Latimæandra Flemingi, Ed. & H.). Latimæandra are modified Isastræans; and these last, like Latimæandra, often have their calicular walls separated for a short distance downwards.

Many genera have the walls united, except close to the calices, and during growth union takes place there.

Heterogyra, Reuss, cannot be included in the so-called genus Chorisastræa. I do not think it advisable to retain this last genus.


Colony massive. Corallites increasing by gemmation and irregular serial calicinal growth, united inferiorly, free superiorly. Calicular surface irregular, showing nearly circular and very deformed calices, free from the calicular margin down to a certain depth. Septa numerous, denticulate. Columella absent. Endotheca exists, but an epitheca does not cover the costæ.

Distribution.—Fossil. Eocene: Europe.

The alliance of this form is with the Latimæandroids and not with the Symphyllioida. Its importance is considerable in relation to the so-called genus Chorisastræa, E. de From., and the morphology of Latimæandra also.

The genus Merulina was placed by Milne-Edwards and Jules
Haime as a unique genus or a group of Pseudo-Fungidae, because of the Agaricia-like appearance and perforated wall. Dana placed the genus in the Astraeidae, and I think that is its proper position; for the perforations are not more than growth-apertures and do not always exist; and in forms where there are calices on both sides of the common wall there are no perforations. I do not retain the group Pseudo-Fungidae in the sense of M.-Edwards and Haime.

Group-Genus Merulina.


Colony fixed, foliaceous, frondiform, folded, or subdendroid. Corallites in linear series with fused walls, having simple ridges crossed by septo-costae. Calices with centres distinct, in small series, confluent by their septo-costae. Columella slightly developed, spongy or tubercular. Septa stout, sharply denticulate, trabeculate, here and there few, granular at the sides. Common plateau, when it exists, is striate and echinulate along long and somewhat diverging lines, bound as it were in long groups, between which are perfect foramina near the edge of the colony, and deep depressions like slits elsewhere. Where the colony is not foliaceous and is solid, there is no common plateau, and there are no perforations, the calices being on all sides. Endotheca scanty, often only seen at the columella. Gemmation submarginal and calicinal.

Distribution.—Recent. Indo-Pacific, Pacific Ocean.

XIII. Alliance Plerastræoida.


Genus Plerastræa, Ed. & H.
Genus Holocentia, Ed. & H.

There is some difficulty in placing the next genus, Plerastræa, in its proper classificatory position. According to Milne-Edwards and Jules Haime its position is next to the genus Clausastræa, d'Orb., in the Astraeidae. But in a species I described from the Eocene of Sind I found synapticula. By a printer's error this form has been termed Plerastræa.) The figure given by Milne-Edwards and Jules Haime in the Ann. des Sci. Nat. 3° sér. t. x. pl. 9. fig. 12, leaves no doubt about the
Astræid nature of their type species, *Plerastrea Savignyi*. Claus-
*astræa* has now to be removed from the true Astræidae, for it has
synapticula. *Plerastrea mirabilis*, nobis, Foss. Corals &c. of Sind,
Pal. Indica, p. 65 (1880), cannot remain in its genus as deter-
mined by Milne-Edwards and Jules Haime. It is now *Pratzia
mirabilis*, and a Lophoseron.

   des Corall. vol. ii. p. 553 (1857).**

Colony massive, turbinate, or flat, with a convex or subplane
upper surface. Corallites limited by walls which are simple,
united, and well developed. Calices superficial. Columella
papillary. The septa few and subconfluent with those of the
neighbouring calices, dentated, uniting more or less. Dissep-
iments well developed and abundant. An epitheca may exist
and be strong and folded.


The next genus is a doubtful one. If it has no synapticula it
must remain; but if it has, it is synonymous with *Centrastræa*, a
subgenus of *Thamnastræa*, Lesauvage.

   Corals, Pal. Soc. p. 99 (1851).**

Colony massive, gibbous. Corallites united by their costa,
which are slightly developed, or by their walls. The septa are
entire, have their upper edge nearly horizontal, and merge into
those of the neighbouring calices by means of the costa, with
which they are continuous. These septo-costæ hide the summit
of the walls of the calices. The columella is styliform.

**Distribution. — Fossil. Cretaceous: Europe, S. India. Eocene:
   Borneo.**

This is not a satisfactory genus; see the admirable remarks of
its founders (*op. cit. p. 99, 1851*). The South-Indian Cretaceous
species has ragged septa and no synapticula.

**XIV. Alliance TABULOIDA.**

Agglomerate Astræidae increasing by gemmation. Corallites united by
their walls. Dissepiments in the form of tabulæ. Septa variable, in
cyclical arrangement.

**Genus Holocystis, Lonsdale.**

**Genus Coccophyllum, Reuss.**

Genus absorbed: — *Tetracenia*, d’Orb.


Colony in a convex mass, increasing by extra-calicular gemmation. Corallites united directly by their walls or by coste, which are thick and usually well developed. Calices subpolygonal, either united by their margins or separated by a broad groove; fossula deep. Columella very small, styliform. Septa entire, in three complete cycles; four primaries much more developed than any other septa, exsert, close, thick at the margin and beyond, feebly granular, and very unequal according to their orders. Dissepiments of one kind, simple, horizontal, equidistant, and corresponding in height in the different interseptal loculi, forming tabule, which are traversed by the primaries.


Colony broad, convex. Corallites united by their irregular-shaped walls. Calices of various sizes, polygonal. Columella absent. Septa projecting but little into the calice, distinctly granular at their free edge. Tabule abundant, stretching across the interior of the cylindrical corallite, and often with a concave upper surface. Gemmation from the calicular wall.

_Distribution._—Fossil. Trias: Europe.

The next genus stands much alone. The young calices surround the larger parent, and arise by marginal budding. The walls are thin, and almost rudimentary where the buds join. The endotheca is very abundant, coming high up, and centrally there are tabulae. A rudimentary columella exists.

It must form a group with affinities with the Rugosa, like the Alliance just noticed.

Group-genus *Moseleya*, Quelch.


Corallum compound (colony), flattened, or slightly and broadly convex. Young calicles developing by calicinal marginal budding.
around a very large median calicle, which has very numerous septal orders, the calicles becoming polygonal and deep at the centre. Epitheca very slight; wall very thin and almost rudimentary, but developed so as to give a distinct simple line of separation to the calicles on the surface, often interrupted; seen in section in a very rudimentary state separating the calicinal centres. Costæ very distinct, thin, and finely denticulate. Septa often confluent and continuous, from centre to centre, in the line of union between adjoining calicles, very thin and close, finely toothed above, and having the teeth subequal or slightly larger near the centre. Endothecal dissepiments vesicular, very abundantly developed, leaving but a very small portion of the septa free exteriorly; seen in transverse section forming nearly concentric lines, and more or less complete tabulae at the centre. A false columella present, seen exteriorly to be formed by the trabeculate and vermiciform nature of the innermost upper part of the septa, entirely or almost absent in transverse section, where the septa are seen to meet almost at a point.

Distribution.—Recent. Torres Straits.

The next and last genus of this family is placed at the close of it provisionally. It will not conform to any Alliance, although it has some Latimæandroid characters of growth.

Group-genus Dictyophyllia, Blainville.


Colony incrusting, covering considerable space. Surface subplane. Corallites low, separated by very narrow grooves at the calicular surface, variable in size. Calices more or less polygonal or circular, or long, nearly or quite straight, narrow, looking like a series with perfectly indistinct centres. In a polygonal calice (one of a bud) are numerous subequal, close, short septa projecting from the wall a little way inwards, and within these, towards the calicular centre and occupying a large space, is a columella—a mass of trabeculae, reticulate and slightly convex; trabeculae connected, here and there, by cross bars. The long calices show the same structures as the others—a wall with short subapical septa projecting a little, and a large long axial mass of trabeculae—the columella. The columella appears to rise from a flat floor, which is presumably the base of the colony. Costæ absent. Calicular walls separated.

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Distribution.—Fossil. Upper Cretaceous: Maestricht, Europe.

There are several very perfect specimens of the only species of this remarkable genus in the British Museum. Their appearance and structural characters are, to a certain extent, those of the serial Astræidæ.

CHAPTER V.

The Section Fungida of the Madreporaria, definition, families. The family Plesiofungidæ, its groups and alliances and genera. The family Fungidæ, alliances and genera. The family Lophoseridæ, alliances and genera. The family Anabaciadæ, and genera. The family Plesioporitidæ, alliances and genera.

II. Section MADREPORARIA FUNGIDA*.

Madreporaria solitary or in colonies. Septa and septo-costæ with synapticula which cross the interseptal and intercostal loculi. An endotheca may or may not exist. Septal laminae solid or presenting degrees of fenestration. Basal structures perforate or imperforate. Soft structures with short, lobe-like, scattered, sometimes obsolete, tentacles, not covered when contracted; disks not circumscribed, and in colonial forms confluent.

The reasons for adding two families to this section have been given in a former page (4).

Families.

(Transition-group.) I. Plesiofungidæ.
II. Fungidæ.
III. Lophoseridæ.
IV. Anabaciadæ.

(Transition-group.) V. Plesioporitidæ.

The family Plesiofungidæ contains 13 genera, of which 10 are taken from the family Astreidæ of Edwards and Haime. The Fungidæ contain 10 genera. Two new genera enter, and the old form, Zoopilus, finds a place. Haliglossa becomes a subgenus; and Podabacia is synonymous with Halomitra.

* Verrill makes a suborder Fungacea, and foreshadowed the present amplification of the Fungida in 1865 (see Verrill, 'Notes on Radiata,' a work full of valuable information)
The Lophoseridæ become a very important family, and there are 35 genera and 2 subgenera. Out of the 19 genera of Milne-Edwards and Haime, 3 are passed on to the Plesioporitidæ, so that there are 19 new genera added.

The Anabaciadæ remain as they were, 2 genera.

The Plesioporitidæ have 13 genera; 1 was formerly an Astreäid, 3 were Lophoseridæ of Ed. & H.; 9 genera are thus added.

The section Fungida contains therefore 73 genera and several subgenera.

Besides these 73 genera, 23 have been recorded, and either abolished in revision, or in some instances made subgenera.

Transitional Family.

I. Family PLESIOFUNGIDÆ *.

This family unites more or less the Aporosa and Fungida. Fungida simple or colonial, with synapticula in the interseptal loculi, besides endothecal dissepiments. Septa solid and imperforate, occasionally irregularly perforate and trabeculate.

This Family contains five groups. One genus can hardly be satisfactorily placed, because nothing is known regarding the nature of the septa; but, provisionally, I place it in a group by itself. This is Epistreptophyllum, Milaschewitsch.

E. Pratz unites Siderastræa, Astræomorpha, and Mesomorpha in a group; but I cannot agree to the union of the last two with the first-named. Hence Siderastræa stands as a genus alone. The Thamnastroid group is fairly well defined.

Group-Genus Epistreptophyllum.

A simple Plesiofungid.


Corallum simple, adherent, conical or cylindrical. Calice sunken. Columella well developed and spongy. Septa numerous, not exsert. Wall ornamented with subequal costæ. Deeply in the interseptal loculi are endothecal dissepiments, and, besides,

* See Verrill, 'Notes on Radiata,' p. 540, E. Pratz, 'Palæontographica,' 1882, and Zittel, Palæontology, foreshadowing this group.
numerous synapticula; but in the upper parts there are only numerous sharp-pointed wart-shaped granules on the sides of the lamellæ.

Distribution.—Fossil. Jurassic: Europe.

Group-Genus Siderastræa, Blainv.


Colony massive, convex or plane, dense, incrusting. Corallites united by thin and often indistinct walls. Calices subpolygonal, deep, margins rounded. Columella small, papillary, made up of ascending trabeculae, which often fuse, here and there, into a mass. Septa solid, rather close, thin, denticulate where free, often uniting. Two rows of synapticula close to the wall unite the opposed septal lamellæ, and tend to fill up the interseptal loculi near the wall. Septa imperforate. Endothecal dissepiments few. Gemmation submarginal.


L. Agassiz states that the soft parts of Siderastræa are those of the Fungida and not those of the Astræidæ, and the tentacles drawn by Pourtalès prove this.

Group-Genus Polyaræa.


Distribution.—Fossil. Eocene: Borneo.

K. v. Fritsch states that the colony has the habit of Brachyphyllia, Reuss.
FAMILIES AND GENERA OF THE MADREPORARIA.

I. Alliance ASTRÆOMORPHOIDA.

Colonial Plesiofungidae. Calices small, more or less confluent by costae. Walls absent. Septa trabeculate, but solid. Columella styli-form.

Genus ASTRÆOMORPHA, Reuss.
Genus MESOMORPHA, Pratz.


The colony is flat, with small irregular calices, having only from 6 to 16 thick dissimilar irregular septo-costae only slightly geniculate. The central septa unite with a compact styliform, but sometimes rudimentary, columella. Septa not united directly with the columella along their entire height, but by trabeculae occurring at regular intervals from 5 to 75 millim. apart, so that a series of openings exists on the boundary between septum and axis. Tolerably stout, transverse or slightly oblique dissepiments stretch across the interseptal loculi, agreeing with the axial trabeculae in number, but alternating with them. Hence a number of superimposed cavities occur in the interseptal loculi.

Reuss notices the affinity of the genus to Clausastræa, and how it is distinguished from that genus and Thamnastrea.

E. Pratz (Palæontographica, 1882, p. 108 et seq.) analyses the species of this genus, and states that the genus is essentially Triassic, the specimens studied by Reuss from supposed Cretaceous rocks being derived fossils. The species described by Milaschewitsch from Nattheim are Thamnastreans, and differ in their morphology from ASTRÆOMORPHA. The Eocene species is a Thamnastrea.

E. Pratz remarks on the morphology. The septa, instead of being formed of many trabeculae passing from the internal base of the corallite upwards and inwards, give the impression of being formed by an independent irregularly-formed trabecule composed of many nodules running upwards and outwards. The granulations group themselves at tolerably regular intervals, and form more or less horizontally placed enlargements, which run in the same plane around each septum. In transverse sections, calcareous threads are seen to radiate from the middle of a septum to the periphery. A vertical section shows that they are directed upwards and outwards. The dissepiments resemble tabulæ. The
septa are compact, and are united by tabulæ and synapticula. There is no intercalicular wall.

**Distribution.**—*Fossil*. Trias: Europe.


Colony massive, branching, gibbous, sometimes incrusting. Calices small, shallow, not defined by ridges, but confluent with septo-costæ running in low curves over a flat surface. Septa compact, with spinules on the sides and edge, indicating a trabeculate construction. Columella styliform. No true wall. Synapticula stout, and when in the sclerenchyma between the corallites giving a coenenchymatous appearance. Dissepiments exist.

**Distribution.**—*Fossil*. Cretaceous: Europe.

II. *Alliance Thamnastroidea*.

Colonial Plesiofungids, varying in shape, massive, foliaceous, dendroid, incrusting or not. Confluent septo-costœ well developed, usually solid, trabeculate. Calices superficial, widely open, large.

*Genus Thamnastroæ*, Lesauvage.

Subgenus *Centrastræa*, d'Orb.

*Genus Clausastroæ*, d'Orb.

*Genus Pseudastroæ*, Reuss.

*Genus Pironastroæ*, d'Achardi.

*Genus Reussastroæ*, d'Achardi.

*Genus Dimorphastroæ*, d'Orb.

*Genus Dimorphocænia*, E. de From.

*Genus Styloastroæ*, E. de From.?


The synonymy of this great genus has been correctly given by Milne-Edwards and Jules Haime, 'Hist. Nat. des Corall.' vol. ii. p. 555 (1857), and carried down by them to 1851. M. de Fromentel's 'Introd. à l'étude des Polyp. foss.' (p. 211), published 1858-1860, is unfortunate in not bringing in the synonymy published by Milne-Edwards and Jules Haime, and in not noticing their able work.

Lesauvage, Goldfuss, Blainville, d'Orbigny, Lamouroux, and Defrance differed in their views regarding the genus; and Milne-Edwards and Jules Haime, criticizing the results of these naturalists, and having an immense amount of original matter at hand,
established a new generic diagnosis. Later on Etallon, Reuss, and myself decided that the genus must enter the Fungida; and since that time it has been placed in the Poritidae by Milaschewitsch and R. Tomes, and replaced by the latter in the Fungida. The careful researches of E. Pratz enable me to place the genus in the transitional group between the Astræidæ and Fungida—in the family Plesiofungidae.

Milaschewitsch, noticing the perforate condition of the septa of Thamnastreans from Nattheim, was led away to believe that this condition was invariable in the genus. Moreover, he thought that a perforate septum necessitated a Porosa alliance. There are perforate septa in Cyphastrea, an aporose form, and solid septa in most species of Madrepora, a perforate genus. Perforation may be noticed in some English Thamnastreans that have been much weathered, but in parts of the colony only. The condition is not universal in specimens from Nattheim, and is the result of destructive siliceous fossilization and weathering.

The trabecula of the septa do not always leave spaces between them like lattice-work; such a condition is local and exceptional. At the same time the thinnest part of the septum is between the nodular masses of the trabecules. There is no doubt that the septa are united by growths which are not exaggerated granules, and which are synapticula. These not only interfere with the open condition of the interseptal loculi, but make the position occupied by any thing like a mesenteric fold very shallow. The existence of endotheca is decided, and especially in some Oolitic species. It was noticed by Milne-Edwards and Jules Haime, and figured in my Monog. Brit. Foss. Corals, Pal. Soc. 1872, Pt. iii. pl. 4. fig. 9, and has been recognized in continental forms.

The presence of a wall bounding the corallites has been debated. I do not find a true wall, but that synapticula are often placed in vertical series and act as a wall, which, however, is not complete. Often no trace of such a limiting series can be found. On the other hand, the existence of a wall has been stated by De Fromentel. The columella is variable in the genus, and has been used to establish subgenera. Finally, the colony is sometimes convex, plane, and nodulose, or decidedly branched. The structures in these forms are identical, and therefore the old plan of making the branched forms into a new genus or subgenus has been abolished.
The subgenera are not very satisfactory, on account of the influence of fossilization and wear and tear in destroying the columella or in modifying it. But if it can be established that a species has had no columella, or has a papillary one, or one which is essential and styliform or knobbed, it is right to put it in the characteristic subgenus. Thus the true Thamnastræans, according to Milne-Edwards and Jules Haime, have a papillary columella (Hist. Nat. des Corall. vol. ii. p. 555). The Thamnastrææ with a knob or styliform process for columella belong to the subgenus Centrastræa, d'Orbigny. In most cases sections show the relics of the columella.

Mr. R. Tomes, F.G.S., follows M. de Fromentel in his classification (Quart. Journ. Geol. Soc. 1882, p. 434), and gives him the authorship of Synastraæ as well as Centrastræ, the first being a creation of Milne-Edwards and Jules Haime, and the last of d'Orbigny! As the subject has been now thoroughly discussed, it is only necessary to revise the genus Thamnastræa after Milne-Edwards and J. Haime, and to admit, for the sake of convenience, Centrastræa as a subgenus. Mr. R. Tomes suggests the term septal-costæ for the costæ which join the septa of different calices in Thamnastræa. The term septo-costae was used half a century ago, and has been employed ever since, and is the better term of the two.


Syn. Synastraæ.

Colony massive, convex, subplane, or gibbous, or thin and expanding, or in layers, pedunculate or with a broad base, or in-crusting, or more or less dendroid in shape. Corallites indistinctly defined. They are united by costæ or by an ill-developed wall. Calices superficial, centres distinct, and the intercalicular space variable in extent. Columella variable, papillary, nodular, small, styloid. Septa merging into septo-costæ which are confluent with those of neighbouring calices, usually flat on the free border, dentate, the minute projections being the tops of lines of trabeculae, stout or thin, solid or perforate here and there; straight, wavy, curved, or geniculate, long or short, often uniting or not. Dissepiments rudimentary or decidedly developed. Synapticula numerous, small. Gemmation submarginal. Common colonial wall, when it exists, costulate, epithecate, and with synapticula.
**Families and Genera of the Madreporaria.**


Subgenus Centrastræa, (genus) *d'Orb.* (1847).

*Thamnastræa* with an almost styliform columella.

In recognizing this group care must be taken not to be deceived by the results of fossilization.

Genus *Clausastræa*, *d'Orbigny*, *Note sur les Polyp. foss.* p. 9 (1849), amended.

Colony massive, with a plane or convex upper surface and broad base. Corallites large, without definite walls, which are replaced by a cellular endotheca. Calices superficial, shallow, widely open. Columella absent. Septa large, dentate, few, some confluent with the septo-costæ of the calices close by and others traversing the intercorallite space to reach somewhat distant calices, straight, or geniculate, or curved here and there. Laminae short, solid. Endotheca replacing walls here and there, and stretching across the interseptal loculi high up like tabulae, but not passing over the axial space. Synapticula small, short, stout, numerous. Gemmation submarginal.

**Distribution.**—*Fossil*. Jurassic: Europe, England.


Colony massive. Calices crowded, irregular, rather deep in the centre, environed by a shallow groove, so that only occasional septa become continuous with those of other calices. Septa dentate and numerous. Columella ends in a small irregular pimple (*Höcker*). Pali in one crown. Synapticula exist, being placed very regularly. (Endotheca does not exist, according to Reuss.)

**Distribution.**—*Fossil*. Eocene: Europe.


Colony lamello-discoid. Calices in concentric circles, confluent, centres distinct and small. Columella absent, or as one papilla. Septo-costæ very large. Synapticula numerous. Endotheca scarce. Epitheca well developed.

**Distribution.**—*Fossil*. Eocene: Europe, Sind, Asia.
Genus Reussastrea, d’Achiardi, Coralli Eocen. del Friuli
(Pisa, 1875), p. 67, tav. 13. fig. 2; amended.

Colony in the shape of a lamina more or less thick. Calices distinct, numerous, varying in their distances, shallow. Septa confluent with those of neighbouring calices. Columella lamellar and essential. Calicular wall ill defined. Dissepiments well developed, arched. Synapticula exist; and the solid septal laminae are very granular.

Distribution.—Fossil. Eocene: Europe, Sind, Asia.


The colony is pedunculate or not, flat on the upper surface, rarely convex, more or less circular in outline. Corallites arranged around a large central parent in distant concentric circles. Columella papillary and small. Septo-costæ confluent. Synapticula exist. Common wall striated or not, naked.


Colony in a tolerably thin lamina. Corallites disposed in concentric rows around a central parent. Plateau naked and costulated. The septa are entire, and almost all radiating from the centre to the circumference. There is no columella.

M. de Fromentel states that this genus corresponds in the Eusmilian family with the genus Dimorphastaæa, the distinction being the entire nature of the septa in the first-named genus and the absence of a columella. There are synapticula.


The genus Styloæandra, according to M. de Fromentel, is clearly allied to the genus Latimæandra, and is only really distinguished by having a styliform columella in the centre of the calices.

The figure shows (pl. 113. fig. 3) a broad colline covered by confluent costæ. It appears that this genus is hardly near Latimæandra, and that it is possibly one of the Thammamæstræan alliance, where it is placed with doubt.
II. Family Fungiidae.

(Subfamily Fungiinae (pars), Ed. & H. Hist. Nat. des Corall. vol. iii. p. 4, 1860.)

Simple or colonial forms, usually depressed, with the septa solid or occasionally porous. Synapticula crossing the interseptal loculi and uniting the septa without the presence of dissepimental endotheca. Wall more or less synapticulate or special, perforated and echinulate. Calices with radiating septa in the simple forms; with or without radiating lamellae, along a central axial line, or scattered in the colonial forms. Tentacles short, scattered, sometimes obsolete.

This family stands very much by itself, and its genera are remarkable for their calicular structures and developments.

The Alliances are fairly natural, and are the

I. Fungioida.

II. Cryptabacioida.

III. Herpolithoida.

I. Alliance Fungioida.

Simple Fungiidae, more or less discoid.

Genus Fungia, Dana.

Subgenus Haliglossa, Ehr.

Genus Diafungia, Duncan.

Genus Micrabacia, Ed. & H.


The corallum is simple and free in adult age, circular, subcircular, elliptical, lobed, or angular in outline; depressed or hemispherical, with a horizontal or dome-shaped base, which is costulate and perforate more or less. The calice conforms to the shape of the superficies of the corallum. Septa numerous, plain, lobed, dentate or spinulose on their free edge, the smaller uniting with the larger, which reach from the axial space to the more or less turned-down calicular edge. Small septa trabecular, the large solid. The columella trabecular and rudimentary. Interseptal loculi deep, and occupied by vertical or slanting rows of stout.
synapticula, which form, with the sides of the septa, canals leading to the base, and sometimes communicating with the outside through the basal openings. Costae on the bases of the septa, and united by synapticula, which constitute a false basal wall. Young corals adherent, subturbinate and pedicellate.

**Distribution.**—Recent and Sub-fossil. Pacific, Red Sea, Indian seas, Pacific coast of America.

The genus is a large one, and may be rather artificially divided into groups of species as follows:—

1. *Fungia lacerantes.* Fungiæ with spiniform septal teeth.
2. *Fungia subintegra.* Fungiæ with very small dentations.
3. *Fungia lobifera.* Fungiæ with the septa terminating above in angular lobes.

The genus *Haliglossa,* Ehrenberg, may be considered a sub-genus of *Fungia,* and it includes elongate forms with a discontinuous axial space, and links the *Fungia* on to the genus *Herpolitha.*


Corallum discoid, free, without trace of adhesion, not quite circular in outline, much broader than high. Base with a primary triangular piece extending beyond the centre, slightly projecting downwards, the rest of the coral grouping from its nodes and apex, so that there is an appearance of former fracture and subsequent growth. Calice unsymmetrical from the prolongation of the larger septa of the primary piece beyond the centre, and from the radiation of septa from the sides and apex of the primary piece to the edge of the disk or the margin.

Columella absent. Septa numerous, order confused, many join others near and remote from the margin. Larger septa exsert, arched near the margin, from which they rise perpendicularly, and low near the septa of the primary piece. Septa dentate and strongly granular near their free edge, solid and stout.

Costae broad, unequal, often bifurcating, variously directed. At the margin each costa gives off a branch on either side to form, with the corresponding offshoot of the next costa, a septum. Hence the septa correspond with the intercostal spaces.
costal spaces regularly furnished with equidistant synapticula, presenting a regularly perforated appearance. Synapticula strongly developed between the septa, some reaching high up in the interseptal loculi. There is no true wall, the septo-costal structure being united by synapticula alone.

Distribution.—Recent. Korean Sea.

Were there symmetrical growth, and did the costae radiate from a common centre, the form would come within the genus *Micrabacia* (Edwards and Haime, Hist. Nat. des Corall. vol. iii. p. 30, 1860). The genus is therefore a very interesting addition to the family Fungidae, and must be placed between the genera *Fungia* and *Micrabacia*.

It is mimetic of the genus *Diaseris* of the Lophosericæ.

The genus *Micrabacia*, Milne-Edwards & Jules Haime, requires some amendment; and having had the opportunity of studying some good specimens, I give the following amended diagnosis:


Corallum simple, free, lenticular, broader than high, convex above, slightly concave at the base, which has a circular outline. Calice with a small shallow axial depression, filled by a false columella, from which the principal septa radiate, being joined with those of higher orders towards the circumference. Septa numerous, solid, imperforate, arched above, with a perpendicular outer edge. Costæ distinct on the base, bifurcating at the edge, a process from two costæ forming a septum. Intercostal spaces continuous with the line of direction of the septa, crossed by synapticula in concentric rows, and perforate between the synapticula. Interseptal loculi crossed by large and small synapticula, which radiate from the base in discontinuous lines, bounding canalicular spaces continuous below with the intercostal openings, and above with the interseptal loculi high up. Costæ granular. Septa crenulate or minutely denticulate.


II. Alliance CRYPTABACIOIDA.

Colonial Fungidae. Calices all distinctly radiating.

Genus *Halomitra*, Dana.
Genus *Sandalolitha*, Quelch.
Genus *Cryptabacia*, Ed. & H.

Syn. Podabacia, Ed. & H.

Corallum compound, free or attached, convex or folded. Upper surface with a circular, funnel-shaped, large calice, surrounded with a ring of smaller calices. Septo-costal rays continuous from central calice to others and to the thin margin. Septa numerous, unequal, denticulate, some trabeculate in parts, solid otherwise. Synapticula long or short, vertical. Costæ marked on the perforate and echinulate base.

*Distribution.*—Recent. Red Sea and Indian Ocean, Oceania.

This genus absorbs Podabacia, Milne-Edwards and J. Haime, and therefore has a wider distribution.


Corallum compound, flattened, free, much elongated, and very thin. Wall sparsely porous, and extremely reduced. Distinct costæ, closely granulated or very finely and bluntly echinulate, curving towards the short axis. Calices few, in the long diameter of the corallum; parent calicle very large, occupying the centre, forming almost the entire corallum, with very numerous septa, there being about seven complete cycles, but a much larger number of cycles incompletely developed on the long axis; smaller calicles very few, distinctly radiate, developing on the course of and interrupting the larger septa in the long axis of the parent calicle. Septa very long, crowded, curving towards the short axis, and of more or less equal vertical extent, very low, giving an even laminate appearance to the corallum. Synapticula well developed, and forming strong connexions at the basal parts of the septa. Columella rudimentary and trabeculate.

*Distribution.*—Recent. Tahiti.


Corallum compound, free, oblong, convex above and concave beneath. Calices with radiating septo-costæ, some calices occupying the central axial line and there are others on either side. Septo-costæ short and not numerous. Inferior surface echinulate and perforate.

*Distribution.*—Recent. Indian Ocean, Manilla, Pacific.
III. Alliance HERPOLITHOIDA.

Colonial Fungiæ, with some or all the calices incomplete and not radiating.

Genus Herpolitha, Eschholtz.
Genus Polyphyllia, Quoy.
Genus Lithactinia, Lesson.
Genus Zoopilus, Dana.

Genus Herpolitha, Eschholtz, Isis, p. 746 (1825), amended;

The corallum is free, long, narrow, and compound. The upper surface has calices of two kinds—one set occupy a long central axial line and are multilamellar, and the other set are placed irregularly, have few lamellæ, and are small. The septo-costal rays are long and stout, and alternately thick and thin, and all are entire. No rays reach from the axial furrow to the circumference. The base is concave, perforated and echinulated. Synapticula regular, numerous, oblique, tall, and wanting here and there. Columella trabecular.

Distribution.—Recent. Red Sea, Indian Ocean to east.

This genus has been called Herpolithus by Leuckart subsequent to Eschholtz (see Hist. Nat. des Corall., Milne-Edwards & Jules Haime, vol. iii. p. 24); and Klunzinger has restored the proper name ('Korallenthiere des Rothen Meeres,' p. 68).

Genus Polyphyllia, Quoy et Gaimard, Voy. de l'Astrolabe (Zooph.), p. 185, pl. 20 (1833); Dana, Explor. Exped., Zooph. p. 316 (1846).

Corallum compound, free, oblong, and convex above and concave below, or discoid. Calices incomplete; some, which are sub-radiant, occupy the central axis in the long coralla, and are associated with rudimentary calices placed on either side, with short septo-costal rays very unequal in size, separated by transverse laminae, which are the prolongations of a lower set of septa. Or the surface is covered with undeveloped calices with non-radiant septo-costæ. The base is echinulate and perforate. Synapticula well developed. Principal septa very thick.

Distribution.—Recent. Pacific, Red Sea.

There are no perfectly radiating calices in the genus Polyphyllia—that is to say, the centre of a calice has not septa radiating from it, as in Halomitra for instance. The radiation is...
interrupted. Besides, there are what may be called false calices, in which a large septum is covered over for a short distance by a kind of hood coming from some of the higher orders next to it. This structure appears to have one large fleshy tentacle upon it.

In the genus *Lithactinia* there are no subradiating calices in the median line, and all are of the false kind. This appears to be of generic importance, and I retain the genus. The genera *Herpolitha*, *Polyphyllia*, and *Lithactinia* form an Alliance on account of the presence of false calices in their compound coralla.


Colony free and thin, hemispherical, cap-shaped, or almost plane above, and echinulate and perforated at the concave base. Costae not distinct. Calices of one kind, nonradiate, and formed by short septo-costal laminae, which are separated from those before and behind by thin transverse processes, which arch over them, and come from inferior septa. There are no true calices. Synapticula present.

**Distribution.**—Recent. Pacific islands, Oceania.


Colony free, budding and explanate. Polyps everywhere scattered; mouths radiately seriate. Coralla with the larger lamellæ radially prolonged quite to the margin, the intermediate much smaller and short, and these alone interrupted by the oririmes (small depressions or centres of radiation = polyp-mouths). Polyp-mouths in the intervals between the large lamellæ.

**Distribution.**—Recent. Pacific.

III. Family LOPHOSERIDÆ.

(Subfamily Lophoserinae, Ed. & H.)

Fungidae in which the wall is neither perforated nor echinulate. Synapticula exist, but not endothecal dissepiments. Septal laminae usually solid, but occasionally with ill-defined perforations, remote from the bottom of the septa.

Very considerable changes have taken place in the old subfamily of Milne-Edwards and Jules Haime, the *Lophoserinae*, owing to the introduction of new genera and the elimination of
old ones in consequence of the necessity of founding the family Plesioporitidae.

There are two Subfamilies—the Lophoseridae simplices and Lophoseridae aggregate.

1. Subfamily Lophoseridae simplices.

I. Alliance TROCHOSERIODA.

Lophoseridae with simple coralla, trochoid, turbinate, conico-cylindrical, or subturbinate. Calices shallow, rarely deep. Septa very numerous, some uniting, close, imperforate, and united by synapticula. Columella variable or absent. Pali may exist. Epitheca may or may not exist.

Genus Trochoseris, Ed. & H.
Genus Gyroseris, Reuss.
Genus Turbinoseris, Duncan.
Subgenus Palaeoseris, Duncan.
Genus Phragmatoseris, Milaschewitsch.
Genus Omphalophyllia, Laube.
Genus Placoseris, E. de From.
Genus Elliptoseris, Duncan.


Corallum simple, trochoid or cylindroid, adherent; wall naked, and with delicate costal striations. Calices circular, or lobed at the margin, and irregular, shallow. Columella papillary. Septa very numerous, strongly granulated laterally, uniting. Synapticula numerous.


The morphology of the septa separates the following genus from Leptophyllia and its allies, which belong to the Plesioporitidae.

Corallum simple, turbinate, or conical, compressed a little, with a broad base, having a mark of former adhesion, or a narrow and free base. Epitheca rudimentary or absent. Calice shallow, usually elliptical. Septa numerous, solid, often uniting or not. Columella absent. Costæ well developed. Wall stout. Septa united by synapticula, and sometimes the costæ also.


Corallum simple, turbinate, and pedicellate. Calice widely open. Septa numerous, crowded, the smaller uniting with the larger, which reach the central fossula. Columella rudimentary. Synapticula numerous. Costæ covered by a complete and dense epitheca.

*Distribution.*—*Fossil.* Cainozoic, probably Miocene: Australia. The stout epitheca distinguishes this form from Turbinoseris, of which it is a subgenus.


Corallum simple, adherent, pedunculate, fan-shaped. Calice elongate. Columella absent. Septa numerous, not exsert. Synapticula exist low down in the interseptal loculi; higher up there are long, oval-outlined granules projecting from the septal lamellæ. Wall aporose, and furnished with costæ which are continuous with the septa.

*Distribution.*—*Fossil.* Jurassic: Europe. This genus is closely allied to Turbinoseris (if the septa are imperforate).


Syn. Cnemidium, Quenst.; Montlivaltia, Lam.; Thecophyllia, d'Orb.

Corallum simple, adherent, turbinate, cylindrical or almost
cyclolitoid in shape. Calice shallow, subplane, circular in outline. Columella styliform, prominent. The septa are numerous, close, unequal, uniting, bifurcating and trifurcating, exsert, granulate, and serrate. Epitheca strong and well developed.

**Distribution.**—Fossil. Trias: Europe.


Corallum largely fixed, with a cylindrical wall. Calice round and deep. Columella elongate, and composed of a series of trabeculae soldered together and strongly spinulose at the sides. Septa numerous, unequal, and synapticulate.


In the drawing (pl. 49. fig. 4a, b) the columella is very small.


**Distribution.**—Fossil. Eocene: Sind.

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**II. Alliance CYCLOSERIOIDA.**

Simple Lophoseridæ more or less discoid or plano-convex in shape, with nearly flat basal walls and numerous septa, many of which unite. Pali may occur. Columella variable. Epitheca exists or not.

- **Genus Cycloseris**, Ed. & H.
- **Genus Diaseris**, Ed. & H.
- **Genus Zitteleofungia**, Duncan.
- **Genus Bathyactis**, Moseley.
- **Genus Asterosérès**, E. de From.
- **Genus Microseris**, E. de From.

The genus Tricycloseris, Tomes, is too doubtful, and is absorbed. See E. Pratz, ‘Paleontographica,’ 1882.


The corallum is simple, free, circular, elliptical, or angular in
outline, more or less horizontal or concave below, flat, nummi-
form, convex, semihemispherical above. Wall flat, costulate,
imperforate. Central fossette narrow elongate or circular. Co-
umella rudimentary or papillary, and slightly developed. Septa
very numerous, uniting, denticulate at the free edge, exceed-
ingly granular at the sides, imperforate. Synapticula abundant,
and variable in their length.

Distribution.—Fossil. Cretaceous: Europe. Eocene: Europe;
Sind, Asia. Miocene: Sind, Asia.—Recent. Red Sea, Chinese
seas, Pacific.—Subfossil. Red Sea.

The genus Tricycloseris, Tomes (Quart. Journ. Geol. Soc.),
places itself in the proximity of Cycloseris, as the name indicates.
E. Pratz remarks (Paleontographica, xxix. p. 108) that the soli-
tary specimen of the genus may be an abnormal form, and brings
before our notice that occasionally simple forms have exception-
ally developed more than one calicular centre, as may be observed
in Montlivaltia and Omphalophyllia.

Genus Diaseeris, Milne-Edwards & Jules Haime, Hist. Nat. des
Corall. vol. iii. p. 54 (1860), pl. D 12. fig. 4.

Syn. Ecmesus, Phil.; Hemicyathus, Seguenza.
Corallum simple, free, discoid, low. Wall naked and costu-
late, imperforate; margin lobed, irregular. In the young state
composed of separate pieces or lobes which unite irregularly
during growth. Septa irregular, uniting, numerous, serrate or
dentate. Synapticula exist. Columella rudimentary or absent.

Distribution.—Fossil. Miocene, Pliocene: Europe.—Recent.
Florida, Barbadoes, North Atlantic, Pacific, Australia.

Many species of Cyclolites were described by me in the "Fossil
Corals and Alcyonaria of Sind," 'Palæontologia Indica,' Series xiv.
(1880), pp. 52–55. E. Pratz considers that the forms should pass
into another genus, and presumably because the septa are
imperforate and there is no endotheca. Certainly now that it is clear
that the typical Cyclolites had perforate septa and dissepiments,
the species from the Eocene of Sind differ generically from it. I
have founded the genus Zittelofungia to meet the want caused
by the necessary removal of Cyclolites into the Plesioporitidae.

Genus Zittelofungia, Duncan.

Syn. Cyclolites, Lmk.
Corallum free, plano-convex, circular or elliptical in outline,
with a flat or slightly concave base, and a convex calice with a circular or oval fossa. Columella absent. Septa very numerous, close, thin, unequal, uniting, crested, denticulate or moniliform at the free edge, granular at the sides, imperforate. Synapticula numerous. Dissepiments wanting. Epitheca of base in concentric folds, stout or thin.

Distribution.—Fossil. Eocene: Sind.


Syn. Montlivaltia, Tennison Woods; Fungia, Pourtalès, non Dana.

Corallum free, discoid, not attached or cup-shaped in the young condition, thin and fragile. Primary septa free, the others united so as to form six deltoid continuations. Upper margins of septa usually coalescent over the apices of the deltas. Septa deeply toothed. Synapticula sometimes abundant, sometimes few, arranged in a series of concentric circles. Columella well developed. Base costulate. No epitheca.

Distribution.—Recent. Deep water, from 30 fathoms to 3 miles, North and South Atlantic, Caribbean Sea, South-Indian Ocean, Malay Archipelago, West and East Pacific, Australian seas.

The specimens show that the columella is often reduced to the junction of septa only.

Moseley makes some most valuable remarks on the influence of growth and nutrition on the species of Bathyactis:—"In some specimens, dredged on a siliceous bottom composed of Diatom skeletons, the wall is excessively thin, and towards its marginal region is perforated by a series of apertures on either side of the costæ." "When a specimen hardened in spirit is decalcified, the wall of the corallum in dissolving in the acid becomes perforated by a similar series of apertures, yielding first at these spots."

tom. viii. p. 328 (1867).

Syn. Stephanoseris, *E. de Fromentel, non Ed. & H.*

Corallum hemispherical, with an imperforate basal plateau, which is discoid and covered with granulations which are in radiating lines near the edge. Columella slightly developed, and reduced to three or four slightly visible points. The septa are large, unequal, and strongly granulated where free. Pali well developed before the tertiary septa. Synapticula present.


M. de Fromentel does not say anything about the dissepiments or the condition of the septa.


No. 23 (1870), p. 367.

Corallum hemispherical. Wall horizontal, naked, and covered with sparsely distributed granulations which do not simulate costae. Septa large, arched, uniting in joining at the centre of the calice, where there is a little rounded fossula. Synapticula rare, but well developed.


This genus requires further consideration.

III. Alliance PSAMMOSERIOIDA.

Simple Lophosericidæ with the base containing a Sipunculid worm or growing on univalve shells, low. Penultimate septa well developed. With or without pali. No epitheca.

Genus Psammoseris, Ed. & H.
Genus Stephanoseris, Ed. & H.


Corallum simple, low; base broad, containing a Sipunculid worm; sides perforated with several apertures. The wall is thick, naked, strongly granulate, and barely striated below, costulate elsewhere. Calice circular. Columella spinulose, papillary. Septa low, thick, close, granular; primaries and secondaries longest and largest; the septa of the fourth cycle next in length, and uniting axially in front of the tertiaries.

*Distribution.*—Recent. Chinese seas, Malacca.

The corallum is short, with an unsymmetrical tumid base, which is larger than the calice. Base containing a Sipunculid worm, and perforated with large and small apertures, or fixed on a Gastropod shell. Calice circular or subcircular, open. Septa numerous, well developed, arched, tall, subentire, denticulate axially. Septa of first and second orders tallest; those of last cycle close to and nearly as high as their neighbours of the earlier cycles. Pali before all septa except the last cycle, small, arched. Columella trabeculate, and minutely papillary at the surface. Costae large, unequal, granular, with deep narrow intercostal spaces. Underpart of base smooth or granular, not costulate except at the edge. Wall very thick, solid. Granules on septa numerous, elongate, radiating.

**Distribution.**—Recent. Indian Ocean, Corean sea, Philippines, Zanzibar.

This last genus was placed by Gray amongst the Heterocyathi, and separated by Jules Haime on account of its internal structures. I place it here with much doubt; for I have not found synapticula in any specimens, and the details of the soft parts are not known. Indeed this Alliance is unsatisfactorily placed, and requires greater revision than materials will at present permit of.

**IV. Alliance PODOSERIOIDA.**

Simple Lophoseridæ with a wide base of attachment. Calice convex, with a central fossula. Costæ distinct, and covered or not with epitheca.

Genus **Podoseris**, Duncan.

Genus **Episeris**, E. de From.


The corallum has a wide or pedunculate base of attachment; the height varies, but the calice is generally narrower than the base, and is convex. Its central fossula is circular and small. The columella is formed by the septal ends; and the septa are numerous, close, unequal, uniting. The costæ are distinct, straight, and covered more or less by epitheca. Synapticula numerous.


Corallum tall, at first horizontal and then cylindrical. Epitheca strongly developed and folded. Septa very exert, finely dentate. Columellary fossula very elongate.


The typical species, Episeris macrostoma, is a very large coral, and is not without its affinities with Podoseris, nobis.

Group-Genus Gonioseris, Duncan.


Corallum simple and free. Base polygonal, projecting angles formed by groups of costæ ending in septa. Margin concave between the angles. Centre of base concave. Costæ numerous, covering the base and converging in groups at each angle along a line leading from a large septum to the centre. Upper surface convex, divided by masses of septa continuous with the costæ from the base of the angles. They are exert externally, and reach the axial space, where they meet. There is a large prominent primary septum in each mass. The calicular wall is not seen from without. Synapticula broad and numerous.


2. Subfamily Lophoserideae aggregatae.

I. Alliance CYATHOSERIOIDA.

Colonial Lophoserideæ, trochoid or depressed turbinate in shape. Common wall naked and costulate. Calices superficial, radiating, and with confluent septo-costæ.

Genus Cyathoseris, Ed. & H.
Genus Crateroseris, Tomes.
Genus Thamnoseris, Etallon.


Colony trochoid, adherent. Calices superficial and tolerably distinctly radiating. Septa long, thick, granulate laterally and confluent. Columella papillary or rudimentary. Wall of the colony naked and striated, and sometimes folded so as to
produce lobes or collines at the articular surface. Synapticula exist.


vol. xxxix. p. 560 (1883).

Corallum composite, massive, depressed turbinate; calicular surface 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 well-defined fossula. The intercalicular spaces are depressed. The septa are imperforate; margins moniliform and continuous with septo-costae, which pass from one calice to another without interruption. Septa and septo-costae have synapticula attached to them. Increase by gemmation between the calices at the outer margin.

**Distribution.**—**Fossil.** Portland Oolite: England.

No section is given of this form; and in the description of the species the synapticula are said to be rather small.

There is some doubt about the next genus, and regarding its proper alliance. M. de Fromentel notices (‘Introd. à l’étude,’ p. 241) a species of a genus called *Thamnoseris* which had been communicated to him by Etallon; and this author remarks on M. de Fromentel, and gives a correct generic diagnosis of the genus in his ‘Lethaea Bruntrutana,’ Zurich, 1864, p. 406.

*Genus Thamnoseris, Etallon, Lethaea Bruntrutana,*

p. 406 (1864).

Colony in rounded masses or in thin laminae. Epitheca thin and complete. Columella papillary. Septa confluent, thick, covered on their free edge and flanks with very projecting granules which are close together, and constitute more or less numerous synapticula.

In a description of a species, *Thamnoseris Frotena*, Etallon, *op. cit.* p. 406, pl. lvii. fig. 10, it is stated that the corallum is conical and turbinate, with growth-rings on the inferior plateau, and sometimes even on the circumference of the corallum. Upper surface subplane, or a little convex and irregular. Calices subequal, usually polygonal, with a well-marked centre. Septa unequal according to the orders, of slightly different thickness;
three cycles and part of the fourth. Synapticula rare. Columella fasciculate, vermiculate, and distinct.

The delineation of the species is a mere sketch; but it shows that the calices are close and separated by a mere ridge, over which, from the description, we may presume the septa are confluent with their neighbours. The calices are deepish.

Now in the species noticed by De Fromentel the calices are also deep; the septa are confluent and in bundles. Neither Etallon nor De Fromentel writes anything about the structure of the septa, whether they are perforate or merely trabeculate or solid.

Etallon lays stress on the fact that there are no dissepiments between the septa.

The generic diagnosis might now be stated as:—

Colony variable in shape, amorphous and convex, turbinate and conical, or in lamellae. Corallites low and small, polygonal, close. Calices rather deep, polygonal, separated by narrow margins, over which the septa pass. Columella fasciculate and papillary, fused. Septa in three or four incomplete cycles, well-developed, often uniting, thickish, but diminishing in width in the higher orders, granulate on the free edge and on the flanks, close. Synapticula small, variable in number. Dissepiments wanting. Epitheca exists; and it and the colony may be marked with growth-rings.

Distribution.—Fossil. Jurassic: Europe.

II. Alliance PAVONIOIDA.

Colonial Lophoseridæ in thin, frondiform, curled, adherent laminae, crested or not. With an imperfect or synapticulate calicular wall. Calices numerous, distinct or indistinct; on one or on both sides of the fronds. Collines or crest-like ridges exist. Septa occasionally more or less trabeculate and perforate, or solid.

Genus Lophoseris, Ed. & H.
Genus Tichoseris, Quech.
Genus Mycedium, Oken.
Genus Phyllasteræa, Dana.
Genus Trachypora, Verrill.
Genus Leptoseris, Ed. & H.
Subgenus Haloseris, Ed. & H.
Genus Protoseris, Ed. & H.
Subgenus Phylloseris, Tomes.
Genera absorbed:—

Pavonia, Lamarck; Echinophyllia, Klunzinger.
Phylloseris, Tomes, and Haloseris, Ed. & H., become subgenera.

Syn. Pavonia, Lmk.

Colony adherent, thin, foliaceous, erect, in lobes or crests, irregular in shape, with radiating calices, confluent by their septo-costae; on one or both surfaces and between and on low crests placed more or less vertically, over which septo-costae pass. Columella tubercular or rudimentary, deep. Common septa solid or trabecular in parts. Calices rather elongate, circular when young, surrounded by a wall or by synapticula fused into a mural condition. Synapticula well developed, and distinguishable from ornamental granulation. Gemmation occurs between the calices and amongst the septo-costae.

**Distribution.**—Recent. Pacific, from west coast of America to Australia, east of China, Japan, Hong Kong, Indian Ocean, Red Sea, Burmese seas.

Verrill states that it does not exist in the Atlantic.


Colony fixed, forming small frondescent folded laminae, much incised at the edges, and crispate. Calices indistinct on the internal surface, which is covered with very long septo-costal rays, which are very granulated. Columella rudimentary. External surface delicately striated. Synapticula exist.

**Distribution.**—Recent. Philippines.


Corallum compound, massive, columnar or lobate, with neither transverse calical ridges nor longitudinal crests, astræiform. Calicles with distinct solid walls, which are thin at their edges but thick at their basal parts; calical centres arranged either singly within their own wall, or united in more or less irregular and sinuous groups of two or more, incompletely separated from each other and surrounded by the common wall of the calicle from which they are developed. New calicles arise either by
direct fission of a single calicle forming two separate ones with distinctly raised walls, or by the upgrowth of the synapticula at different parts of the calicle to form new walls, the resulting centres often formingæandroid series, until the development of their own wall isolates them. Septa not at all confluent, entire, those of adjoining calicles quite separated by the raised walls. Columella absent or forming a very small styliform projection at the point of coalescence of the septa. Synapticula distant, very unequally and irregularly developed, being generally rather thick interseptal outgrowths of the wall.

Distribution.—Recent. Fiji Islands.


Colony frondiform. Calices well developed, circumscribed, usually a central one surrounded by concentric series of others, inclined and submamillary, projecting or flat. Columella variable, papillary, compressed, tubercular, or absent. Septocostæ long, continuous. Synapticula exist. Common undersurface naked and variably costulate.

Distribution.—Recent. Caribbean Sea, East-Indian seas, Pacific.

Reuss noticed the genus in the Eocene, but probably the form was a Thamnastrea.

The variation in the species of this genus has been commented upon by Pourtalès, and it is evident that it is but slightly removed from Lophoseras.

Dana introduced the genus Phyllastrea to include Mycedium Okeni.


Syn. Oxypora, Kent.


Distribution.—Recent. Amboyna, Pacific.


Colony explanate, thin; below echinate and coarsely costate; above with scattered polyp-centres destitute of walls, with one or two cycles of septa radiating at the centres, but becoming subparallel between them, as in *Halomitra*, strongly dentate or lacerately lobed. The strongest lobes surround the polyp-centres. Columella loose, trabecular.

**Distribution**.—Includes **Echinopora aspera**, Ellis and Solander, of the East Indies.

Klunzinger places the genus between *Halomitra* and *Mycedium* and **Echinopora**. It looks like a Thamnastreaen amongst the **Echinoporæ**.


Colony adherent, in very thin laminae, often folded or irregularly twisted, pedunculate or not. Calices not numerous; a large central one surrounded by small ill-defined but radiating concentric calices. Septo-costæ very long. Columella tubercular. Beneath, the surface is naked and delicately striated.

**Distribution**.—**Recent**. Ile de Bourbon.—? **Fossil**. Eocene: Europe.

The genus **Protoseris**, Milne-Edwards & Jules Haime, Brit. Foss. Corals, Oolitic (Pal. Soc. Lond. 1851), p. 103, tab. xx., is clearly closely allied to **Lophoseris**, Lamarck (1816). The distinction is the papillary columella, for the frondescent shape is found in **Lophoseris**. In this last genus the columella is tuberculous or rudimentary. It is interesting to find the genus **Lophoseris** foreshadowed in the Jurassic age.


Colony foliaceous, ascending, folded, and lobed, more or less funnel-shaped. Calices superficial and distant, separated neither by crests nor by ridges. The columella is papillary. The septa are flexuous and confluent. The lower surface of the laminae is costulate and without epitheca. **Synapticula** exist.

**Distribution**.—**Fossil**. Jurassic: England.

Differs according to its describer wholly in the way in which the fronds are produced (? developed), and in the presence of a strongly developed epitheca, from Protoseris. The only distinction is the presence of an epitheca, which is not generic. Hence the species Phylloseris rugosa, Tomes, must come within the scope of the genus Protoseris. I place Phylloseris as a subgenus of Protoseris. Its sole locality is in the Lower Oolite of England.

III. Alliance STEPHANARIOIDA.

Colonial Lophoseridæ, massive, incrusting, or lobate and subdendroid. Septo-costæ confluent and well developed. Walls absent or indistinct. No collines.

Genus Stephanaria, Verrill.
Genus Pratzia, Duncan.


Colony in short lobe-like branches. Calices moderately large, with two or three cycles of septa, denticulate on the edge, well developed and confluent. Walls indistinct or wanting; the division between the calices indicated only by small granular points, which sometimes interrupt the septa of adjoining calices. Columella papillose. Paliform papillae before all the principal septa, the inner ones becoming confounded with the columella.

Distribution.—Recent. West-American coast.

Genus Pratzia.


The colony is massive, incrusting. Calices superficial. Columella substyloid, produced by the septal ends. Septa solid, arranged in several lozenge-shaped or triangular groups, confluent, crowded. Walls absent. Synapticula abundant, close, and reach high up in the interseptal loculi. Endotheca absent. Epitheca absent.

Distribution.—Fossil. Eocene of Sind, Asia.
IV. Alliance AGARICIOIDA.

Colonial Lophoseridæ, foliaceous or massive, or incrusting. Calices distinct or indistinct, in series separated by collines. Septo-costæ confluent and extending over the collines.

Genus Agaricia, Lamarck.
Genus Plesioseris, Duncan.
Genus Pachyseris, Ed. & H.
Genus Comoseris, d'Orb.
Subgenus Oroseris, Ed. & H.
Genus Hydnophorabacia, d'Achiardi.
Genus Coscinareæ, Ed. & H.

The genus Oroseris becomes a subgenus.

Genus Agaricia, Lamarck, Syst. des Anim. sans Vertèb. (1801);

Syn. Undaria, Dana.
Colony foliaceous and irregular in shape. Calices on one or both surfaces, circumscribed or limited at least on two sides, in transverse or concentric series, which are separated by unequal ridges (collines), over which the confluent septo-costæ pass. Columella tuberculous, papillose, or compressed. Septa confluent, not numerous. Common plateau striated and naked. Synapticula exist.


Syn. Macedroseris, Rousseau (pars).
Colony massive, adherent, and without epithea. Surface irregular and nodular. Calices in short series, confluent by their septo-costæ and with distinct centres. Septa often uniting, solid, except near axial space, where they are trabeculate with ascending processes; granular on the sides, warty and spinulose on the free edges. Columella well developed and papillary. Synapticula of two kinds:—1, long, broad, and vertical, in two rows near the true calicular wall; 2, small and nodular, near the axial space. Eminences between the series of calices covered by septo-costæ, and having a true wall. Growth by gemmation beyond and between the calices.

Distribution.—Recent. Pacific.

Linn. Journ.—Zoology, Vol. XVIII.
This genus, characterized by its solid septa, walls, and synapticula, and serial calices, includes *Macandroseris*, now *Plesioseris, australiæ*, Rousseau, sp.


Colony adherent, foliaceous, very variable in shape. Base a thin solid wall, which is costulate. Upper surface presenting long concentric eminences or collines and intermediate valleys, the first crossed by parallel septo-costæ, the latter showing an axial space, with or without a projecting columella close to the end of the septa. No distinct calices or radiating series of septa. The series of septa in the valleys are long and very bifurcate. Columellary space very long and filled up by series of tabulate dissepiments. Septa close, finely dentate and granular on their sides, rarely perforate. Synapticula long vertically, and occupying the position of a collarine-wall, and small and nodular, and placed on the septa close to the columellary space.

**Distribution.**—*Fossil.* Lower Eocene of Sind, Miocene of Sind. —Recent. Pacific and Indian Oceans.


Colony thick, attached or free, base covered with a stout epitheca. Upper surface with calices more or less close, distinct at their centres, and with confluent septa, separated at certain points by collines, over which the septo-costæ pass. Collines long or short, narrow or broad, straight or curved, radiating from the centre of the upper surface or not. A rudimentary columella. Septa united by synapticula. No wall around the calices or in the collines. A basal wall, which is solid and marked with costæ, underlies the dense epitheca.

**Distribution.**—*Fossil.* Jurassic: Europe. Cretaceous: India.

There is a very fine specimen of *Comoseris irradians*, Ed. & H., in the Museum of the Geological Survey in Jermyn Street, which shows the construction of the septa and synapticula very well. The septa are slender, trabeculate, but imperforate, and there are the same kind of endothecal processes as are seen in *Thamnastrea*.

The epitheca is worn off, and the striated, costulate, basal wall
is well shown; it is imperforate. Before Thamnastrea was shown to have synapticula, the distinction of the two genera was evident, and Comoseris was the solitary example of a fossil Fungid with confluent calices and an epithea. It is now closely allied to the endothecate Thamnastrea, the sole distinction being the presence of collines in Comoseris.

In introducing several new species of Oroseris to the Oolitic coral-fauna of England, Mr. R. Tomes, F.G.S., asserts (Quart. Journ. Geol. Soc. vol. xxxviii. p. 440) that the genus really bears but a faint resemblance to the genus Comoseris. He seems to have misunderstood the diagnoses of the genera, for it must appear on reading them that Oroseris can hardly stand as a genus distinct from Comoseris. The only distinction is the length of the ridges bounding the calicinal valleys.

In many parts of the corals of both genera, there are no ridges for a certain space, every calice not being thus separated, so that such areas dismembered would resemble species of Thamnastrea. It is this fact which brings the forms so closely together. The presence of the ridges or collines, so continuous in the species, cannot be put on one side in classification, and especially in the face of the allied genera Maandroseris and Plesioseris.

In placing Oroseris as a subgenus of Comoseris it must be admitted that the first-named form has a more varied shape than was given to it by Milne-Edwards and Jules Haime. Mr. Tomes has delineated an incrusting form and a semi-massive, irregular one, and also a species massive and with a lobed outline. He has shown also that the epithea may be strong and wrinkled, indeed as much so as in Comoseris.

**Subgenus Oroseris, (genus) Milne-Edwards & Jules Haime,**


Colony in rather thin laminae, and the basal wall is either naked or covered with a rudimentary, or strong and wrinkled epithea. The calices are subconfluent and separated irregularly by transverse subcristiform eminences (collines), which usually, but not invariably, limit simple series of calices and do not extend the length of the colony. The columella is rudimentary.

**Distribution.—Fossil. Jurassic**: England, Europe. **Neocomian**: Europe. **Cretaceous**: England. **Eocene**: Europe. **Miocene of Italy**.

Colony frondiform. Calices distributed over the upper surface and having conical eminences between them. Septa confluent, granular where free. Columella papillary. Synapticula well developed. Base of colony echinulated and finely vermiculate.

*Distribution.*—*Fossil*. Eocene: Europe.

There is an undescribed genus, represented by two specimens in the British Museum, in which the collines are irregular, longer than in the above, covered by close septa-costae. The columella is styliform. Colony massive. It is clearly allied to the above, but yet distinct.


Colony massive, partly incrusting, convex above, with irregular-shaped, rather deep calices in short series, with slightly projecting intermediate eminences. Calicular centres usually distinct; septa uniting with those of neighbouring calices and extending over the eminences. Some septa are simple and others unite by their sides with larger ones; spinulose at the free edge, perforate and trabeculate, except near the solid basal wall, which is very thin and costulate. Columella deep, small and papillary. Synapticula more or less in vertical series, discontinuous and stout. No walls between the calices. Gemmation between the calices, on the eminences, and intervening spaces.

*Distribution.*—*Fossil*. Cretaceous: India?—*Recent*. Red Sea; Mauritius; Burmese seas.

A careful examination of numerous specimens of species in the British Museum and in my own collection, has not enabled me to discover endothecal dissepiments. Milne-Edwards and Jules Haime drew them, but Klunzinger's photographs do not show them. Probably the stereoplasm-looking endotheca in Milne-Edwards's plate is the result of irritation from parasitic growth. The thin basal wall in the specimens from Mergui resembles epitheca more than theca.
FAMILIES AND GENERA OF THE MADREPORARIA. 165

IV. Family ANABACIADÆ.

Madreporaria Fungida simple or colonial. Septa trabeculate and fenestrated. Synapticula small. Dissepiments absent. Wall indistinct.

Genus Anabacia, d'Orb.
Genus Genabacia, Ed. & H.

Genus Anabacia, d'Orbigny, Note sur les Polyp. foss. p. 11 (1849).

Corallum simple, free and without a trace of adherence, plano-convex or biconvex in shape. The upper surface has a central shallow fossette without a true columella. The septa are very numerous, close, uniting, and are continued over the edge to the base, where their free edges are in the position of costæ. They extend from the base vertically to the upper surface, are trabeculate and perforate, and delicately spined or crenulate at their free edge. There is no basal wall, and the septa unite by synapticula.


Colony sublenticular, base naked and perforate. A central calice surrounded by one or two circles of smaller size with confluent septo-costæ. Septa trabeculate, perforate, thin, close rather numerous, crenulated where free. Calicular fossette not, deep. No basal wall.

Distribution.—Fossil. Middle and Inferior Oolite: Europe.

Transitional group.

V. Family PLESIOPORITIDÆ.

Fungida with trabeculate and regularly perforate septa. Synapticula between the septal laminae in the interseptal loculi. Sclerenchyma trabeculate. Dissepiments may or may not exist. Wall existing or not, and imperforate. Epitheca may exist and be well developed.
I. LEPTOPHYLLIOIDA.

Simple Plesioporitidae, turbinate, conico-cylindrical, fixed or not. Epitheca present or absent. Septa very numerous, trabeculate, perforate, uniting, joined by synapticula.

Genus Leptophyllia, Reuss.
Subgenus Thecoseris, E. de From.
Subgenus Trocharœa, Etallon.

The genera Thecoseris and Trocharœa become subgenera; Haplarœa is not placed.


Syn. Haplarœa, Milas.

The corallum is simple, fixed, and pedunculated; the wall is naked and marked with close costæ, which are numerous and granular. The calice is circular or subovular or elliptical in outline. The columella is absent. The septa are very numerous, close, thin, often uniting, and are composed of vertical trabeculae with vertical rows of perforations between them. Synapticula occur in abundance, and are found high up in the interseptal loculi. Dissepiments occur in the interseptal loculi. Epitheca absent.

Distribution.—Fossil. Jurassic, Cretaceous: Europe.

It is not possible to retain the genus Haplarœa, as its distinction from Leptophyllia is having an epitheca, and this is not generic in importance.


Corallum elevated and regularly turbinate. Calice concave, and the fossa round. Septa thin, numerous, not exsert, often anastomosing and finely denticulated, the larger usually meeting in the centre of the calice and forming a false columella. Wall thin, costæ numerous, covered to the margin of the calice by a strong folded epitheca. Synapticula feebly developed.


Corallum simple, largely fixed, having the structure of Microsolena. It approaches the genus Anabacia, but has more distinct (latticework-like) septa and is broadly adherent. No epitheca.

The species described and delineated by Etallon (op. cit. p. 411, pl. lviii. fig. 4) is Trocharœa actiniformis. A small short corallite, cylindrical, and hemispherical above, largely fixed, the base being broader than the calice. Calicinal central fossette narrow and deep. Septa latticework-like, stout, in five cycles, the last being more or less incomplete. Columella indistinct. Height 7 millim.

Distribution.—Fossil. Jurassic: Europe.

I give the diagnosis of Haplarœa, but do not place the genus.


Corallum simple, cylindrical, tall, deeply indented with broad circular growth-rings, and furnished with a smooth epitheca (here and there). The calice is shallow and elliptical. There is no columella. The septa are very numerous, well developed, and perforated by large apertures distributed without order. The younger septa unite with the others, and all are united by numerous well-developed synapticula.

Distribution.—Fossil. Jurassic: Europe.

Group-Genus Cyclolites, Lamk.


The corallum is simple, free, circular, elliptical, or slightly angular in outline, flat or slightly concave at the base, where there is a well-developed concentrically folded epitheca, convex more or less above. Fossula circular or elongate. Columella
rudimentary or absent. Septa very numerous, close, unequal, often uniting, denticulate where free, trabeculate in construction, with regular nodules, partly solid and often perforate, then forming a latticework. Synapticula feebly developed, or elongate and visible. Dissepiments exist.

*Distribution.*—Fossil. Jurassic, Cretaceous: Europe, India.

II. **Alliance** MICRCSOLENOIODA.

Colonial Plesioporitidae, polymorphous, massive, dendroid, lobed or sub-plane. A wall often present, with costae. Septa trabeculate and perforate. Synapticula present.

- **Genus** Microsolenla, Lamour.
- **Genus** Polyphyllos eris, E. de From.
- **Genus** Thamnarea, Etallon.
- **Genus** Diplarea, Milas.
- **Genus** Disarea, E. de From.
- **Genus** Dimorpharea, E. de From.
- **Genus** Latimeandrararea, E. de From.
- **Genus** Meandroseris, Rousseau.

The genera Dendraræa, d'Orb., Actinaræa, d'Orb., Dimorphoseeris, Duncan, and Meandrarea, Etallon, are absorbed.

**Genus Microsolenla, Lamouroux, Exp. Méthod. des genres des Polyop.** p. 65 (1821); amended.

**Syn. Dendraræa, d'Orb.; Actinaræa, d'Orb.**

Colony massive, polymorphous, mamilliform, conical, with a broad base, nearly spherical, turbinate and pedunculate, and lobed, gibbous, lamelliform, or digitiform and subramose. Basal wall with delicate costae covered with a strong epitheca. Calices shallow, close or distant without order. Septo-costæ straight or curved, delicate, close, confluent, in groups or not, minutely pointed with small spinules above, and formed by vertical trabeculae swollen regularly and forming a regular latticework of perforations. Columella very small or absent. Synapticula abundant, small. No calicular walls.


**Genus Polyphyllos eris, de Fromentel, Pol. Foss. de l'étage Néocomien, p. 67 (1857).**

Colony massive and convex. Corallites united by a costal
development. Calices circular on dome-like projections, with a central, circular, well-marked fossette. The septa are numerous, toothed, uniting and joined by well-developed synapticula. The basal epitheca well developed, and hiding delicate and numerous costæ.

*Distribution.*—*Fossil.* Cretaceous: Europe.


Colony branched or elongate, dense, strongly perforate as if vermiculate. Calices superficial. Columella sometimes tubercular. Septa confluent, irregular, more or less bent and echinate (perforate in the delineation). Wall absent. Synapticula?

*Distribution.*—*Fossil.* Jurassic: Europe.

This genus, with a very Microsolenian facies, is allied to the Perforate genus *Psammocora* by Etallon. E. Pratz places it, however, in the neighbourhood of *Microsolenia.*


Colony dendroid, with a broad basal stem; branchlets more or less vertical. Calices more or less oval in outline, rounded off at the margin, and shallow. Columella spongy. Septa numerous, anastomosing, thick at the wall, thin near the centre of the calice; they are perforate near their inner ends. Synapticula well developed.

*Distribution.*—*Fossil.* Jurassic: Europe.

The illustration shows costæ, and probably there was an epitheca.


The colony is branched and in low bush-shaped forms, and the corallites arise low in the primary stem, and grow upwards, not separating much. There is no wall to the corallites, and the calicinal parts are convex and rounded, the calices having a circular fossette in their axis. The septa are very numerous and delicate, being composed of nodules and processes, the first being joined to the corresponding structures of the neighbouring septa. The costæ are covered with a delicate epitheca.

The author of this genus states that the internal construction
of the corallum closely resembles that of *Microsolena*. Gemmation occurs on the margin of the calices or within them.

**Distribution.**—*Fossil* Jurasie: Europe.


**Syn. Dimorphoseris,** Duncan.

Colony polymorphous in a convex mass, or laminate. Calices shallow, a central larger one surrounded by others placed circumferentially. Septo-costae continuous from the central calice to the others and between them. Septo-costae numerous, and close or few. Free edge of the septa minutely punctate, and the rest of the structure as in *Microsolena*. An epitheca.

**Distribution.**—*Fossil* Jurasie: England, Europe.


**Syn. Meandrarœa,** Etallon.

Colony in a lobed and subplane form (laminate). Calices not very deep, distinct, and situated between rather high collines with rounded tops. Septa trabecular, spinulose, and confluent. Wall absent. Columella rudimentary. A thin but well-developed epitheca.

**Distribution.**—*Fossil* Corallien of England, Europe.

The founder of this genus states that the septa resemble those of *Microsolena*, Lamouroux, and *Disarœa*, de Fromentel.

It appears that in some species the valleys are long, twisted at the centre, and straight at the circumference of the colony. The septo-costae pass over the collines except in one instance, *L. Cotteaui*, E. de From., which is exceptional.


The colony is partly adherent and rather thick, has a basal imperforate costulate wall, which is naked and more or less sublobed. The calices are shallow, distinct, and are grouped in long or short linear series, which are separated by low collines or eminences. Septa extend from one calice to another and over the eminences, are dentate, trabecular, and perforate; perforation less low down. Columella small and papillary. Eminences low, long or short, and more or less radiating from the
FAMILIES AND GENERA OF THE MADREPORARIA. 171
centre. Synapticula, both small and large, occupying the place of a corallite-wall, and of that of the eminences also. Gemmation between the calices.

_Distribution._—Recent. Red Sea, Indian Ocean.

This diagnosis refers to _Meandroseris_ so far as it includes _M. Bottae_.

**Group-Genus Mycetaria, Pratz.**

**Genus Mycetaria, Pratz, Palaeontographica, xxix. Band, Lieferug 2, p. 111 (1882).**

Corallum simple, or composed of two or more confluent calices, growing in a succession of alternating oval, irregularly trochoïd to cylindrical shapes. The young individuals either remain united close to the parent as they grow, or become separated and distinct in the upper portion, forming angular projections. Epitheca exists. Septa projecting, numerous, finely toothed, subequal, and built up of regular series of trabeculae. Intratrabecular areas slightly or not filled in. Septal laminæ united by more or less regular synapticula.

_Distribution._—Fossil. Jurassic: Europe.

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CHAPTER VI.

The Section Madreporaria Perforata, definition, and families. Family _Eupsammidæ_, alliances and genera. Family _Madreporicæ_, alliances and genera. Family _Poritidæ_, alliances and genera.

III. Section MADREPORARIA PERFORATA, Ed. & _H_.

This section is thus described in the Hist. Nat. des Corall. vol. iii. p. 88, 1860, and was established in 1850.

"Corallum entirely or almost entirely composed of porous or reticulate _œœnenchyma_. Septal apparatus well characterized and primitively composed of six elements, but sometimes being represented only by series of trabeculae. Dissepiments rudimentary. Tabulae absent."

This definition is correct as far as the end of the last sentence but one; but it requires some additions and alterations.
Section MADREPORARIA PERFORATA, Ed. & H., amended.

Corallum composed entirely or nearly entirely of porous or reticulate coenenchyma. Visceral cavities intercommunicating, and not shut off from the surrounding medium. Septa either well developed, solid or slightly or much perforated, or represented by trabeculae only. Dissepiments may or may not exist, and tabulae also. Soft parts filling the porose sclerenchyma. Calices with a disk, tentacles, and interseptal mesenteries.

There are three families of the Madreporaria Perforata:

I. The EUPSAMMIDÆ (subfam. Ed. & H.).
II. The MADREPORIDÆ, Ed. & H. (pars).
III. The PORITIDÆ, Ed. & H.

Forty-two genera and five subgenera are included in these families. Twelve genera have been eliminated, but five become subgenera.

I. Family EUPSAMMIDÆ.

This family includes the very important and now very large group which was considered to be only worthy of the position of a subfamily by Milne-Edwards and Jules Haime (Eupsamminæ, Hist. Nat. des Corall. vol. iii. p. 90, 1860).

The genera included have a very characteristic facies; and although their structures, both hard and soft, ally them most definitely with the Madreporaria Perforata, they are not without some affinities with the Fungida. The soft parts differ from the corresponding structures of the Fungida.

This distinction of the soft parts is important, for some of the species of Eupsammidæ have hard structures, which act as synapticula, and resemble, to a certain extent, the corresponding structures of some of the Plesiofungidae. Notably this is the case in Eupsammia and Stephanophyllia. Moseley's researches indicate that this last very fungoid-looking genus is clearly not one of the Fungida, for the soft parts differ (Report on Corals, H.M.S. 'Challenger,' p. 203).

Family EUPSAMMIDÆ.

Syn. Eupsamminæ, Ed. & H.

Perforate Madreporaria, simple or in colonies. The corallite walls usually have costæ formed of sclerenchymatous nodules.
joined by vertical and transverse processes, and having apertures in the intercostal spaces. Calices well developed. Septa in several cycles, some orders uniting with others, directly or by trabeculae, to form symmetrical star-like patterns. Septal laminae stout, and the principal ones entire and imperforate, except sometimes near the wall; the higher orders more trabeculate and perforate. Endotheca scanty. Sclerenchyma may exist. Epitheca occasional. Increase by gemmation and fissiparity.

Although there is a great family likeness amongst the genera now recorded, it is very difficult or impossible to place them all in definite Alliances. Some groups of single genera are therefore established.

But the Eupsammidæ indicate their right to be considered a family by having varieties of form which are noticed in other great families. There are simple and colonial types, and the forms are turbinate, discoid, incrusted and massive, dendroid, &c.; and there are types which undergo fissiparity, gemmation from the sides, and also from stolons.

There are the following Alliances in this family:—Stephanophyllioida, Balanophyllioida, Dendrophyllioida, Leptopsammioïda.

I. Alliance STEPHANOPHYLLOIDAE.

Simple Eupsammidæ, with a discoid, basal, horizontal wall.

Genus Stephanophyllia, Michelin.
Subgenus Discopsammia, d'Orb.
Genus Leptopenus, Moseley.
Genus Cyclobacia, Bölsche.

Discopsammia, d'Orb., becomes a subgenus.


The corallum is simple, free, discoid, with a horizontal wall. Calice circular, with five cycles of septa, and some of a sixth, not projecting outwards, but large, high, thin, and close, uniting by their upper or internal borders, the primaries only being free, with conical projecting points on their sides. Septal edges dentate more or less near the axial space, and the laminae are of fused trabeculae more or less perforate. Columella distinct, in a well-marked calicular fossa. Costæ straight, delicate, and radi-
ating regularly from the centre of the base to the circumference, and formed of granules moderately distinct. Wall regularly perforate.


Corallum plano-convex, with a superficial calicular fossette, a rudimentary columella, and the free edges of the septa rounded and slightly denticulate.

*Distribution.*—Fossil. Cretaceous series of Europe.

This subgenus corresponds to the Lenticular *Stephanophyllia* of Milne-Edwards and Jules Haine.


Corallum discoid, excessively thin and fragile, with the wall so completely covered by perforations as to resemble lacework, being built up of a network of delicate radiating and circumferentially-directed trabecula. Perforations placed at regular intervals between the costæ, and each divided into two by the septa, which alternate with the costæ. Septa, except the primaries, which are free, coalescing successively according to order, and forming deltoid figures beset with a series of long, outwardly-directed spines on their free margins; attached beneath to the transverse trabecula, which separate from one another the perforations of the wall by a series of short processes, in the intervals between which their lower margin is free. Columella large, spinous. Tentacles knob-bearing.

*Distribution.*—Recent. Sea-floor of Southern Hemisphere, deep water (over 1500 fms.), South Atlantic, South Indian Ocean, and off Valparaiso.


This is probably identical with *Fungia*, and is therefore a link between *Micrabacia* and *Fungia*. I do not place the genus.

II. Alliance BALANOPHYLLIODA.

Eupsummidse with simple coralla, rarely budding, well-developed calices. Columella variable; and fully-developed septal orders. Costae variable.

Genus BALANOPHYLLIA, S. Wood.
Subgenus THECOPSAMMIA, Pourtalès.
Genus EUPSAMMIA, Ed. & H.
Genus ENDOPACHYS, Lonsdale.
Genus HETEROPSAMMIA, Ed. & H.

Thecopsamnia, Pourtalès, becomes a subgenus.


Corallum simple, or budding around the base, but never forming true colonies or dendroid masses; fixed by a broad or narrow base, or pedicellate and becoming free, very variable in shape, and may be turbinate, straight, or curved, subturbinate, conico-cylindrical, and curved. Calice elliptical, rarely circular, sometimes deformed. Columella not projecting at the bottom of the calice, variably developed—long, narrow, wide or large, and finely spongy. Septa thin, close, numerous, perforate near the wall, the highest cycle curving towards the penultimate, and larger than these; granular at the sides, and joining by the granules. Wall porous, variably stout. Costae well developed, distinct, subequal. Epitheca present or absent.


Corallum simple, attached, pedunculate, turbinate, or subcylindrical. Wall thick, very porous and vermiculated. Calice slightly elliptical, deep. Septa well developed, not exsert, granular; those of the 4th and 5th orders bend towards the tertiaries or unite in front of them. Columella papillose, porous or sublamellar and compact, and forming three masses. Costae
obscure. Epitheca well developed, coming up not far from the calicular edge, marked with ridges or not, and its substance penetrating the porose wall.


Corallum simple, subturbinate, free in adult age, when the traces of adherence gradually disappear, compressed or not. Calice elliptical or subovall, deep and narrow centrally. Columella variably developed, of twisted processes, tubercular or papillary, or spongy, or barely existing. Septa solid or roughly perforated, numerous, close, well developed, slightly exsert, strongly granular on their sides, and uniting by the granules here and there; the septa of the last cycle more developed than the penultimate, and curving towards and joining or not the septa of the cycle preceding them in age. Wall porous, naked, showing simple, close, unequal verrucellate, distinctly granular costae.

*Distribution.*—*Fossil.* Eocene, Oligocene, Miocene: Europe.—*Recent.* Chinese seas.

Synapticula are often seen near the calicular margin, between septa.


Corallum simple, straight, free, compressed and keeled along the narrow base and sides, where there are also costal wing-shaped appendices. Calice with unequal axes on different planes; the fossette long and narrow. Columella spongy, slightly developed. Septa in five cycles, narrow, slightly exsert, close, the higher cycle joining the preceding, sides granular.

*Distribution.*—*Fossil.* Eocene: Alabama.—*Recent.* Australian seas?


Corallum simple, straight, low, increasing fissiparously so as
to form a compound corallum with two or more calices. The base broad, flat, unsymmetrical, tumid, containing a Sipunculid worm, and perforated for it. Calice circular, close, or a figure of 8, or round, open, shallow. Columella spongy, well developed, deep. Septa numerous, many joining near the columella. Wall stout, porous, often enlarged at certain spots around the calice. Costæ not present, but replaced by series of very small granules, coalescing into papillae or small striae.


The porosity of the wall, the relations of the septa, and the absence of pali separate the genus decidedly from *Stephanoseres*.

### III. Alliance DENDROPHYLLIOIDA.

Colonial Eupsammidæ, with well-developed calices and septa. Columella variable in development, spongy, lamellar, or absent. Cœnenchyma variable. Dissepiments rare.

**Genus Dendrophylla**, Ed. & H.

Subgenus Cœnopsammia, Ed. & H.

**Genus Placopsammia**, Reuss.

**Genus Astropsammia**, Verrill.

**Genus Pachypsammia**, Verrill.

**Genus Stereopsammia**, Ed. & H.

**Genus Calostylis**, Lindström.

Genus absorbed:—

*Brassyia*, B. Wright.

*Cœnopsammia*, Ed. & H., becomes a subgenus. *Aulopsammia*, Reuss, is not a Madreporarian.


Colony generally dendroid and high or low, corymbose or cæspitose, or forming clumps; increasing by gemmation, which is lateral or subbasal. Corallites rather large, cylindrical, cylindroturbinate, more or less elongate. Calice subcircular, deep. Columella more or less developed, often large. Septa barely exsert or not, thin, close, those of the fourth cycle well developed, and the septa of the last cycle or cycles bending to their predecessors and uniting or not to them. Walls subcostate near the calices, covered with rough vermiculate grains in rows, with irregular spaces between.
Milne-Edwards and Jules Haime divide this genus into groups of species:

1. Arborescent *Dendrophyllia*. With an arborescent trunk, branches arising from it in vertical series, and ramifying in their turn in an alternate and distichous manner.

2. Branching *Dendrophyllia*. The parent occupies the axis of the corallum or colony, and the secondary branches arise around it, forming several vertical series, some uniting when they come in contact.

3. Incrusting *Dendrophyllia*. Not developing much in height by budding, and resembling an Astræiform mass, with some coenenchyma. Corallites often uniting about the base.


The genus *Brassyia*, B. Wright, Ann. & Mag. Nat. Hist. 1852, ix. p. 77, was established for specimens of one species. It is a stumpy, broad-based coral, clearly colonial, from the buds upon it, although it is stated to be simple. The only interesting point is that the septa are said not to unite.

It is synonymous with *Dendrophyllia*, and is in no way intermediate between *Dendrophyllia* and *Balanophyllia*.


Colony in tufts, or fasciculate or dendroid, rarely massive. Corallites more or less cylindrical, free or surrounded by coenenchyma. Calices subcircular. Columella well developed. Septa not exsert, in three complete cycles, and whenever there are higher orders they are rudimentary. Costæ delicate, subvermiculate inferiorly, simply granular near the calice. Gemmation lateral and subbasal. Septa and wall differing in the amount of perforation.


Colony with a broad base, and short stunted projections, ending in elliptical calices. Columella long and lamellary, compact. Septa in four cycles, and with some of the orders uniting, as is usual in the Eupsammidae. Costæ visible to the base, often wavy and inosculating.

Distribution.—Fossil. Miocene, Oligocene: Europe.—Recent. Galapagos?

Genus Astropsammia, Verrill, Notes on Radiata, p. 509 (1868–70).

Colony massive. Corallites united to their summits by an abundant, very porous coenenchyma. Walls scarcely distinct from the coenenchyma, very porous. Septa in four cycles, with some orders of the fifth; those of the fourth unite to the tertiaries. Columella usually well developed, composed of loose, convoluted, and twisted lamellæ and trabeculae. Interseptal spaces cut off below by thin transverse dissepiments, which often coincide in all the chambers. Calices shallow. Gemmation chiefly marginal and interstitial. Fissiparity may occur.

Distribution.—Recent. Mergui, Burmah; Gulf of California.

Some forms considered to be Cænopsammia, and which have coenenchyma, belong to the next genus.


Colony massive and incrusting. Corallites united near their summits by a massive coenenchyma. Four complete cycles of septa. Columella rudimentary or trabecular, not salient. Surface of the coenenchyma with waving ribs. Gemmation lateral, irregular.

Distribution.—Recent. Chinese seas.

This genus approaches Stereopsammia, but has a solid coenenchyma. It differs from Dendrophyllia in not having a distinct columella.


Colony incrusting, glomerulate. Corallites short, united at the base, free near the calice. Calices circular, rather deep.
Columella absent or rudimentary. Septa hardly exsert, those of the last cycle less developed than those of the penultimate. Costae fine, close, frequently discontinuous and vermiculate. Gemmation irregular, and from the base.


Pourtales considered his *Amphelia rostrata* to belong to this genus; but it can hardly be included.

Lindström has described, with his usual care, a remarkable coral, which he considers to be one of the Eupsammidae, from the Silurian strata of Gothland. The description and figures carry conviction that this genus, *Calostylis*, is one of the Perforata, and that it should be placed in the Eupsammidae. The resemblance of the thick mural structure of the calices to that of *Thecospsammia*, Pourtales, is very striking.


Colony cylindro-conical, uniserial, budding between the calice and the base. Septa numerous, thin, coalescing, irregularly perforated, ragged at the upper free edge, and forming a trabeculate columella with their inner ends. Columella broad, convex. Dissepiments few. Costae extend from the calice to the base, and are covered here and there by a smooth thin epitheca.

**Distribution.**—*Fossil.* Silurian: Gothland.

The above diagnosis is compiled from Lindström's generic diagnosis, and from the description of the species, *Calostylis cribbraria*. Lindström's diagnosis is rather too short for the purposes of comparison with other Eupsammidae:—"Polyparium compositum, gemmatio uniserialis, lateralis, septa numerosissima, interdum inter se coalescentia, columella trabecularis, epitheca incompleta."

**IV. Alliance LEPTOPSAMMIOIDA.**

Simple Eupsammidae with irregular septal development.

**Genus Leptopsammia**, Ed. & H.

**Genus Endopsammia**, Ed. & H.

There are two genera, each established for one species only, which are exceedingly unsatisfactory. They are *Leptopsammia* and *Endopsammia* of Milne-Edwards and Jules Haime. They are closely allied, and in both there is an imperfection of the
fourth cycle, and a deficiency of that lateral junction of the septa which is so generally characteristic of the family.


Corallum simple, adherent, tall, subturbinate, narrow at the base. Calice elliptical, with a large and deep fossa. Columella very developed, projecting. Septa not exsert, moderately close, very thin, barely granulated; the septa of the first and second cycles nearly equal, the septa of the fourth order curved towards the tertiaries, which they reach at a little distance from the columella. The septa of the fifth order perforate, denticulate, projecting barely from the wall. Epitheca rudimentary near the base. Costae distinct.

Distribution.—Recent. Philippines.


Corallum short, straight, adherent by a broad base. Calice circular, with a deep fossa. Columella spongy, well developed and projecting. Septa stout, exsert, very largely granular. The fifth order rudimentary, the fourth curving towards the tertiaries; these and the primaries large and nearly equal. Costae well developed. Wall thick and porous. A pellicular epitheca.


The following genera cannot be placed in Alliances:

Group. Incrusting colonial Eupsammidae.
Genus Astroides, Blainville.

Group. Fissiparous colonial Eupsammidae.
Genus Lobopsammia, Ed. & H.

Group. Simple Eupsammidae, budding from the wall.
Genus Rhodopsammia, Semper.

Group. Colonial Eupsammidae, budding from stolons.
Genus Rhizopsammia, Verrill.


Colony incrusting, massive. Corallites imperfectly united, or free at their sides. Wall spongy, but dense. Calices circular or polygonal, free or united by their edges. Columella very deve-
loped, projecting, spongy. Septa moderately developed, very thin, not exsert, finely and unequally dentate, those of the last cycle less developed than those of the penultimate. Endotheca scarce. Epitheca surrounding the corallites thin and compact.

*Distribution.*—Recent. Mediterranean.


Colony dendroid and very short and dichotomous, short branches directed outwards. Calices with irregular-shaped margins, increasing by fissiparity. Four cycles of septa well developed, and some of the fifth; higher orders bending to and joining the penultimates. Columella spongy. Costae delicate, with indistinct granules.

*Distribution.*—Fossil. Oligocene: Europe.


Corallum simple or colonial, free or attached, with lateral buds, cylindro-conical or compressed. Calice elliptical, rather deep. Columella more or less projecting, composed of convoluted "leaflets." Septa narrow, sharp at the edge, hardly exsert; first and second cycles extending to the columella, unequal; succeeding cycles joined with those of preceding cycle. Costae simple, distinct from the base, close, subequal, granular. Epitheca absent or rudimentary.

*Distribution.*—Recent. Philippines.

Several species of this interesting genus are described by Semper and beautifully figured. The budding is below the calicular margin, and some buds may bud again. The parent is clearly alive after this process, and the whole colony is a pale pink in colour when alive, and the tentacles, which are long, are of a deeper tint. Some coralla are attached, others are free; and some have buds, others have not. In one instance there is a bud with a quadrangular transverse outline springing from the calicular margin.


Colony low, incrusting, extending by stolon-like expansions of
the base, from which buds arise. Corallites cylindrical or nearly so, connected by thin creeping expansions, which have the same texture as the wall. Calices subcircular or elliptical. Septa thin, crowded, a little projecting, arranged in four or five cycles; last cycle well developed, uniting to those of the preceding cycle, which rise up in the form of prominent paliform lobes, beyond which the central region of the calice is deep. Columella very porous and its surface papillose. Wall very porous. No epitheca. Costæ scarcely distinct, represented by series of rough granules.

Distribution.—Recent. Pacific, Pearl Islands.

II. Family MADREPORIDÆ (pars), Ed. & H.

This family corresponds to the subfamily Madreporinæ, Ed. & H. It is necessary to give the subfamily the position of a family, not only because the Eupsammidæ have become a family, but also because it is evident that the great genus Madrepora will eventually be largely subdivided. The subfamily Turbinarinæ, Ed. & H., is included in this family.

Colonial perforate Madreporaria, increasing by gemmation; coenenchyma more or less abundant, spongy, and reticulate, slightly or not distinct from the porous corallite-walls. Septa lamellar, slightly porous, or else solid, variable in number and size. Calices prominent or sunken.

Alliances:—Madreporoida, Turbinaroida. These alliances were subfamilies according to Milne-Edwards and Jules Haime.

I. Alliance MADREPOROIDA.

Madreporidæ with diverse shapes, usually ramose or foliaceous or inerustling. Coenenchyma moderate or considerable. Septa with two opposite primaries larger than others. Interseptal loculi with dissepiments. Gemmation symmetrical or not, extracalicular. Calices more or less prominent and variable in shape.

Genus Madrepora, Linnaeus.
Subgenus Isopora, Studer.


Colony very variable in shape, branching, bush-shaped,
expanding, flat, corymbiform, or foliaceous, pedunculate or in-crusting. Gemmation around the parent corallite and from the side of other calices. Coenenchyma abundant, spongy, reticulate, spinulose, growing exogenously from the porous walls of the corallites. Calices variable in shape, projecting or immersed, but never all so; terminal calices, or some amongst the mass, longest or largest (parents). Septa distinct, variable in solidity, two opposite primaries largest and nearly meeting. Twelve tentacles, and one larger than the others. No columella. An endotheca may exist, which occasionally becomes tabulate.


Colony leaf-shaped or lobate. Calices equally prominent, and distributed over the whole surface. The apical calices are wanting. Distribution.—Recent. Philippines.

II. Alliance TURBINARIOIDA.

Madreporidae in colonies, with an abundant coenenchyma between the corallites, which is distinct from the mural structures, spongy and reticulate. Increase by gemmation.

Genus Turbinaria, Oken.
Genus Astræopora, Blainville.
Genus Dendracis, Ed. & H.
Genus Actinacis, d'Orbigny.
Genus Palæacis, Haime.
Genus Prisciturben, Kunth.
Genus Stylaræa, Seebach.


The colony is usually crateriform or foliaceous and twisted. There is an abundant coenenchyma between the corallites, and it is dense and also echinulate at the surface. The calices are more or less projecting. The septa are nearly all of the same size; and there is a well-developed spongy columella.

This genus was shown by Milne-Edwards and Jules Haime to absorb Gemmipora, Blainville, and Explanaria (pars), Lamarck.

**Genus Astreopora, Blainville, Dict. des Sci. Nat. t. ix. p. 348 (1830).**

The colony is massive in shape, adherent or incrusting. The cœnenchyma is lax, and decidedly echinulate at the surface. The septa are unequally developed on the small calices. There is no columella. Tabulæ are seen in some specimens.

*Distribution.—Fossil.* Eocene of Europe and West Indies. Miocene: Sind, Asia.—*Recent.* Red Sea, Indian and Pacific Oceans.


The colony is arborescent, and the cœnenchyma is very dense and granulated at the surface. Calices submammiform. Septa few in number, subequal. No columella.

*Distribution.—Fossil.* Eocene of Europe.

**Genus Actinacis, d’Orbigny, Note sur les Polyp. foss. p. 11 (1849).**

Colony subdendroid, with a greatly developed cœnenchyma, which is rather dense and granulated, and not very perforated. Calices circular, small, distant. Septa few in number, subequal, somewhat exsert. A columella, which is papillose. Pali exist before all the septa.

*Distribution.—Fossil.* Cretaceous of Europe.


Syn. Sphenopoterium, Meek and Worthen.

Colony pedunculate, cuneiform. Calices immersed in a vermiculate perforate cœnenchyma, marked with anastomosing striations. Calice-walls of the same structure as the cœnenchyma, thick, but porous. Calicular margins circular in outline. Calices widely open. Septal system of fine, numerous, unequal striations (30). Gemmation intercalicular, and producing occasionally by pressure polygonal calicular margins.

*Distribution.—Fossil.* Carboniferous: America.

Colony low, expanding, attached by the whole base. Coenenchyma well developed, compact, and composed of a sponge-like structure. Calices projecting, rather inclined, differing in size, nearly or quite circular in outline, surrounded by coenenchyma. Septa variable, both thick and thin. Columella spongy.

Distribution.—Fossil. Silurian: Oeland.

This is a very puzzling genus, and its characters have been very ably described and delineated by Kunth. Its position is probably amongst the Turbinariæ.


Colony low, covering some space, with a crust-like, vermiculate, perforated coenenchyma and a basal epitheca. Calices polygonal, moderately deep, with a stout, projecting, spongy columella. Septa strongly crenulate, in two cycles. Walls moderately stout, bearing points in the angles of the calices.

Distribution.—Fossil. Lower Silurian: Europe (Wesenberg).

III. Family PORITIDÆ, Ed. & H.

Perforate Madreporaria composed of reticulate and trabeculate sclerenchyma. Septa never completely lamellary, but trabecular and fenestrated, or as series of discontinuous trabeculae. Walls very porose. Corallites increasing by gemmation, and united directly or by intervening porous sclerenchyma. Dissepiments and tabulae may exist.

There are two Alliances—the Poritinoida and the Montiporoida.

I. Alliance PORITINOIDEA.

Corallites united by their trabeculate walls without intervening coenenchyma, or with some of very rudimentary kind.

Genus Porites, Ed. & II.  
Genus Synaræa, Verrill.  
Genus Napopora, Quelch.  
Genus Dictyaræa, Reuss.  
Genus Rhodaræa, Ed. & II.  
Genus Goniopora, Quoy et Gaimard.  
Genus Litharæa, Ed. & H.
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Genus Protaræa, Ed. & H.
Genus Alveopora, Quoy et Gaimard.
Subgenus Favositipora, S. Kent.
Genus Somphophora, Lindström.
Genus Dichoræa, T. Woods.

Genera absorbed:—Stylaræa, Ed. & H., non Seebach; Meandraræa, Etallon.
Favositipora, S. Kent, becomes a subgenus; Koninckia, Ed. & H., a doubtful genus.
Genera removed:—Microsolena, Lamour.; Coscinaræa, Ed. & H.; Dictyophyllia, Blainville; Pleurodictyum, Goldfuss; Holaræa, Ed. & H.; Cenostroma, Winchell.


Colony ramifying, or in tufts, or foliaceous, often massive, and lobed or low, inerusting or not. A basal enditeca invariable in the last instance, frequent in all. Corallites with trabeculate and perforate walls, not distinct from those of their neighbours, and therefore without intermediate cænenchyma. Calices small, pentagonal. Septa twelve or less, feebly developed, trabecular or spinulose. A small columella, forming at its free end a knob or a trabecular point or a style. Pali five or six, and not very distinct from the septal ends, in a circle around the columella. Endotheca exists sparingly, and may be dissepimental or tabulate, or may be mere stereoplasm.

This genus absorbs Stylaræa, Ed. & H., 1851.

The absence of any intercorallite reticular tissue or cænenchyma is invariable in the recent forms; but in the Eocene Porites panicea, Lonsdale, there is a small quantity in some parts of a colony, but not in all (Supp. Brit. Foss. Corals, Pal. Soc. 1866, p. 63; P. M. Duncan).


Corallum irregularly branched or glomerate. Corallites without distinct walls. The septa rudimentary. Six prominent and paliform lobes surround the central cavity, which has a small rudimentary tubercular columella. Outside of the pali are other
similar points or granulations scattered between the cells (corallites), which are not distinctly circumscribed, but often separated for some distance by a porous eoonenchyma.

*Synarea* includes *Porites conformis, P. monticulosa* of Dana; also *Porites antiqua, Dana, = P. Dana*, Ed. & H.

**Distribution.**—Recent. Pacific.


Corallum compound, porous. Gemmation intracalicinal, the developing buds with distinct centres almost destitute of distinct walls, at first united in groups of 2–6, and surrounded by the common wall of the parent calicle; but as development proceeds they are separated off by a narrow, raised, distinct wall. Calicinal depressions very variable in size and shape, according to the number, position, and degree of development of the buds. Walls of the older calicles porous, distinctly raised, and angular. Septa generally of two cycles, rudimentary. Pali six, sometimes one smaller than the others or absent, generally well developed, and distinctly marking the position of the calicinal centres. Columella rudimentary, represented by small papilliform projections, often absent.

**Distribution.**—Recent. Tahiti.


The colony is in knotty branchlets. The calices are rather irregular in shape, generally pentagonal, separated by a slight ridge. Septa few, about 6 to 12, uniting around the axis by false paliiform lobes. Columella absent. Considerable distinction between the size of the calices and the dimension of the septa.

**Distribution.**—Fossil. Eocene: Java, Asia, Europe.


The colony is massive; the calices are deep and pentagonal; the trabeculae of the walls of the corallites are well developed, but they retain their spongy appearance. Septa trabecular, not much developed, and in three cycles. Columella absent or rudimentary. Pali six in number and very large, placed before the secondary septa.
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Colony attached or free, lobed or hemispherical, or in tall blunt cylindrical masses. Corallites with distinct trabecular walls joining those of their neighbours, without intermediate tissue. Calices unequal in size, and shallow or deep, pentagonal. Septa projecting but little in the upper part of the calices and ragged, extending towards the columella as porose trabecular laminae. Columella well developed, spongy. No pali. Gemmation between the calices. Endotheca exists.

Distribution.—Recent. Red Sea, Indian Ocean, Pacific.


Colony low, free or incrusting, lobed, or dendroid, or discoid, with an imperfect or well-developed epitheca. Corallites with trabecular porose walls adherent to, or fused with those of their neighbours. Calices polygonal or irregular. Septa well developed, and subperforate and echinulate. Columella trabecular, and formed by the septal ends. No pali.


The septa approach those of the Astreidae, and the genus is closely allied to the recent Goniopora.

Some comparatively late researches on the next genus have modified the generic diagnosis, and have given a higher distributional range to the species.


Colony incrusting and massive. Corallites polygonal, with simple perforated walls, which at the calicular surface are narrower than the calice by one half, and are ornamented with points. Calices shallow. Septa 6–12 to 24 in number, pass a little way in and are sublamellary and dentated. No columella.


Colony lobed, convex, foliaceous or dendroid. Corallites united by very largely fenestrated trabecular walls. Calices polygonal, deep, usually unequal. Septa as simple series of distant spiniform trabeculae, which may ramify near the axial space, and form a false columella or not. Epitheca basal or pellicular.


In some specimens of *Alveopora viridis*, Quoy (*A. spongiosa*, Dana), there are tabulae; but there are twelve tentacles, which are short and cylindrical. They have been placed in the following subgenus.


The corallum resembles that of *Alveopora*, and has tabulae.


This type belongs to the *Alveopora-viridis* group, and can hardly be separated from *Alveopora* generically. It had better include the tabulate *Alveopora* for the future, which are nevertheless true Perforata.

The genus *Koninckia*, Ed. & H. Hist. Nat. des Corall. vol. iii. p. 263, is one of the *Alveopora-Favositipora* group, and is ill-defined. It is from the White Chalk of Royan.


Colony with deep polygonal calices. Wall thick, indistinctly fenestrate with large spaces. Six septa, rather distant, having pointed dentations, not uniting together nor reaching the centre of the calice. Dissepiments (tabulate) irregularly distant one from another.

*Distribution.*—Fossil. Silurian: China.

Lindström, with his usual perspicuity, places this genus in the neighbourhood of *Alveopora* and *Favositipora*.


Colony turbinate, pedunculate, broadly attached. Calices
polygonal, numerous, minute, irregular. Septa a series of needle-shaped points. Wall of corallites thickly studded with short, stout, and very conical points, swollen at the base, and pointing towards the interior of the fossa. A common epithet in very thick folds. Gemmation intracalicular.

**Distribution.**—Recent. Pacific.

The Rev. T. Woods gives a delineation of the species; and there is no intermediate cœnenchyma shown between the calices.

M. de Fromentel, *op. cit.* p. 256, places the genus *Pleurodictyum*, Goldfuss, in the group Perforata, which includes *Porites*. This genus finds no place amongst the Madreporaria Perforata, as it is founded on a cast of a species of the genus *Michelinia*, a Palaeozoic tabulate form which in all probability belonged to the Alcyonaria.

M. de Fromentel* places the genus *Holarcea*, which was founded by Milne-Edwards and Jules Haime to receive *Alveolites parisiensis*, Michelin, amongst the Perforata in the neighbourhood of *Porites*. The condition of the specimens on which the above-named species was established is very defective. Milne-Edwards and Jules Haime, in 1860, in their *Hist. Nat. des Corall.* vol. iii. p. 244, place *Holarcea* as a synonym of *Axopora*, a genus with tabulae, and certainly not one of the Madreporaria, but an Alcyonarian. *Holarcea* is therefore no longer a genus.

The genus *Coenostroma*, Winchell, is probably an ally of *Stromatopora*, and not a coral.

**II. Alliance MONTIPOROIDA.**

Poritidae with a more or less abundant spongy cœnenchyma.

Genus *Montipora*, Quoy & Gaim.
Genus *Anacropora*, Ridley.


Colony various in form, glomerate, massive, incrusting, foliaceous, lobate or branching. Cœnenchyma abundant, porous, or spongy, usually echinulate at the surface, and often rising into ridges, papilliform eminences, and crests between the corallites;

* 'Introd. à l'Etude des Polyp. foss.,' Paris, 1858–60.
usually very different on the base. Corallites small, wide apart, separated by coenenchyma in which they are immersed, or else the calicular margin is raised, lacerate, and spinulose. Calices deep, with columella and pali. Septa little developed, six or twelve, and often trabecular. Secondaries smaller than the primaries.

*Distribution.*—*Recent.* Red Sea, Indian Ocean, Pacific.

Mr. S. O. Ridley has investigated and described a very interesting form, which he places in a new genus, *Anacropora*. The aspect of the species is that of one of the Madreporidae, and the two large primaries add to this character; but the gemmation differs. The septa are trabecular, but are fairly developed.


Colony ramose. Axis and apex of branches formed by a spongy coenenchyma. New calices formed centripetally, *i.e.* from the base towards the apex; no calice of any kind at the apex. Calices equally distributed all round stem and branches, with a tendency to arrangement in longitudinal series. Septa trabeculate, comprising two cycles of six septa each, two (approximately upper and lower) primaries being larger than the four lateral primaries.

*Distribution.*—*Recent.* Keeling Islands.

The proper position of *Psammocora* is with the Lophoserinae, p. 161. I have only been able to study this genus after going to press.

**Genus Psammocora, Dana, Zooph. Wilkes Exped. (1846), p. 344, amended.**

Colony in ramose tufts; branchlets often lobed, or in convex masses, or foliated and lobed. Surface more or less irregular, from gibbous humps or linear elevations. Coenenchyma exists in places, especially on the gibbosities, which, however, just as frequently are covered with calices. Calices small, centres distinct, but margins ill-defined, usually circular, shallow, with a small central fossa with a minute papilla, the top of the columella. Septa 6-9-12 in number, very variable in thickness; sometimes one half of them reach the columellary space, and form a ring of tissue around the columella, the other septa having previously united to them; or several septa are club- or boss-shaped at their free margins, and are much larger than the others which environ them. These larger septa
appear isolated, but are continuous with laminae that extend downwards. Sometimes these boss- or club-shaped septa are found beyond the calices and between sets of them, and thus resemble the tentacular septa of the family Fungidae. Here and there great confusion of calices and these septa is apparent. The costae are indefinite, but they are continuous with the septa, and reach over linear elevations, and sometimes cover much space. They often bifurcate. Septa solid, spinulose, connected by numerous small synapticula. Wall formed by synapticula, which exist between the costae also. Gemmation and rarely fissiparity.

**Distribution.**—Recent. Indian Ocean, Chinese seas, Pacific.

*Psammocora*, Dana, was splendidly illustrated by Dana in his great work, and the remarkable superficial views given, are often strikingly correct. But with age and after death deposit of carbonate of lime occurs, in the first instance consolidating the tissue, and in the other adding to their density. Sections, or rather fractures, made longitudinally and transversely, prove that the septa are solid, stout, spinulose at the free surface, and that synapticula abound. There is some coenenchyma between coralites here and there, sometimes forming monticules; and it is evident that fissiparity may occur, but it is rare. Under the circumstances the genus must be removed from the section Perforata into that of the Fungidae, family Lophoseridae, near *Plesioseris*, nobis.

The following nine genera are new:—

- *Antillastrea*, p. 108.
- *Brachymaandrina*, p. 90.
- *Diplothecastra*, p. 115.
- *Koilocœnia*, p. 115.
- *Nototrochus*, p. 17.
- *Physophyllia*, p. 118.
- *Pourtalosmilia*, p. 72.
- *Zittelofungia*, p. 150.

Total number of genera recorded, after revision, 343 out of 478.
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List of Sections and Families of Madreporaria.

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   Subfamily Turbinolidae simplices.
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   Odontocyathus, Moseley, p. 23.
   Leptocyathus, Ed. & H., p. 23.
   Caryophyllia, Link., p. 25.
   Subgenus Acanthocyathus, Ed. & H.,
   Stenocyathus, Pourt., p. 25.

Alliance Discocyathoidae.
   Genus Discocyathus, Ed. & H., p. 28.
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Genus
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Genus
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Genus


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Alliance Stephanarioida.
Genus
Stephanaria, Verril, p. 160.

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Genus
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V. Family PLESIOPORITIDÆ

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Genus

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EXPLANATION OF TERMS.

**Corallum.** An entire solitary or individual coral.

**Colony.** A compound corallum of authors. A number of individuals united together. A number of corallites springing from a common stock.

**Corallite.** An individual member of a colony.

**Common wall or colonial theca or common plateau.** The structure which often environs the colony at the sides, or is at the base. It may be only found as a basal structure.

**Corallite-wall or Theca.** The external structure which gives the corallite its shape, bounds the visceral cavity and interseptal loculi, and to which septa are attached within and often costae without. It is solid in the Aporosea, perforated in the Perforata and in some Fungida. Walls may be separate or fused together.

**Calice.** The upper opening of the corallite or corallum. A calice may be circular, elliptical, oval, elongate, deformed, or polygonal in outline. It may be separate from other calices in a colony, or more or less united with others by fusion of the walls of the adjacent corallites. The margin of the calice is the top of the corallite-wall.

The parts of the calice are—the septa, pali, the columella, the fossa, and interseptal loculi.

**Septum.** A typical septum is a lamina or plate, which reaches from the inner surface of the corallite-wall near or quite to the centre of the calice. It may reach any distance towards a central axial line. The upper edge is free at the calice, whilst the lower edge is fused with the lowest part of the corallite's cavity.

Septa may be few in number or very numerous. They may be solid, fenestrated, or perforated here and there, or reduced to mere trabeculae and points. They may be entire at the upper edge, or ragged and denticate there. They may unite with their fellows laterally or by means of the inner edge, but usually this is either free; or it may be united, directly or indirectly, with a columella or with pali. The spaces between the septa are interseptal loculi.

Septa are arranged in systems, and appear in cycles or orders. A typical Aporose coral has six systems, and the same number of septa in each.

The first septa which appear are the primaries, and there are six of them, so that a system is between two primaries. Next come the secondaries, six in number, one between each primary pair; so that there are then 12 septa, or each system has two cycles of septa, one composed of primaries and the other of secondaries. The tertiary septa appear between each secondary and a primary, in every system; so that there are 6 primaries, 6 secondaries, and 12 tertiaries, making three cycles, or 24 septa in all. The next cycle has its septa in the interval between the tertiaries and secondaries and tertiaries and primaries. The new septa are therefore 4
to each system, and in all 24. These, added to the previously existing 24, make 48 as the number of the entire four cycles of septa.

The fifth cycle has its septa in the intervals between the already existing septa, and when it is complete the number of all the septa in the corallite is 96. The sixth cycle, if complete, gives 192 septa.

The septa which arise simultaneously, in the different systems, are of the same order. There is not much occasion for this term until the fourth cycle of septa is considered. The septa often do not all arise spontaneously, and then the fourth and fifth orders become of importance.

There is some discrepancy of opinion regarding the exactitude of the statements of Milne-Edwards and Jules Haime, but this succession is in the main true, and especially in calices which are symmetrical and circular in outline. Ellipticity of outline appears to interfere with the normal increase of the septa, or abnormality develops the ellipticity.

In some genera the six systems do not occur, and the septa may be in 3, 4, 5, 6, 7, 8, 10 systems. In each of these systems, however, there may be a normal succession of septa. Occasionally septa abort; and, on the other hand, one or more may be unusually large.

_Pali._ Pali or paluli are laminae or plate-like growths which extend upwards from the bottom of the corallite to the calice, where they usually project between the inner edge of certain septa and the columella or the axial space. They are placed before certain cycles or orders of septa only. There may be one or two sets or crowns or even more of them, as they are placed before (or between the centre of the corallite and the septal end) several cycles of septa. They differ in structure from the septa.

_Columella._ A structure which fills the axis of the corallite more or less. It may be solid, and may arise from the base of the corallite within, and reach up to the calice and end in a knob or point. It is then essential and styliform.

It may arise from the base, and be formed of ribbon-shaped laminae more or less intertwined, and reaching up to the bottom of the calice. Such a one is essential and trabeculate.

It may be made up of trabeculae springing from the base and ending upwards with a spongy or papillary top. It is then essential, spongy, or papillary. Sometimes the columella arises from the junction in the middle line of processes or trabeculae from the ends of the septa. It is then _not essential, but parietal_. This form may be very slight or rudimentary.

The essential columella may sometimes be a long solid lamella, and then the columella is said to be lamellar.

It may happen that there is no columella, and then the central axis is vacant.

_Calicular axial fossa_ may be wide or narrow, circular or elongate. _Calicular fossa_ is the depth of the whole calice.

_Costa._ Projections upon the corallite or colonial wall or plateau-base with intercostal depressions or spaces. Usually the costa correspond with the septa; but sometimes they relate to the interseptal space or differ in number. The costa may be directly continuous with the septa at the calicular
margin, and may pass from calice to calice. When there is continuity, the costæ are termed septo-costæ. These may pass over the common wall and base.

Costæ do not exist in some genera; and, when they are developed, may be spiniulose, moniliform, or smooth and lamellar. Some are crested and spined.

**Endotheca or Dissepiments.** Thin plate-like structures, oblique, arched, and more or less distant, one above the other, in the interseptal loculi, and sometimes, when there is no columella, in the axial space. They unite septa, close the loculi, enable the coral to grow in height and strength, and limit the growth downwards of the mesenteries and soft parts.

**Tubula.** Horizontal stout dissepiments, crossing much or all of the space within the corallite-walls.

**Synaptica.** Special growths from the septal sides, reaching over the interseptal loculi to the other septa. They occlude much of the interseptal loculi, often form a false basal wall to the corallite, and tend to form the mural and basal structures in some genera. They are false when they only consist of granular or papillary ornamentation united across the interspaces.

**Exotheca.** A cellular structure stretching between neighbouring costæ and filling up the intercostal spaces, and often extending beyond the costæ and uniting neighbouring corallites. When abundant, it forms a cenenchyma. It may be in bands, or may be very thick, and yet vesicular; in this last instance it is termed peritheca.

**Epitheca.** A basal structure covering all the outer structures of a colony or corallum. It may reach close to the calice or only a little way from the base. It may resemble the wall itself, or be membranous or pellicular, and may be extended into radicles. It may be either smooth or transversely wrinkled.

**Gemmation.** This is rarely deciduous, and may arise from the calice—calicular gemmation. If from between the axis and the calicular margin—intercalicular gemmation; from the margin—marginal gemmation. Between calices—intra-calicular gemmation. It may occur from any part of the wall of a corallite, from the calicular margin to the base—infra-marginal or lateral gemmation. It may be close to or at the base—basal gemmation. Sometimes it occurs from stolons, or soft or solid growths from the base.

**Fissiparity.** Union of septa across a calice and division of the corallite into two or more parts, which become separate individuals, or by a continuance of the process develop series.

**Collines or Ridges.** The raised parts of a colony between series of calices, usually covered by septo-costæ.

**Stereoplasm.** A term usefully introduced by Lindström. Delicate endothecal structure occupying different positions in the corallite, often forming vertical processes in the interseptal loculi, or encircling septa, or acting as true endotheca. Often filling up the base within, and then more solid.
FAMILIES AND GENERA OF THE MADREPORARIA. 203

The following 40 genera are now considered to be subgenera:

- Acanthocyathus, Ed. & H.
- Agathelia, Reuss.
- Agelecyathus, Dunc.
- Antillia, Dunc.
- Blagrovia, Dunc.
- Blanfordia, Dunc.
- Blastotrochus, Ed. & H.
- Caulastræa, Dana.
- Ceratophyllia, v. Fr.
- Cladophyllia, Ed. & H.
- Cœlaria, Ed. & H.
- Cæl osmilia, Ed. & H.
- Cœnangia, Verrill.
- Cœnopsammia, Ed. & H.
- Cyphastræa, Ed. & H.
- Discopsammia, d'Orb.
- Epismilia, E. de From.
- Favositipora, S. Kent.
- Haliglossa, Ehr.
- Haloseris, Ed. & H.
- Haplarræa, Milas.
- Helioecenia, Etallon.
- Isopora, Studer.
- Javanía, Dunc.
- Leptaxis, Reuss.
- Leptomussa, d'Ach.
- Oppelismilia, Dunc.
- Orosers, Ed. & H.
- Palæoseris, Dunc.
- Phyllangia, Ed. & H.
- Phylloseris, Tomes.
- Plesiosmilia, Milas.
- Rhizotrochus, Ed. & H.
- Stephanocyathus, Seg.
- Stylotrochus, E. de From.
- Thecoecyathus, Ed. & H.
- Thecoseres, Ed. & H.
- Trocharæa, Etall.
- Tropidocyathus, Ed. & H.
- Ulastræa, Ed. & H.

The following 95 genera are either synonymous with others, or are necessarily absorbed, or of deficient value:

- Actinaria, d'Orb.
- Agathiphyllia, Reuss.
- Amphiastræa, Etall.
- Anomocora, Stud.
- Aplocyathus, d'Orb.
- Aplocyathus, d'Orb.
- Aulopsammia, Reuss.
- Axohelia, E. de From.
- Bathycyathus, Ed. & H.
- Blastocyathus, Reuss.
- Blastosmilia, Dunc.
- Brachytrochus, Reuss.
- Brassyia, Wright.
- Brevisimilia, Bölsche.
- Chorisastræa, E. de From.
- Clemactis, Agass.
- Cnemidium, Quenst.
- Cœnastræa, Etall.
- Cœnosmilia, Pourt.
- Cœnotheca, Quenst.
- Comophyllia, d'Orb.
- Confusastræa, d'Orb.
- Conotrochus, Seg.
- Crispato trochus, T. Woods.
- Cyathophyllia, E. de From.
- Cyclobacia, Bölsche.
- Cylicosmilia, Ed. & H.
- Cynarina, Brigg.
- Deudræa, d'Orb.
- Dimorphoseris, Dunc.
- Diploceenia, Dunc. (non E. de From.).
- Diploheha, Ed. & H.
- Echinophyllia, Klunz.
- Ecnesus, Phil.
- Ellipsocœnia, d'Orb.
Ellipsosmilia, d'Orb.
Epitrochus, E. de From.
Fiscicella, Dana.
Gyrosmilia, E. de From.
Hemieyathus, Seg.
Homophyllia, Brügg.
Hoplangia, Gosse.
Isoecora, Etall.
Isophyllia, Ed. & H. 
Koilotrochus, T. Woods.
Konineckia, Ed. & H.
Lobactis, Agass.
Meandraræa, Etall.
Metasteræa, Ed. & H.
Microphyllia, d'Orb.
Microtrochus, T. Woods.
Notocyathus, T. Woods.
Oulophyllia, Ed. & H.
Ovalastræa, d'Orb.
Oxyphora, S. Kent.
Oxysmilia, Duch.
Parastræa, Ed. & H.
Paterocyathus, Duch. et Mich.
Pavonia, Lmk.
Pentalophora, S. Kent.
Phyllodes, Phil.
Phlylogya, Tomes.
Phyllopora, T. Woods.
Phyllosmilia, E. de From.
Placohelia, E. de From.
Platyceyathus, E. de From.

Platygrya, Ehr.
Plathyelia, E. de From.
Pleuractis, Agass.
Pleurocéanæa, d'Orb.
Pleurocyathus, E. de From.,
Moseley, Keferst., Reuss.
Plocophyllia, Reuss.
Podobacia, Ed. & H.
Psammohelia, E. de From.
Psammosmilia, E. de From.
Reussia, Duch. et Mich.
Scolymia, Haiue.
Smilophyllia, E. de From.
Sphenopterium, Meek.
Stenogrya, E. de From.
Stephanasteræa, Etall.
Stephanosseris, E. de From.
Stephanosmilia, Reuss.
Stylangia, E. de From.
Stylaræa, Ed. & H. (non Seebach).
Styloceyathus, Reuss.
Syzygophyllia, Reuss.
Tetracenia, d'Orb.
Thalamoceanæa, d'Orb.
Tiaradendron, Quenst.
Tricycloseris, Tomes.
Trismilia, E. de From.
Ulocyathus, Sars.

Undaria, Dana.
Vasilium, T. Woods.

Total genera as subgenera........ 40
" " abolished ...... .... 95

Total...... 135
# LINNEAN SOCIETY.

Treasurer's Account of Receipts and Payments for the year from May 1st, 1883, to April 30th, 1884. Presented at the Anniversary Meeting, Saturday, May 24th, 1884.

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<th>Receipts</th>
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<td>Proceedings and Catalogues</td>
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<td>Donations</td>
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| Expenses of Publications:     |         |
| Printing                      | £542 1 7 |
| Illustrations                 | 403 15 5 |
| Distribution                  | 53 1 3  |
| Miscellaneous Printing and Stationery | 32 6 2 |
| Petty expenses (including Tea and Postage) | 67 7 0 |
| Investment of Compositions    | 400 0 0 |
| Balance at Bankers' on 30th April, 1884 | 323 10 9 |

| **Total**                     | **£2770 6 8** |

The foregoing accounts have been examined and found correct.

May 20, 1884

FRANK CRISP, Treasurer.

H. T. STAINTON, J. JENNER WEIR, JOHN MILLAR, THOMAS CHRISTY, } Auditors.
LINNÉAN SOCIETY.

NOTICES.

The Library and Reading-Room will be closed, for cleaning, revision of Books, and putting up additional shelving, during August. The Rooms will be reopened to the Fellows on Monday, 1st September.

Fellows who have had Books on Loan previous to the Recess are requested to return them at earliest convenience. Parcels may be left with the Housekeeper or Hall-Porter.

New List, Subscriptions, and Delivery of Publications.

The New List of Fellows is now being prepared for Press; therefore all changes of Address, alteration in titles, &c., should be sent in early, otherwise they cannot be entered in this year's List, which will be issued towards the end of October.

Fellows are reminded that Subscriptions for 1884 were due on the 24th May last.

Intimation of irregularities in the delivery of the Society's publications will oblige, and especially in the cases of Members resident abroad, whether packets be sent through agents or otherwise. It is also desirable that Fellows resident abroad should send notice of the best mode of transit. If desired by post, a small sum must be sent in advance to defray prepayment of packets.

EVENING MEETINGS, SESSION 1884–85.
To be held at Burlington House,

On Thursday Evenings, as undermentioned, the Chair being taken at 8 p.m.


" 20. " 19.


" 18. " 16.


" February 5. " June 4.


The Anniversary Meeting takes place on Monday, 25th May, 1885, at 3 p.m.