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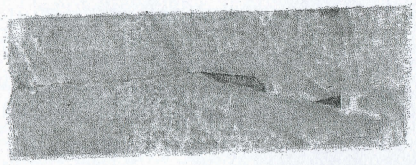

TRANSACTIONS AND PROCEEDINGS

AND

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ON SOME FOSSIL CORALS FROM ALDINGA.

By the Rev. J. E. Tenison-Woods, F.L.S., F.G.S., &c., Hon. Memb. Adelaide Phil. Society.

[Read September 17, 1878,]

Some corals collected by Professor Tate have been sent to me for examination, and though labouring under considerable disadvantages for the task of their description I have accepted it with much pleasure; not only because these organisms possess more than an ordina y interest for me, but also because they form very good tests, perhaps better than any others of the age and relations of the beds. From the beginning, the corals of our Australian Tertiary formations have received more attention than any other fossils from the same beds. There are few indeed from Victoria or Tasmania that have not been described. There is, therefore, a well-established ground to go upon. I have also recently published in the Proceedings of the Linnean Society of New South Wales for 1877 (vol. 2, p. 292) a list of the extra-tropical corals of Australia. This enables us to compare any new tertiary corals, or the corals of any new beds with the known fauna, so as at once to make very reliable deductions; and thus the relations are, in a manner, of either fossils or formations immediately made known to us. The corals from the Aldinga beds possess a more than usual importance. Very little has been made known of the fossils, and that little excites our interest in a high degree. Professor Tate has made known the existence in its strata of fossil *Belemnites* and *Salenia* and the other organisms are sufficiently different from those of such well-known formations as Mount Gambier, the Murray, and the Muddy Creek to make us wish for more information. The examination of the corals now to be described has not disappointed my anticipations. The forms are for the most part new, and also for the most part so connected with what

has been been already described, that they are seen to belong to one great group. I shall reserve for the end of the paper such remarks on the species as may throw light upon their affinities. I will merely observe now that the most of the specimens were either broken or in such a hard matrix that a full and satisfactory examination is what I could not obtain in every case. The matrix and the preservation shows a remarkable difference from the corals of the various strata of Victoria or Tasmania. There the corals were well preserved, but in a very brittle and soft matrix, so that unless they were very carefully handled they were irrevocably destroyed. A peculiar glazed appearance, which is very common in the fossils of Victoria and Tasmania, is not seen in these; nor do they seem to be stained with ferruginous oxides to the same extent. I mention this because in Victoria and Tasmania the peculiar characters referred to seem to be due in part to the intercalation of volcanic rocks with the formation. It would be worth while to enquire whether such influences had begun when these, perhaps the oldest members of the series, were deposited.

Before I begin the description of the species it may be as well to take a glance at what has been hitherto done in our Tertiary fossil corals, so that the references may help those who wish to follow up the subject.

In 1864 Professor Duncan described some fossil corals sent by me to him. The descriptions and figures appeared in the Annals of Natural History for September of the same year.

In 1865, the same experienced author described in the Annals for September, p. 182, some other corals.

In 1870, he also described in the Journal of the Geological Society, p. 285, a number of new species sent home from the Victorian Geological Survey, and at the same time gave a complete review of all our tertiary species, stating their relations and the evidence they afforded of our climate.

In 1875, he further described in the same Journal, vol. 31, p. 673, some Tasmanian fo sil corals, and again in 1876 other species from the same tertiary beds in vol. 32, p. 341.

In 1876 I described two species of fossil corals from Table Cape, Tasmania, in the Proceedings of the Royal Society, Tasmania, p. 115.

In 1877, in the Proceedings of the Royal Society of N. S. Wales, p. 183, I figured and described some new species of corals, and also extended the observations of Prof. Duncan on his and my *Caryophyllia viola*

and *Sphenotrochus excisus*, which I removed into the genus *Deltocyathus*. In this paper I also gave a list of all the Australian Tertiary species, but from which list was inadvertently omitted *Sphenotrochus emarciatus*, *Antillia lens*, Duncan, and *Placotrochus elegans*, nobis.

MADEPORARIA APOROSA.

Family Turbinolidæ.—Group Trochocyathaceæ.

Genus Deltocyathus, *M. Edw. and Haime* (1848).

Deltocyathus, M. Edw. and Haime, 1848. *Corallum* simple conical free, no trace of adherence; *calice* nearly circular and shallow; *columella*, ending in a rounded multipartite surface; *septa* straight, large exsert and granular, and the higher orders generally well developed; *pali*, highly developed, unequal, penultimate largest and turned towards antepenultimate so as to form chevrons or deltas; *costae*, highly developed distinct to the base, with many granulations.

Deltocyathus italicus (*Edw. & Haime*), was formerly the only species of this coral known. Messrs. Edw. and H. separated it from *Stephanophyllia* in which genus it had been placed by Michelin (*Iconographie zoophytologique*, Decrip. of polyp. fossil of France, &c., 1841-1847, p. 32, pl. 8, fig. 3, a young specimen). But *Stephanophyllia* has porous walls, and therefore is very far removed from the family in which the species has to be included. It must, however, be remarked that there are certain pits in the intercostal spaces, which look very much like pores. M. Edwards and Haime describe it thus:— Corallum, a short cone; costæ unequal, formed of a series of very regular globules; columella composed of three bundles of stems disposed in series; four complete cycles; septa very little exsert, thick on the outside; pali very unequal, thick. Professor Duncan is of opinion that the specimens found by Mr. de Pourtales in the Caribbean Sea did not differ much from the Miocene fossils of Europe, or these again from those found at Cape Otway. At least he says that the differences are not greater than are to be found between external divergencies in the fossil forms. The specimens from Aldinga differ very much, first of all in the size. They are longer than any of the dimensions given. They differ again in the shape. Some are perfectly hemispherical, some are truncated cones, and some bell-shaped. But I cannot doubt that I am dealing with a very closely allied species. In one important point it seems to me to differ, and that is that there is no columella. The septa all unite in the centre by numerous processes,

and what seem to be lobes of the columella are in reality the pali of the primaries, which meet in the centre. The same thing occurs in what I call *Deltocyathus viola*, and I must reserve my remarks on the subject for another occasion. I shall therefore name the species and describe it as follows:—

Deltocyathus Aldingensis, n. sp., pl. 1, fig. 1.

Corallum, hemispherical, or in the form of a truncated cone, or bell-shaped, that is to say, hemispherical, with a very thick cylindrical base like a pedicel, no trace of attachment. *Costae* very distinct and prominent, with numerous small rounded granules, in four cycles corresponding to the septa and continuous with them; primaries and secondaries equal and distinct to the base, where they suddenly thicken; tertiaries thinning out towards the base, and joining the third and fourth orders at about three-fourths from margin, and then making one continuous rib; all very closely covered with numerous small rounded granules. Intercostal spaces about equal in width to costæ and having numerous rounded pits or pores in equi-distant series. *Calice*, circular, either flat or a little convex, from a cauliflower-like mass in the centre arising from the pali. *Septa* in six systems of four cycles, which are not exsert, of equal thickness, very granular, with finely zigzag margins, and continuous with the costae; primaries straight, free to the centre, where they join rounded cauliflower-like pali; secondaries also straight and free until about two-thirds from the centre, where they are joined by the tertiaries and become much thicker, and here a kind of paliform excrescence projects. The higher orders unite with the tertiaries about a third from the margin. Dimensions—Alt. of the largest specimens 7, diam. 8½ millimetres.

The sides of the septa in a section are seen to be very regularly, closely, and prominently granular. A section at the centre shows that all the septa are united by small processes. When the calicular surface is ground flat, the primaries and secondaries are seen to unite in the centre, and the pali (?) are then seen to be represented by a very slight thickening, nothing in proportion to the foliated appearance of the surface. The junction is not apparent on the natural surface, but the tertiaries seem to send out a transverse thickened process to meet the fourth and fifth orders on each side. It is by a process of this kind that all the septa are joined for they do not in reality curve towards each other.

Deltocyathus Tateanus, n. sp., pl. 2, fig. 5.

Corallum, very small discoid, flat, thick in proportion to diameter,

base concave, and very slightly smaller than calice. *Costae*, very prominent, continuous with septa, not quite so wide as intercostal spaces, smooth, acute, persistent to the centre of base. *Epitheca*, none. *Calice*, circular. *Fossa*, very shallow, scarcely depressed in the centre. *Systems*, six. *Cycles*, four. *Septa*, not exsert, or only slightly. *Pali*, apparently before secondaries, a chevron-like mass with the ends directed towards tertiary septa. In the specimens the surface is worn, and the pali are indistinguishable from the septa, and it thus appears as if the tertiaries united with the secondaries about a third from centre. There are also tubercles in the centre which seem like pali of primaries. *Wall*, thin, bending outwards to meet costa. Dimensions—Alt., $1\frac{1}{2}$; diam. 3 millim.

Only two specimens, both worn, and one a little broken; the latter the only one in which the pali could be fairly made out. Better specimens may however show that some of my conclusions are subject to modification. It is closely allied to the living *D. rotaeformis*, nobis, but in that species the costae do not correspond with the septa. I have great pleasure in dedicating this species to my friend Prof. Tate, whose zeal and industry in the cause of geology need no encomium from me. It should be noted that the concavity of the base is not seen except in the longer specimen, the other being convex. In the young stages of *Deltocyathus italicus* the base is often rounded, and in form like *Trochocyathus meridionalis*, Duncan; but in all other respects the species seem to be different.

DELTOCYATHUS ALATUS, n. sp., pl. 2, fig. 4.

I am doubtful whether to regard this fossil as only a variety of *D. excisus*, Duncan. It comes from the Murray cliffs where the latter is not found. Its peculiarities are as follows. The septa are much more spinous in their granules, and they are not so exsert but often deeply lobed. That is to say the kind of lobate teeth and crest at the edge of the primaries and secondaries are distinctly divided and stand out separately. The pali are very solid and distinct. There is no columella, but the septa and pali unite in the centre. The two prolongations of costae at each side of the coral in *D. incisus* become flattened and spread out into aliform appendages in this coral. Not, however, in all cases. There are specimens which approximate closely to *D. incisus*, and there are others where they are much more prominent, and more spread out on the side of the corallum than in the figure given. The granules on the

costae are finer, more numerous, and closer than can be easily expressed on a small sized drawing. On the whole I should not be disposed to regard the species as distinct; but the variation is very important, varying in amount in different specimens. It will be seen that aliform appendages are therefore not of such specific importance as they have been thought to be.

With regard to the genus, I must observe that I do not think the mere deltiform pali a sufficient generic distinction from *Trochocyathus*. But all those species which I have classified as *Deltocyathus* have really no columella. The pali are united to the septa and meet in the middle giving rise to a rather compact tissue in which the component septa are generally distinguishable in this species, but not in *D. viola*. Most of the species may be said to represent *Trochocyathus* in Australia. I think if it be added to *Deltocyathus* that there is no columella, there will be no necessity for creating a new genus. It must be acknowledged that the divisions as they at present stand are not satisfactory. If it were clearly stated that there is no columella because the visceral cavity is empty as in *Desmophyllum*, or that the septa and pali meet in the centre, as in *Conocyathus*, there would be no ambiguity. At present both are described as having no columella.

The fossil at present referred to is common in the Murray River cliffs, four miles south of Morgan. Dimensions, about the same as *D. excisus*.

It is remarkable that though *D. excisus* is very common at Muddy Creek, I have never seen a specimen with any form of base except two small basal prolongations, though this form is the exception at the Murray beds. The deeply lobed septa are rarely seen in the Muddy Creek specimens.

The next species is a *Trochocyathus*, of which we have already two fossils described and two doubtfully from New Zealand. In this genus the fossils extend from the present day to the Lias.

TROCHOCYATHUS HETEROCOSTATUS, n. sp., pl. 2, fig. 1.

Corallum short, broadly wedge-shaped, with a very conspicuous oval, slightly convex, radiately ribbed, basilar scar, which has a neat, somewhat prominent, clearly defined margin; base proportioned to calice as five to eight. *Calice*, elliptical, shallow ends of major axis slightly lower than those minor. *Costae*, distinct, granular, with fine granules, and disposed in four cycles, but in a very singular and exceptional manner.

Those corresponding to the fourth and fifth orders of equal width, and continuous from margin to base. First, second, and third orders broader and more exsert at the summit, but thinning out rapidly to a fine point, and terminating at about a fourth from the base, except the primaries at the ends of the major axis which are continuous to the base. *Septa*, exsert proportionately to the orders in six systems of four cycles. Primaries somewhat high, rounded, narrow, or not projecting much into the fossa. Secondaries apparently only half their height, but all are broken in the only specimen I have seen. Third order a little thinner, but apparently as high. Fourth and fifth orders nearly as thick at the margin, but only very slightly projecting into the fossa as a thin edge; all highly granular and continuous with the costae. Granules disposed in ridges at the edge of the primaries. Pali small, styliform processes before all the cycles except the last. Columella uncertain, as it was partly covered with hard matrix, which could not be removed without destroying the septa. Dimensions—Alt. 4, major axis $4\frac{1}{2}$, $3\frac{1}{2}$.

Family Oculinidæ.

In the third principal group of the *Madreporaria aporosa* we have the family of the *Oculinidæ*, that is to say, branched corals with lateral buds with a great deal of very compact ivory like tissue. We have two species of this family in the collection—one with alternate calices and a peculiar structure which affords evidence of importance, as I shall notice presently. It belongs to the genus

Amphihelia—(*Edwards and Haime*).

which is erected for dendroid corals with alternate buds. The cœnenchyma is highly developed, especially at the base. The costae are only faintly marked. The columella is rudimentary, or absent, and there are no pali. The septa are few, entire, and not exsert. There are two species living—one in Australia and the other in the Mediterranean. One has been found fossil in our tertiary rocks. This is A. *incrustans* (Duncan), a very abnormal form.

Amphihelia striata, n. sp., pl. 1, fig. 4.

Corallum of irregular, short, cylindrical branches; calices circular, scattered, the lower ones sunken, the terminal ones very much exsert, all alternate, very deep and narrowing towards the base. No columella, but filling up from below in an open kind of spongy tissue arising from the coalescence of the septa. In the terminal calices the septa are exsert and salient, in the lower ones they are quite inconspicuous, in six

systems of three cycles, which are unequal according to the orders, a little thick but conspicuously swollen and rounded at the extra-mural part. The costae are conspicuous on the edge of the young calices, but the whole corallum is covered with a thick compact outer layer or sheathing tissue, which is covered with fine anastomosing grooves. On one branch these grooves form circles like tattooing; underneath this the costae seem to be very continuous, and each is covered with a linear series of small granules. In most of the broken fragments the outer sheath can be seen plainly.

This species comes very near *A. venusta*, E. and H., but the peculiar striations on the outer sheath, and the costae distinguishes it sufficiently. Some of the calices fill up from below by a kind of spongy tissue which results apparently from a union of the septa; others are quite empty to the base to which the calice narrows in a curved line, the point being only separated by a very thin wall from the curved upper portion of the alternate calice below. This is a variation in the structure which affects Prof. Duncan's reasons for transferring *Amphihelia* to the Turbinolidæ. It is not confined to the young branches, but is seen in the oldest portions of the corallum and in calices adjoining one another.

Amphihelia Ziczac, n.sp., pl. 2, fig. 2.

In the species which I am about to describe there are peculiarities which I think should place it almost in a genus apart. There is an axis into which the calices are sunk, and then outside this, but separated by hollow spaces, there is an outer sheath of some thickness. These hollow spaces seem to have no communication with the visceral cavities. It seems like an outer covering of dermic tissue, which was secreted over the basal structure while the lower cells were alive, leaving large apertures for them. As far as can be seen also, the septa are represented only by merely raised rounded lines on the upper part of the calice, and though they are never conspicuous in the genus, yet here they can scarcely be seen except at the bottom of the visceral chamber where they are confluent. The following is the diagnosis:—

Corallum in zigzac branches of various thickness, the longer or probably basilar ones having an outer sheath with interstices, which do not communicate with the visceral cavities. *Calices* at every angle, projecting, alternate, numerous, and at equal short distances. *Septa* only salient at the bottom of the calices, and represented by rounded lines at the upper part, and not visible at all at the margin, in three cycles; the two first equal, and confluent at the base, but no calice was preserved

entire, and it could not be said whether the third order was present in all the systems or not. *Costæ*, none visible; but the surface is covered with fine grooves which divide it into small polygonal spaces on which there are faint granulations, but the whole structure is so much worn that this appearance is exceedingly difficult to make out. Dimensions:—Length of the branches from ·25 to ·37; diameter, from ·3½ to ·7; distance between the calices on the same side 8 millimeters.

Family Astræidæ—Group Trochosmiliaceæ.

Genus Conosmilia (*Duncan*), 1865.

In the descriptions of new corals from Australia, published by Prof. Duncan in the "Annals of Natural History for 1865," (p. 182), a new genus was erected for simple pedicellate corals with a twisted laminated columella and scanty endotheca. This was *Conosmilia*. I have given a synopsis of the genus in the "Proceedings of the Royal Society of N. S. Wales" for last year. I think the general character of these fossils may become the type of a family, as there are other anomalous genera to be noticed presently. In the collection there is one species of what I believe to be this genus; but it is a deformed specimen, and therefore any attempt to determine the details would be hazardous. I shall merely give it a name and some of its leading features, and leave the rest until better specimens are found.

Conosmilia contorta, n. sp., pl. 1, fig. 3.

Corallum, very much twisted and distorted, but normally a very elongated one, cylindrical or slightly elliptical. *Costæ*, broad, flat, or in places acute, smooth or indistinctly vermiculate, corresponding with septa. *Epitheca*, thin, smooth, somewhat shining, in concentric folds occasionally. *Septa*, not granular, not exsert, but projecting in rounded edges more or less according to the orders. Systems, six. *Cycles*, four. *Fossa*, rather deep. *Columella?* *Endotheca*, scanty. Long. 20 lat. of calice, 8. One specimen with doubtful fragments of two others.

In the new species I am about to describe we have *Conosmilia* without a columella, but with pali. In every other respect it resembles the above-named genus of fossils, which Professor Duncan was the first to describe. The absence of a columella or the presence of pali has always been regarded as of generic importance in the present classification. I therefore propose a new genus for these corals, which I shall name *Cyathosmilia*. There is considerable analogy between this genus and *Conocyathus* of the Trochosmiliaceæ. They may be regarded as Conosmilæ with pali and without a columella, or Conocyatheæ with endotheca and without the peculiar cyclocostal arrangement which is so thoroughly *Turbinolian* in its character.

Cyathosmilia (new genus).

Simple pedicellate corals with endotheca and pali. No columella.

Cyathosmilia laticostata n. sp., pl. 1, fig. 2.

Corallum small, curved, slightly compressed in the direction of the curve, tapering towards the pedicel, which is very small and concave, bearing a crest at the outer edge of the curve, which is composed of irregular projections. *Costæ*, simple, broad, raised, rounded, separated by very narrow grooves (which correspond with the tertiary septa, while the costæ correspond with the primaries and secondaries), terminating in regular angular points at the edge of the calice, giving it a coronate appearance. *Epitheca*, conspicuous in concentric folds of irregular width, and undulating over the costa. *Calice*, broadly elliptical. *Fossa*, shallow, in fact only the slightest depression is perceptible. *Systems:* six, with three cycles. *Septa*, not exsert, granular, primaries and secondaries equal, thick, wedge-shaped; tertiaries thin, small, inconspicuous. *Pali*, before primaries and secondaries only, thinner than septa, slightly exsert, primaries only half the size of secondaries. *Endotheca* filling up space between pali, septa, and fossa, and rather numerous; stages very rare between septa, except at the base. *Wall*, thin, dotted with deep pits, or pairs of pores, on opposite sides of the septa. These are not visible except in worn specimens where the epitheca is absent; otherwise it covers them. *Dimensions*—Alt. 6 to 11, major axis 2½ to 5, minor 2 to 4.

Aldinga, about a dozen specimens, but very few complete. In all the larger ones the broken ends of the septa are very distinctly seen to be composed of two thick laminæ pressed together. In these specimens also the intercostal space is flat, wide, and shallow. The centre corresponds to the tertiary septa, and has pores on each side which are distinct, regular, and apparently deep. There were fragments of corals collected which, if perfect, would have been twice the dimensions given.

Cyathosmilia? tenuicostata n. sp., pl. 2., fig. 3.

I give this name to a single specimen of a conical corallum with a rather broad, blunt, cylindrical pedicel, which is granular, and does not seem to have been adherent. *Costæ* corresponding with septa, granular

above, vermiculate below, equal in size and separated by rather broad, flat intercostal spaces. *Epitheca* pellicular, smooth, shining. *Septa* very much thickened at calicular margin exsert, closely and thickly granular. Systems six, cycles four, the fourth rudimentary, though its corresponding septa do not differ from the others. Primaries very thick; secondaries smaller; tertiaries rather thick, but not reaching more than half way to the centre. *Pali* high, broad, and granular; probably before all except the last; yet this is uncertain, as the coral is broken. *Columella? Calice* broadly elliptical, not deep. Dimensions—alt. 5, maj. diam. 6, min. 4½. One broken specimen, in which the endotheca could not be well made out; but its general habit and appearance induces me to refer it to the *Astreidæ* rather than *Trochocyathus*, to which genus it would belong if there were no transverse interseptal dissepiments.

The next fossil in the collection has remarkable affinities and relations. It is a *Conosmilia* without an epitheca and simple granular costæ, but with a very remarkable columella, which terminates in two conspicuous round tubercles. This distinction is of generic value, and I propose a new genus for its reception. In reference to the peculiar columella, I shall designate it by the name of *Bistylia*.

BISTYLIA (new genus).

Simple corals, without epitheca, and a bistyliform columella.

There are two divisions in the Trochosmiliaceæ—(1) without any epitheca; (2) with epitheca. This genus belongs to the first, and is associated with *Lophosmilia*, *Parasmilia*, *Cœlosmilia*, having, like all these, scanty endotheca. The first-named, however, has a lamellar columella, the second a spongy one, and the third none. All three are upper mesozoic fossils, with one living *Cœlosmilia*. *Axosmilia* is one of the Trochosmiliaceæ, with a styliform columella, but it has a distinct epitheca.

BISTYLIA ADHERENS, n. sp., pl. 1, fig. 5.

Corallum small, more or less contorted, nearly always adhering by a large portion of its side, cylindrical, suddenly contracting to a point. *Costæ* small, rounded, granular, continuous, corresponding with septa, and alternating in size with them, broader than intercostal spaces, which have numerous concentric folds, probably the former margins of the corallum. *Calice* circular, generally a little contracted or bending in. *Systems*, six. *Cycles*, three. *Septa* slightly exsert; rather thick, granular, primaries largest, secondaries a trifle smaller, tertiaries half the size, edges rounded or rendered sinuous by the granules. *Fossa*, moderately deep. *Columella*, two small rounded tubercles. Dimensions—Alt. from 4 to 8; diam., 2½ to 3 millim. Six specimens, the most of which had on one side a calcareous cast of the shell to which they adhered, which was a small bivalve apparently.

FAMILY ASTRÆIDÆ.—GROUP CLADOCORACEÆ.

This division is distinguished by the budding which is lateral, and which remains always with its individuals more or less free forming tufts, but never giving rise to a massive corallum. The first genus is *Cladocora*, containing slenderly branching ramose corals, and which according to Professor Verrill is closely related in its polyps to the *Astrangiaceæ*. The corallites in this genus are cylindrical, very long, erect, and free laterally. They have an incomplete *epitheca*, which often unites one individual to another. The calices are circular and shallow. *Columella* papillary. There are six unequal systems all exsert, rounded, and finely toothed at their edges. *Pali* before all the *septa* except the last. *Wall* compact, moderately thick, and furnished with simple costa, which are granular, hispid, and straight.

The fossil figured is an interesting specimen of the genus, one not far removed from the well-known *Cladocora cespitosa* (Gualtieri), which is common in the Mediterranean Sea. Unfortunately the specimen is worn and broken so that the details cannot be made out satisfactorily. There are no perfect calices, and the branches are a good deal waterworn. I have very little doubt, however, that the species is new. It is thus described:—

CLADOCORA CONTORTILIS, n. sp., pl. 1, fig. 6.

Corallum, a very compact tuft of corallites of different dimensions turning around one another. *Branches* irregular, cylindrical, conical, or of equal thickness throughout, occurring at short distances and twisting round to coalesce with others and form a thick, matted, stony mass. *Epitheca* not visible. *Costæ* numerous, narrow, angular at the edges, granular and straight. *Septa* not easily made out, but apparently three thin cycles, some uniting or bending towards the others, and all apparently meeting the pali in the centre. *Wall* rather thick. *Endotheca* somewhat abundant, and, as well as I can judge, rather more abundant than is usual in the genus. *Dimensions*—Alt. 35, diam. of largest branches, 5; of the smaller ones, from 2, 2½ and 3 mil. The fossil appears to me to be very distinct from all existing or fossil species. In the bent and twisted form of the branches it may come nearest to *C. stellaria* (Edw. & H).

FAMILY ASTRÆIDÆ—GROUP ASTRÆACEÆ.

A very interesting, but very imperfect fossil form of *Plesiastræa*, is amongst the collection. The genus belongs to the *Astræaceæ* or corals which have a massive structure, the individuals being intimately united, but multiplying by budding. The main distinguishing feature of *Plesiastræa* is the possession of conspicuous pali, which, indeed, separates the genus clearly from every other species in the group. There are at most only eight species known, two of which are Australian, and one fossil. Three belong to the Pacific. In the species under consideration I am unable to speak very positively as to its character as the fragment is small and very much worn, in fact there is not a single perfect calice in the specimen. It has a very strong resemblance to *Plesiastræa Urvillei* in this that the calices are of equal size, and often oblong, in which respects it differs from *P. Peronii*, the form common on our coasts. Owing to the very complete details given by Messrs. Edwards and Haime in their diagnosis of the internal structure of *P. Urvillei*, which is living at King George's Sound, I am able to say that the fossil is new.

PLESIASTRÆA ST. VINCENTI, n. sp.

Corallum flat. *Calices* very slightly salient, very close, but with distinct borders, circular or compressed. *Costæ*, continuous with the septa, and projecting so as to unite at times with the contiguous ones of the next calice, prominent above the margin. *Systems*, six; *Cycles*, four; but the forth absent from some systems; primaries, secondaries, and tertiaries nearly equal, and extending to the pali, which are so worn that it would be hazardous to attempt details, except that they seem large. The edges of the septa seem to be dentate, much in the way that is figured in the "Annals des Sciences Nat.," (vol. x., plate 9, fig 2a), and the columella appears to be a few papillæ. In a vertical section the exothecal traverses are seen to be abundant, horizontal, and at irregular distances, but there are about 20 in 10 millimetres. The endothecal traverses are extremely irregular, thinner, sloping upwards at every angle, and giving rise to a cellular tissue. In both these particulars it differs remarkably from *P. Urvillei*. Diameter of calices, 3 rarely 4 millim.

Note.—This coral which was first brought to my notice by my pupil, Mr. Stirling Smeaton, occurs in large hemispherical, or flattish rounded masses; an imperfect lump measures seven inches in diameter, and from two to three inches in thickness. Locality—Hallett's Cove, St. Vincent's Gulf *(R. Tate)*.

Summary.—The general facies of these interesting corals is that of the Australian tertiary beds, as far as we are acquainted with them. None of the species are however known. Some of the genera have been found in other beds. These are—*Deltocyathus*, *Trochocyathus*, *Amphihelia*, and, doubtfully, *Conosmilia*. Our *Deltocyathus*, as already observed, is closely allied to, if not identical with, *D. italicus*. That species is common in the Cape Otway beds in Victoria, and is living in the West Indian Seas. It will require a careful comparison to determine if our fossil is the same. It is very abundant apparently at Aldinga. We have two species of *Trochocyathus* already described. Both are very distinct from the Aldinga species, which is much smaller, and has a well-marked basilar scar. We have one of the species living in the Port Jackson. Professor Duncan thinks that the genus can hardly be separated from *Deltocyathus*; but if my remarks on the absence of a true columella are found to hold good for all the species, the distinction is a justifiable one. *D. Tateanus* comes near to an existing form. The flattened character may, however, vary, as we see that in the case of *D. Aldingensis* these are features which vary much at different ages and for different individuals. In *Amphihelia striata* and *A. ziczac* we have two forms of *Oculinidæ*, which are of great interest. They are both closely related to our existing Australian *A. venusta*, but are very different from our tertiary fossil form, *A. incrustans*, which I venture to suggest would perhaps have been better placed in a genus by itself. Both the Aldinga fossils in their structure throw a remarkable light upon the mode of growth of these corals. We see not only that the calices fill up from below in some instances, but not at all in others, a circumstance clearly dependent upon the exigencies of the animal, or perhaps upon its size. This gives us a glimpse of the very artificial manner in which our great divisions of the *Madreporaria* are classified, and makes us fear that as the habits and economy of the animals and their stony dwellings are studied the whole arrangement will have to be remodelled. *Amphihelia* did not, as far as we know, make its appearance until the tertiary period. The *Oculinidæ* generally are entirely a recent family, extending to the Mesozoic rocks, but only four genera are found in them, and only two below the chalk. The only fossil species of *Amphihelia* known are those from Australia.

I have already observed the position that the new genera of *Trochosmiliaceæ* take in the classification. They are a series of simple corals with scanty endotheca, in which respect they are related to Upper Meso-

zoic forms rather than to any other. But our Australian corals are a group in themselves, with really no very strong affinities with any hitherto described. None of those have pali; some have an epitheca, and others are destitute of it, but the fossils amongst our Australian group which have any of these features are sure to differ in every other respect in a remarkable degree from them. It is, as I have already remarked, this natural extension that we might expect to which our systems of classification will have to submit, as our knowledge of the variation of the plan of nature becomes wider. It is on this account that we cannot form any conclusions, or at least any safe conclusions, as to the age of our beds from paleontological considerations alone. The resemblances to the fossils of tertiary ages in the northern hemisphere are few and of a trifling kind, while the differences are very numerous and wide. We are baffled by the difficulty of comparing things which have little or nothing in common. But while this is true, we may institute comparisons upon paleontological grounds alone between our various Australian deposits. Thus, this group of *Trochosmiliaceæ* shows us that the Aldinga formation has fossils which intimately connect it with the Australian group of tertiary rocks. No species can be identified with those already described, though one, *Conosmilia contorta*, may be only a variety. *Cyathosmilia* is a kindred genus with pali. *Bistylia* is a little more divergent, for it has distinct costa like *Parasmilia*, but with a bistyliform columella.

Plesiastræa is entirely a recent form, and we may say Australian as well, for the species described which are not Australian are either from the Pacific or Indian ocean. There is one fossil species known in the Belgian miocene. The fossil species here described is very close to our living form, now common on the same parts of the coast.

Though no existing species has been yet found, and though the genera even are, as far as we know, for the most part extinct, yet I think we are justified in calling the coral fauna an Australian Tertiary one — the forms of life approximate to a Mesozoic character, in my opinion, though I form it upon slight grounds, and I should say that we have one of our oldest tertiary fauna represented. The corals are partially such as would grow in a deep sea at the present time, but *Cladocora Plesiastræa* are merely litoral species, and probably also *Amphihelia*. There are no reef-building forms amongst them, for though the three last named are branched corals, yet they never grow to any size beyond insignificant tufts. They do not evidence a climate different from the present climate of South Australia, that is if the animals were subject

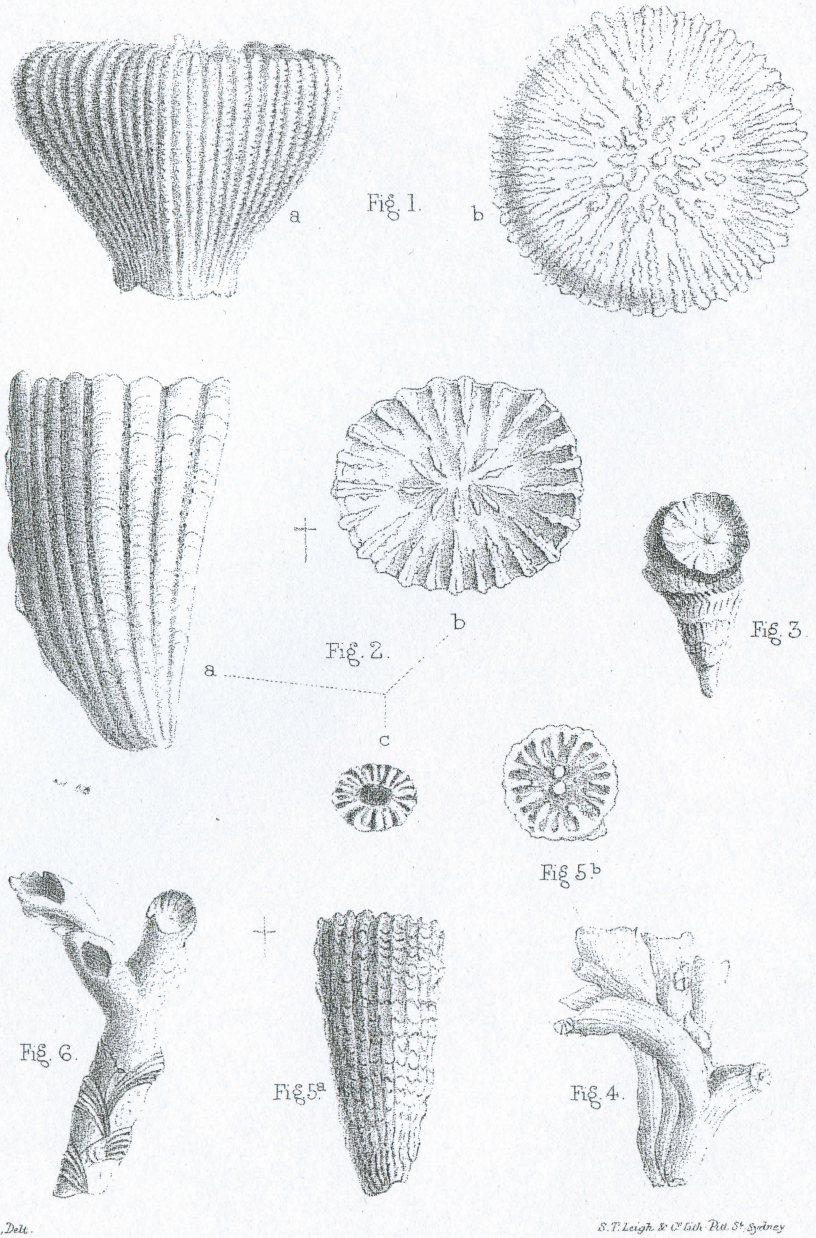


Fig. 1. Deltocyathus aldingensis
" a. Coral. b. Calice.
Fig. 2. Cyathosmilia laticostata
Fig. 4. Amphihelia striata
Fig. 5. Bistylia adherens.
" a. Coral b. Calice.

Plate 2.

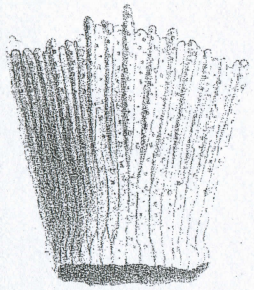


Fig. 1a

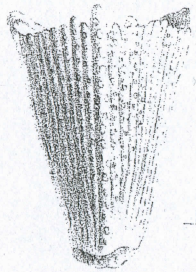
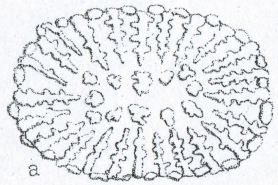


Fig. 1b

a.

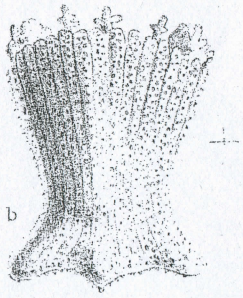
Fig. 3.



a

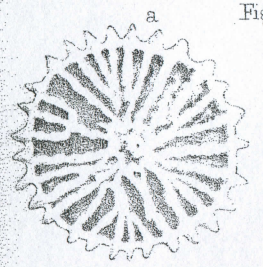
b

Fig. 2.

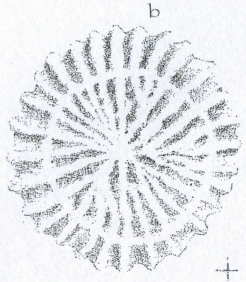


b

Fig. 5.



a



b

Fig. 4c

W. Tenison Woods, Delt.

S. T. Leigh & Co. Lith. 121 St. Sydney.

Fig. 1. Trochocyathus heterocostatus
a. Coral. b. end View.
Fig. 2. Amphihelia ziczac branch & Section

Fig. 4. Deltocyathus alatus.
a. Calice. b. Coral.
Fig. 4c. Deltocyathus alatus, (end View).

to such conditions of life as kindred animals would be now; but I think we should be cautious in forming any positive conclusions on this subject, as the most of the animals are so different from any we know. Besides, each species is subject to its own condition of life. Thus, I have found lately that a Millepora coral exists extensively on the extreme South of New Zealand. This is the only species known to me outside the tropics. If the species were found fossil, we should certainly say that it gave evidence in favour of a warm climate. Cumulative evidence from the whole forms of life are the only safe grounds on which climatical conclusions can be formed.

EXPLANATION OF PLATES.

Plate I.

Fig. 1. *Deltocyathus Aldingensis*, a. coral, b. calice, both much enlarged.

Fig. 2. *Cyathosmilia laticostata*, a. coral, b. calice, much enlarged, c. section slightly enlarged to show the double septa.

Fig. 3. *Conosmilia contorta*, nat. size.

Fig. 4. *Amphihelia striata*, nat. size.

Fig. 5. *Bistylia adherens*, a. coral, b. calice, both enlarged.

Fig. 6. *Cladocora contortilis*, nat. size.

Plate II.

Fig. 1. *Trochocyathus heterocostatus*, a. coral, b., end view of calice showing primary costæ; both much enlarged.

Fig. 2. *Amphihelia ziczac*, a. branch, b., another partly ground down to show secondary layer of dermic tissue.

Fig. 3. *Cyathosmilia tenuicostata*, a. coral, b. section.

Fig. 4. *Deltocyathus alatus*, a. calice, b. coral.

Fig. 5. *Deltocyathus Tateanus*, a. calice, b. base, both much enlarged.