ON THE GENUS FENESTELLA.

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As species of Fenestella are very common as fossils in the Devonian rocks, but especially those of Tasmania, a few observations on the genus and its affinities will be found useful to geologists.

Fenestella is a genus placed now by all palæontologists in the Class Polyzoa, Order I. *Infundibulata.*

Sub order *Cheilostomata*, that is to say, with the aperture of the cell filled with a thin membranaceous or calcarious velum, with a crescentic mouth provided with a movable lip. This latter feature in the case of Fenestella is concluded from analogy and certain anatomical details, because the fossils themselves are never so perfectly preserved as to manifest them.

Fenestella is also placed in the subdivision *B. inarticulata* or continuous, and in the section *bimultiserialaria*, that is, the cells disposed in a double or multiple series. It is also placed by most authors in the family *Escharidæ*, of which the definition is as follows :—Polyzoarium erect, rigid, foliaceous, and expanded, lobate, or reticulated. Cell disposed quincuncially in the same plane on one or both sides of the polyzoarium. But in some cases this hardly applies, as the cells are sometimes, as in the case of *F. internata*, Lonsd. in a double series only. The genus was also placed with the Retepora, of which the definition is foliaceous, calcareous, reticulated, cells immersed opening on one surface only. But in 1830 Mr. Miller suggested a new genus for certain reticulated polyzoa in the carboniferous limestone which Mr. Lonsdale adopted. All cup-shaped reticulated polyzoa were hitherto called Retepora, but now it was agreed to name Reteporathose only on which the openings of the cells were inside the cup, and those in which the cells opened on the outside only were henceforth erected into a new genus, and called Fenestella. But difficulties in applying his distinction soon arose. The cup-shaped or conical figure is nearly always absent. In Tasmania the distinction would be of no avail. The polyzoary, though very wavy and irregular, is always fragmentary, and often lies perfectly flat. Prof. Phillips suggests (Pal. Foss. of Cornwall, Devon, &c., p. 22) another mark of distinction. He says that the non-poriferous surface of Fenestella is usually marked by longitudinal, more or less continuous ribs, united by bars of smaller diameter, leaving oval or subquadrangular spaces. In Retepora these spaces look more like holes or perforations

through the coral. The external poriferous interstices of Fenestella are in several species, but perhaps not in all, carinated in the middle.

It seems to me that there is a better mark of distinction than this, at least for the Tasmanian species. In Retepora the holes are at rarer intervals, and the term bars cannot be applied to the tissue above or below them. It is a mass of cells like the rest of the polyzoary. In Fenestella the bars are sparsely celluliferous. There are calcareous points of attachment to give mutual strength and support to dichotomously dividing and spreading ligulate series of cells. The transverse bars are much narrower than the celluliferous portion, and they are given off almost at right angles, and in some species only very slightly arched. It is this peculiarity which causes the interstices to be more quadrangular than oval.

Prof. Phillips thus defines the genus (*loc. cit.*):—"General figure spreading from a narrow base to an infundibuliform or foliaceous figure; substance, a thin stony expansion, composed of slender radiating or longitudinal ribs variously connected by transverse bars, so as to constitute a more or less regular open network. He adds (but the italic words marked by me do not apply to all the Tasmanian species) the longitudinal ribs margined on each side by *one row of pores* on the outer face only."

It must be always borne in mind that we very seldom find anything but *casts* of these beautiful fossils. The calcareous matters have been so completely dissolved away that nothing remains of the old polyzoary. The casts too seldom show any markings of the front or back of the cells. The most of the specimens preserved by collectors are valueless as showing any details. They are merely impressions of the interstices or net-work markings, and nothing more. Those who are very familiar with the species might determine them from this alone, but it is hardly a safe identification. There are, however, in the Museum of this Society some specimens from Maria Island, where the whole polyzoary has been beautifully preserved. The calcareous matter is untouched, and the detail of the cells is plainly evident. In one species, *Fenestella ampla*, there is a raised margin round the mouth and circular depressions, probably for avicularia. In one place also there is the embossed dome of what appears to be an ovicell. Thus the functions of nutrition and reproduction were in no way different from the polyzoa of the present day. It is seldom that such an opportunity is offered for studying the details of these interesting organisms. Prof. Phillips (*loc. cit.*) says "that owing to the decomposition of the whole or part of the coralline substance in argillaceous rocks these beautiful fossils

must be studied in such cases by very careful comparison of the impressions of the surfaces. In limestone beds the substance is often well exposed by atmospheric influences, but in such instances the poriferous face seldom clearly appears, owing apparently to the former adhesion of this face to the rock." This passage is especially applicable to the fossils of Tasmania. In most cases we have only impressions on argillaceous rocks, while the well preserved specimen now referred to is a limestone rock. Here but for the dark compact surrounding matrix and the accompanying mass of *Stenopora ovata* Lonsd. the white crystalline network of Polyzoan fragments might almost seem to be from the Polyzoan limestone of the middle Cainozoic of Australia. But except in few instance the fossils are most provokingly nearly all face downwards.

There are 28 known species of Fenestella in British rocks according to Morris' Catalogue, in which are none of the Australian species. They range from the L. Silurian to the Permian formation, but their principal horizon seems to be the Devonian. Three species and a variety are known in Tasmania, the species all represented in Australia and the variety also probably. They are thus described :—

Fenestella ampla Lonsdale.* Cupshaped, celluliferous, surface internal, branches dichotomous, broad, flat, thin ; meshes oval ; rows of cells numerous, rarely limited to two, alternate ; transverse connecting processes sometimes cellular ; inner layer of non-cellular surface very fibrous ; external layer very granular, non-fibrous, gemmuliferous vessel small.

"Among the specimens of this coral," continues Mr. Lonsdale, "contained in the collection under consideration was one which afforded some interesting changes dependent upon age, the absence of which in the series originally examined was alluded to in the species. In the uppermost portion of this specimen the casts of the cellular surface exhibited similar characters to those displayed in Mr. Darwin's series, with the addition occasionally of a crescent-shaped impression under the mouth, and due, it is believed, to a local modification of the sculpturing on the surface of the other cells. A little lower the ridges, or furrows representing, them began to disappear, and still lower by a further thickening of the exterior all traces of them were obliterated, the interspaces between the mouths displaying irregular protuberances ; and that which was considered as a state bordering upon decrepitude exhibited casts of minute oral apertures, with longer projections immediately beneath marking the original exten-

* These and the two following descriptions are taken from Darwin's Geological Observations in South America, etc., page 163. Appendix. Quoted also in Strzelecki's New South Wales and Van Diemen's Land, page 268.

sion of the mouths." Query, Were these protuberances ovicells.

Fenestella internata, Lonsdale. Cup-shaped; celluliferous surface internal; branches dichotomous compressed, breadth variable; meshes oblong, narrow; rows of cells, 2—5, divided by longitudinal ridges; transverse connecting processes short, without cells; non-cellular surface, inner layer sharply fibrous, outer layer minutely granular.

Fenestella fossula. Lonsdale. Cup-shaped; celluliferous surface internal; branches dichotomous, slender; meshes oval; rows of cells two; transverse processes non-cellular; inner layer of non-celluliferous surface minutely fibrous, external layer smooth or granular.

Variety *a F. densa*. Etheridge.* Of this variety, if it be not a distinct species, Mr. E. says:—"Form of polyzoarium not known, probably cup-shaped, one portion is foliaceous, meshes or fenestrules oval, small, densely arranged upon the expanded cœnœcium or polypidom, transverse processes or bars non-cellular. These unsatisfactory casts of Fenestella I refer to Lonsdales species *F. fossula*. No good characters are left for determination. The transverse processes or bars and the fenestrules are so obscure that any attempt to give definite characters would mislead. It so closely resembles *F. fossula* from Mount Wellington, Tasmania, and St. Patrick's Plains, New South Wales, that I feel obliged to refer it to that form. Any additional species would only multiply names. I had, however, proposed the name of *F. densa* for this Queensland specimen. The original habit was probably infundibuliform or cup-shaped; but whether the bars were rectangularly dichotomous with oval meshes, cannot be distinctly made out. Locality, Gympie, Queensland, Smithfield reef. Form, Devonian.

It will be seen that the above characters differ from what I have said on the cup-shape which many specimens in the Museum will show to be untenable, and in the transverse bars bearing cells. But as the observations were all apparently made from casts mistakes might easily arise.

We may now enquire, what are the affinities of the genus Fenestella, or its relations with other genera. It cannot strictly speaking, be classed with Retepora for the reasons I have given. As a slender ligulate polyzoarium strengthened and held together by transverse bars its disassociation from Retepora is very evident; and this is plainly seen in the British Devonian species, *F. laxa*, Lons., where the bars are irregular at rare intervals, and giving rise to interstices of three or four lines square. Among existing polyzoa we have

* Proceedings of Geological Society, April 24th, 1872, p. 332.

such a form in *Canda arachnoides* (Lamouroux Encyclop. Methodique 5, p. 64, figs. 18 to 22), where the branches are connected with tubular fibres, but these are flexible, horny, and not calcareous. There is, however, a species of Hornera, *H. Gambierensis*, Busk, in the polyzoan limestone of Mount Gambier, a middle cainozoic tertiary fossil, where the ligulate celluliferous portions are united by transverse calcareous bars. The analogy of this fossil to Fenestella is very great. In Hornera, however, the back of the cells shows concentric ridges of growth, whereas that of Fenestella is fibrous. The casts of the two forms are the same, and widely as they are separated in point of time, I am much inclined to the opinion that *Hornera Gambierensis* is one of the recent analogues of the Devonian Fenestellæ.

Were these fossils entirely calcareous? In answer to this it must be remembered that a corneous substance, the nature of which has not received the attention it deserves, forms the root byssus or point of attachment of many polyzoa. It also forms the point of attachment between each cell in Catenicella, and the junction of the internodes, in Calpidium, Salicornaria, &c. I have reason to believe that it lines the cells in all polyzoa. Something like that is seen in Catenicella under the microscope. In examining many hundred specimens I remarked that similar species showed the same optical peculiarities under the polariscope. In Catenicellæ these were generally slight; in Bugula on the other hand most brilliant. Sometimes when the whole calcareous portions of Fenestella are removed, there remains a series of rounded cells, which are not effected by acids. These may be the corneous lining of the cells. It would seem from the fact that a calcareous root is never seen in Fenestella, that it had a fibrous byssus like Canda, &c. How these bars and extra cellular portions are formed is not known, even in existing species. The body contained in the cell must not, however, be considered as an individual. Indeed, in living species when thousands of the cells are open one of them is touched, the whole draw back, and close instantly. We must consider the polyzoarium like a plant with leaves, bark, buds, flowers, seeds, and the different processes belonging to each. These constitute one whole which they subserve by different functions endlessly repeated in one individual.

Finally the fewness of species of one genus, though individuals are as common as in any deposit is a remarkable fact. In recent rocks genera of polyzoa can be counted by tens, and species by hundreds. It must, however, be remembered that the past forms are as highly organised as those of the present day, and belonging to specially developed classes.