

failing that, the mean temperature of the air did not rise to near the freezing-point. That such preservation of masses of ice is quite possible is shown by their occurrence under the lava of Etna, and often at the foot of cliffs under talus on which vegetation has afterwards grown.

If I understand rightly the published descriptions of the frozen tundras, they are simply another instance of flood deposits now permanently dry, through the lowering of the river-beds, in this respect corresponding with the Rhine loess and probably with the Thames Valley brick-earths. The whole country being formed of flood deposits, it is not surprising that the bones are now constantly found in hills much above the present river-level, for there appears to be evidence that at the time of the formation of the Tundras, the sea-level was a good deal higher than at present, the deposits on the lower lands near the sea being marine or estuarine. When the fall of the river was less than at the present day, the floods would necessarily rise to a greater height.

NOTICES OF MEMOIRS.

I.—ON THE LAURENTIAN BEDS OF DONEGAL AND OF OTHER PARTS OF IRELAND. By PROFESSOR EDWARD HULL, LL.D., F.R.S., etc., Director of the Geological Survey of Ireland.

AFTER a perusal of the writings of previous authors, and a personal examination made in the spring of 1881, in company with two of his colleagues of the Geological Survey, Mr. R. G. Symes, F.G.S., and Mr. S. B. Wilkinson, the author had arrived at the following conclusions.

1st. That the Gneissose series of Donegal, sometimes called "Donegal Granite," is unconformably overlaid by the metamorphosed quartzites, schists, and limestones which Professor Harkness had shown to be the representatives of the Lower Silurian beds of Scotland (*Quart. Journ. Geol. Soc.*, vol. xvii. p. 256). This unconformity is especially noticeable in the district of Lough Salt, near Glen.

2nd. That the Gneissose series is similar in character and identical in position and age with the "Fundamental Gneiss" (Murchison) of parts of Sutherlandshire and Ross-shire, and is, therefore, like the latter, presumably of Laurentian age. That the formation is a metamorphosed series of sedimentary beds, had been shown by Dr. Haughton and Mr. R. H. Scott.

3rd. That the north-western boundary of the Donegal Gneiss is a large fault between the Laurentian Gneiss and the metamorphosed Lower Silurian beds, owing to which the older rocks have been elevated, and by denudation have been exposed at the surface.

4th. That the Cambrian formation of Scotland is not represented in Donegal, and that the unconformity above referred to represents a double hiatus, and is of the same character as that which occurs

in Sutherlandshire, in the district of Foinaven and Ben Arkle, where the Lower Silurian beds rest directly on the Laurentian Gneiss.

5th. That Laurentian rocks may be recognized in other parts of Ireland, as in the Slieve Gamph and Ox Mountains of Mayo and Sligo, at Belmullet, and in West Galway north of Galway Bay, where the rocks consist of red gneiss, hornblende rock, and schist, etc., similar to those in Donegal; also possibly in Co. Tyrone, as suggested by Mr. Kinahan.

II.—OBSERVATIONS ON THE TWO TYPES OF CAMBRIAN BEDS OF THE BRITISH ISLES (THE CALEDONIAN AND HIBERNO-CAMBRIAN), AND THE CONDITIONS UNDER WHICH THEY WERE RESPECTIVELY DEPOSITED. By Professor EDWARD HULL, LL.D., F.R.S., etc.

IN this paper the author pointed out the distinctions in mineral character between the Cambrian beds of the North-West Highlands of Scotland, and their assumed representatives in the East of Ireland and North Wales and Salop. In the former case, which included the beds belonging to the “Caledonian type,” the formation consists of red or purple sandstones and conglomerates; in the latter, which included the beds belonging to the “Hiberno-Cambrian type,” the formation consists of hard green and purple grits and slates, contrasting strongly with the former in structure and appearance.

These differences, the author considered, were due to deposition in distinct basins, lying on either side of an Archæan ridge of crystalline rocks, which ranged probably from Scandinavia through the Central Highlands of Scotland, and included the North and West of Ireland, with the counties of Donegal, Derry, Mayo, Sligo, and Galway, in all of which the Cambrian beds were absent, so that the Lower Silurian repose directly and unconformably on the crystalline rocks of Laurentian age.

As additional evidence of the existence of this old ridge, the author showed that when the Lower Silurian beds were in course of formation, the Archæan floor along the West of Scotland must have sloped upwards towards the east, but he agreed with Professor Ramsay, that the crystalline rocks of the Outer Hebrides formed the western limit of the Cambrian area of deposition, and that the basin was in the form of an inland lake.

On the other hand, looking at the fossil evidence both of the Irish and Welsh Cambrian beds, he was of opinion that the beds of this basin were in the main, if not altogether, of marine origin, and that the basin itself had a greatly wider range eastward and southward, the old Archæan ridge of the British Isles forming but a small portion of the original margin.

The beds included in the above represent the Llanberris and Harlech beds, those of the Longmynd and of St. Davids, in which a remarkable primæval marine fauna had been discovered by Dr. Hicks.

III.—THE DEVONO-SILURIAN FORMATION. BY PROFESSOR E. HULL,
LL.D., F.R.S., etc.

THE beds which the author proposed to group under the above designation are found at various parts of the British Isles, and to a slight extent on the Continent. The formation is, however, eminently British, and occurs under various local names, of which the following are the principal:—

ENGLAND AND WALES.

Devonshire.—‘The Foreland Grits and Slates,’ lying below the Lower Devonian beds (‘Lynton Beds’).

Welsh Borders.—‘The passage beds’ of Murchison, above the Upper Ludlow Bone bed, and including the Downton Sandstone, and rocks of the Ridge of the Trichrug. These beds form the connecting link between the Estuarine Devonian beds of Hereford (generally, but erroneously, called the ‘Old Red Sandstone’) and the Upper Silurian Series.

South-East of England (Sub-Cretaceous district).—The author assumed, from the borings at Ware, Turnford, and Tottenham Court Road, described by Mr. Etheridge, that the Devono-Silurian beds lie concealed between Turnford and Tottenham Court Road on the south, and Hertford on the north.

IRELAND.

South.—‘The Dingle Beds,’ or ‘Glengarriff Grits and Slates,’ with plants and fucoids, lying conformably on the Upper Silurian Beds, as seen in the coast of the Dingle promontory, and overlaid unconformably by either Old Red Sandstone, or Lower Carboniferous Beds; 10,000 to 12,000 feet in thickness.

North.—‘The Fintona Beds,’ occupying large tracts of Londonderry, Monaghan, and Tyrone, resting unconformably on the Lower Silurian beds of Pomeroy, and overlaid unconformably by the Old Red Sandstone, or Lower Carboniferous Beds; 5,000 to 6,000 feet in thickness.

SCOTLAND.

South.—Beds of the so-called ‘Lower Old Red Sandstone’ with fish and crustaceans, included in Professor Geikie’s ‘Lake Orcadie, Lake Caledonia, and Lake Cheviot,’ underlying unconformably the Old Red Sandstone, and Lower Calciferous Sandstone, and resting unconformably on older Crystalline rocks. Thickness in Caithness about 16,200 feet.

The author considered that all these beds were representative of one another in time, deposited under lacustrine or estuarine conditions, and, as their name indicated, forming a great group intermediate between the Silurian, on the one hand, and the Devonian, on the other. He also submitted that their importance, as indicated by their great development in Ireland and Scotland, entitled them to a distinctive name, such as that proposed.

IV.—SECOND REPORT OF THE COMMITTEE, CONSISTING OF PROFESSOR P. M. DUNCAN AND MR. G. R. VINE, APPOINTED FOR THE PURPOSE OF REPORTING ON FOSSIL POLYZOEA. Drawn up by Mr. VINE (Secretary).

(Continued from p. 477.)

1844. MYRIAPORIDÆ, M'Coy. Family name only.

This is the third family of M'Coy's very restricted classification of Palæozoic Polyzoa. It embraces the *Retepora*, Lamk. = to *Elasmapora*, King. The family includes *Glaucanome*, Goldfuss, restricted by Lonsdale, and the genus *Fenestella*, Lonsdale. It is impossible to retain the family name in the present Report.

1849. *Phyllopora*, King.

There are unquestionably present in both the American and British Palæozoic rocks, species of Polyzoa having some of the inosculating characters of *Retepora cellulosa*. These can neither be referred to *Fenestella* nor *Polypora*. My objections to the term *Retepora* for these have already been expressed. King, also, in his Permian Fossils, has expressed his dislike to this term, and he suggests another word to be used instead—*Phyllopora*. I prefer this, especially as it has been consecrated by two good workers—Salter and De Koninck. The earliest appearance of the genus, so far I am acquainted, is in Lower Llandello flags at Ffairfach. The species is unnamed, and it forms one of the specimens of the Wyatt-Edgell collection. The general habit of the specimen is somewhat like *Retepora*. We have only the reverse of a portion of the zoarium, but in several places the branches are worn and the cells exposed, but not with sufficient distinctness to make out their actual structure. The fenestræ are oval and irregular, and the branches anastomose without dissepiments. A fine large specimen—reverse only—of this type is marked "*Bryozoa*," in case vii. $\frac{6}{11}$ of the School of Mines, and as "*Bryozoon*" in the "Catalogue of Cambrian and Silurian Fossils," p. 105. All the other specimens are very fragmentary, but in the Devonian series there is a matrix of a very fine species. If better fragments could be found in the Devonian rocks, good facilities for the closer study of this type of Palæozoic Polyzoa would be offered.

De Koninck refers two specimens, doubtfully, to this genus¹—*P. ? Haimeana*, De Kon.; and *P. ? cribellum*, De Kon. These are amongst the Indian Fossils of Dr. Fleming. In the monograph of Permian Fossils Mr. King refers, and fully describes, *P. Ehrenbergi*, Geinitz, as belonging to this genus. In his paper on the Permian rocks of South Yorkshire,² Mr. Kirkby refers fragments of the same species to *Retepora Ehrenbergi* (*Phyllopora*). The genus is a comparatively rare one, and well-authenticated specimens are also rare. To this genus I refer Nicholson's species³ *Phyllopora* (*Retepora*)

¹ Quart. Journ. Geol. Soc. vol. xix. 1862.

² Journ. Geol. Soc. vol. xvii. 1861.

³ GEOL. MAG. Jan. 1875, Pl. II. Figs. 4-16.

Trentonensis. It is well described, seeing that his specimens were mere fragments. Salter has already referred to this genus—M'Coy's *Retepora* (*Phyllopora*) *Hisingeri*—in his Catalogue of Silurian Fossils.

1821? *Berenicea*, Lamaroux.

This genus for the present I have allowed to remain with the family *Diastoporidæ*¹—not as *Diastopora*, but as provisional. So far as the Palæozoic species are characteristic of the genus, we may take M'Coy's description.² He says, "The cells resemble *Cellepora*, but are not piled," but, with more justness, "they also resemble the cells of *Stictopora* (*Ptilodictya*), but are parasitic and confined to one side. They differ from *Discopora* by each cell being separated by a small space from its neighbour." *Berenicea irregularis*, Lonsdale (Silurian Sys.), and *B. heterogyra*, M'Coy, are distinct types. The *Discopora favosa*, Lonsd., Wenlock Limestone, approach nearer to the *Ceramopora* type of Hall and Nicholson.³

1828. *Discopora*, Flem.?

Two types of this genus, as understood by Lonsdale, are found in the Wenlock series of Fossils at the School of Mines. One, *D. favosa*, Lonsd., is a beautiful little dome-like species with cells very regularly disposed radiating from the centre. The other is much larger and marked *Discopora favosa*? Lonsd. Both are good types, and they will ultimately find their proper place in our classification. But as *Discopora* (*Patinella* and *Discoporella* of Busk) it will be at present impossible to retain them, unless under very severe limitation.

1849. FENESTELLIDÆ, King.

After the three very able papers of Mr. G. W. Shrubsole, F.G.S., it will be useless to dwell too long upon this family. With the whole of Mr. Shrubsole's work I am inclined, generally, to agree. He may be blamed for the limitation of species, but the fault lies not with him, but with authors who have introduced into our scientific literature specific names for fragments that were really portions only of other species. This has already been pointed out, but much yet remains to be done before the family can be considered to be completely revised. It may then be necessary to reintroduce one or two species which are now regarded as synonyms, and also to establish two or three new ones. For the present I can do no other than report on the literature and species which have not yet found a place in the revisions of Mr. Shrubsole.

Gorgonia assimilis, Lonsd., Murch. Sil.

Fenestella „ Cat. Cambrian and Sil. Fos. S. of M.

This species has been alluded to in Mr. Shrubsole's second paper (p. 247). In the above catalogue it may be found among the Caradoc and Wenlock Limestone series of Polyzoa. This species has not been described, and there seems to be a doubt whether it should be referred to *Fenestella* or *Retepora* (*Phyllopora*).⁴

¹ Q. J. Geol. Soc. Aug. 1880.

² Palæozoic Fos.

³ GEOL. MAG. 1874-5.

⁴ "A Review of the Carb. Fenestellidæ," Quart. Journ. Geol. Soc. May, 1879; "A Review of the Various Species of Upper Sil. Fenestellidæ," Quart. Journ. Geol. Soc. 1880; "Further Notes on Carb. Fenestellidæ," *ibid*.

Many of the earlier specimens—Caradoc and Upper Llandovery—are very indistinct, and complete identification seems to be impossible. The type is a peculiar one, but after going over the specimens I can make out the following characters. The zoarium is irregular and dichotomously branching, no regular dissepiments or fenestræ. The frequent bifurcations of the branches, by impinging upon the lower branches, are the only means by which fenestræ are formed; the number of pores on either side of these vary from ten to thirteen. I cannot therefore suppose that these earlier *Fenestella assimilis* of the Catalogue are in any way related to *Fenestella reteporata*, Shrubsole, of the Wenlock Limestone. So far as I am able to judge from the specimens, they are totally distinct.

The whole of the type specimens of Upper Silurian *Fenestella* Mr. Shrubsole has gone over carefully; but as many of these were mere fragments of the reverse, showing no cell-arrangement, he found them altogether valueless for accurate definition. In consequence of this revision the whole of the Upper Silurian FENESTELLIDÆ is put down by him as follows:—

- Fenestella rigidula*, M'Coy, Brit. Pal. Fos. p. 50, pl. i. C. fig. 19.
 „ *reteporata*, Shrubsole, Quart. Journ. Geol. Soc. May, 1880.
 „ *lineata* „ „ „ „ „
 „ *intermedia* „ „ „ „ „

All these species are found in the Wenlock Limestone, Dudley, and two of them—if not three—in the Niagara Limestone, Lockport, America.

Of the Devonian *Fenestella* but few species are recorded. But as Professor Nicholson has published his papers in this country, we are largely indebted to him for what little is known, besides those that are figured and described by Goldfuss and Phillips.

- 1826–33. *Retepora (Fenestella) prisca*, Goldf.,¹ Eifel.
 „ „ „ *antiqua* „ „
 1841. *Fenestella antiqua*; *anthritica*; and *Hemitrypa oculata*, Ph.²
 1874. *Fenestella magnifica*, Nichol. GEOL. MAG. 1874, Pl. IX.
 „ „ *marginalis*, „ „ „ „ „
 „ „ *filiiformis* „ „ „ „ „
 „ „ *Retepora (Fenestella) Phillipsi* „ „

Many, if not all, of these species are founded upon fragments, or on the reverse only of specimens; and according to the laxness or rigidness with which they are examined, their value in a scientific criticism is of variable importance. They are nevertheless links in the chain of evidence, and until they are displaced by better specimens, which, of course, will allow of better work, they should find a place in this Report. Nicholson, with others, uses the term *Retepora* very indifferently. Speaking of *R. Phillipsi*, he says, “This is a genuine *Retepora*, and in its general form and its biserial cells is closely allied to *R. prisca*, Goldf., which I have found abundantly in

¹ Petrefac. Ger. tab. 36, fig. 19, tab. 9, fig. 10.

² Phillips' Palæ. Fos. Devon, etc.

the Corniferous Limestone of Ontario.” As I have already placed Goldfuss’s *R. prisca* with the FENESTELLIDÆ, I cannot do otherwise with this one.

In addition to these species, Nicholson finds two new genera for Devonian *Fenestella* :—

1874. *Cryptopora*, Ann. Mag. Nat. Hist., Feb. 1874.

“ *Carinopora* ” ” ” ”

Two species—*Cryptopora mirabilis*, Nich., and *Carinopora Hindei*—Nicholson places to these new genera. With all due respect for Professor Nicholson and his work, I must take his admission that these are apparently *Fenestellidæ*, and as such there was, I am inclined to think, no need for founding new genera for their reception. The author refers to *Hemitrypa*, and, in one sense, compares his genera with the genus of M’Coy. Unfortunately for the fate of all three genera, we have only true *Fenestella* encrusted by a coral, and the diagnosis of the species given by both authors is encumbered with partly corallite and partly polyzoal structures. All the illustrations which Professor Nicholson gives are structures found in typical *Fenestella*,¹ with the exception of fig. 2 *g*, p. 81. Here the “carina,” or keels, are apparently united by “stolons,” which may be sections of the tabulæ only of the encrusting coral. Fig. *f* is without this “stoloniferous” connexion, but both are sections of branches cut through perpendicular to the surface, and showing the largely developed keel, with the transverse section of the cells. Fig. *i* is one of these, isolated. It would be better to view the structures reversed. Figs. *d* and *e* are evidently ordinary *Fenestella*, and the sections above described are portions of the same frond.² The development of the keel is remarkable, and speaking of *C. Hindei* Nicholson says, “The thickness of the frond, measured at right angles to its plane of growth, is one line or a little more, nearly two-thirds of this being accounted for by the great internal keels.” This is equalled by the species *F. Lyelli*, Dawson, which is figured and partly described in “Acadian Geology.”³

1826–33. *Glaucanome disticha*, Goldf., Petr. Germ.

1874–5. *Ramipora*, Toula, Permo-Carbon. Fossilien.⁴

? 1878. “ *Hochstetteri*, Toula, Bigsby, Devon. Carbon.

“ ” var. *carinata*, R. Etheridge, jun., GEOL. MAG. 1879.

I arrange these genera and species, not because they are allies, but because they are the reverse of that. The genera are as distinct as genera can be, yet they have been confounded by authors. The *G. disticha* of Goldfuss is, I think, distinctly an Upper Silurian type. The Bala type of *Glaucanome*? is a different genus; and *Ramipora*, as described by Toula, has five or six rows of irregular pores. The genus *Ramipora* is a Permo-Carboniferous type, and although having

¹ See the illustration in the Ann. Mag. Nat. Hist. Feb. 1874.

² I wish the reader to refer to Nicholson’s paper as given above.

³ Carb. Limestone, pp. 288–9.

⁴ See Arctic Pal. Polyzoa, R. Etheridge, jun., 1878, Journ. Geol. Society.

some facial resemblance to the species from the Bala beds, and figured as *Ramipora*, var. *carinata*, Eth., jun.,¹ by Mr. Robert Etheridge, jun., the two forms differ in many respects considerably. *Ramipora* is much larger naturally than the Bala *Glauconome*; the cells are differently arranged. In the Lower Silurian species, both the primary and the secondary branches bear two rows of alternately arranged cells. Having handled and carefully examined the specimen in the School of Mines, figured by Mr. Etheridge, I can bear willing testimony to the faithful delineation of this beautiful type.

There are several specimens of this as yet undescribed genus in the collection already named, and their study will afford a good general idea of the varying habit of the species.

1844. *Polypora*, M'Coy.

Zoarium a delicate, reticulated, calcareous expansion. Branches round, from three to five rows of cell-openings—margins usually not projecting, branches connected (occasionally) by thin dissepiments.

This genus is represented by only one species, *P. ? crassa*, Lonsd., in the Wenlock Limestone, Dudley. The genus was more fully represented in America in the Devonian strata, and in our own country;—in the Arctic regions;—and India during the Carboniferous epoch. Professor Nicholson² describes and figures three species: *P. pulchella*, Nich., *P. tenella*, Nich., *P. tuberculata*, Nich. As a *P. tuberculata* has been previously described by Prout,³ the name of Nicholson is rather unfortunate, as there is a difference in the two species, for Nicholson says his is allied to *P. venucosa*, M'Coy, and as such it differs from Prout's *P. tuberculata*, if the identification of the Messrs. Young be correct. *P. pulchella* and *P. tenella* are nearly allied to *P. Halliana*, Prout, which occurs "in the St. Louis Group of Illinois, and which I have likewise detected in the Corniferous formation of Ontario."—Nicholson.

I have now gone over all the genera wherein the cell-characters are either ovate or sub-tubular, without saying arbitrarily that these genera and species belong to the CYCLOSTOMATA. I have begun with the species having the nearest apparent affinities with the CHEILOSTOMATA, and then allowed the others to fall in, in a consecutive order. This temporary arrangement will be better for the present, and this will allow time for a proper classification when the whole of the Palæozoic Polyzoa have been more closely studied. The following genera I have not the least hesitation in placing with the *Cyclostomata* as at present understood.

1859. CYCLOSTOMATA, Busk.

"Cell tubular; orifice terminal, of same diameter as the cell, without any moveable apparatus for its closure; consistence calcareous."⁴

¹ GEOL. MAG. 1879.

² New Devonian Fossils, GEOL. MAG. 1874.

³ Trans. of Acad. of Science, St. Louis, GEOL. MAG. June, 1874.

⁴ Monograph of the Crag Polyzoa, p. 9.

1825. *Stomatopora*, Bronn.

1821. *Alecto*, Lamx. 1826. *Aulopora* (pars), Goldfuss.

“Zoarium closely adnate throughout, simple or irregularly branched; branches linear or ligulate; cells disposed in a simple series or in more or less regular transverse rows of from two to four.”¹

A few types of this genus are present in the Palæozoic rocks of this country—in the Devonian of Eifel—and in America.

James Hall, in his *Pal. of New York*, vol. i., records the existence of *Alecto inflata* in the Trenton Limestone. This is a very simple serial species of a most remarkable type. From the same stratum he records another species, *Aulopora arachnoidea*, altogether different from the first type. Except that Hall calls these species “corals,” there is not in his descriptions any characters that would prevent them being properly placed with the Polyzoa. I have already alluded to this species *A. inflata*, Hall, when writing of *Hippothoa*. I now restore it to its proper place.

1874. *Alecto auloporides*, Nich.²

„ *frondosa* = *Aulopora frondosa*, James.

1874. „ *confusa*, Nich.

These seem to be true *Stomatopora* (*Alecto* of Busk), and their existence is recorded by Nicholson as appearing in the Lower Silurian or Hudson River Group. One species, *A. auloporides*, as a branching form survives into the Niagara Limestone. In the Caradoc series of Fossils in the School of Mines, a small specimen of Polyzoa is marked *Heteropora*, allied to *H. crassa*.³ This is a very peculiar species, but in no way related to *Heteropora* as now understood. The cells are short and tubular, alternately placed on the sides of the branch, very similar to the figure given by Nicholson. Having carefully examined the specimen, I therefore—temporarily—place it as a variety, at least, of *Stomatopora auloporides*, Nich.

I have, since the above was written, discovered no less than three distinct types of *Stomatopora* in the Up. Silurian Shales of Shropshire. One I have figured and described—*S. dissimilis*, Vine.⁴ The others I have not yet sufficient details to allow of full description. I have also discovered two species of *Ascodictyon*,⁵ full details of which will be published. In King's Monograph of Permian Fossils, pl. 3, fig. 13, a figure is given of—apparently—a badly preserved specimen of *Stomatopora*. It very much resembles the species of Hall, but no cell-mouths are given. King names it *Aulopora* (*Stomatopora*) *Voigtiana*, King.

1839. *Diastopora* (*Aulopora*) *consimilis*, Lonsd.

A species of Polyzoa, named as above, is in the Ketley Collection at the School of Mines. It is found in the Wenlock Limestone Series, but no locality is given. This is the *Aulopora consimilis*,

¹ Busk, *Cyclostomata*, p. 22.

² Paper read at Brit. Assoc. Belfast; printed, *Ann. Mag. Nat. Hist.* 1875.

³ Catalogue of Silurian Fos. p. 44, case vii. 67.

⁴ Geol. Soc. Pap. read June 22, 1881.

⁵ Nicholson, *Ann. Mag. Nat. Hist.* June, 1877.

Lonsd., of the Silurian System, pl. 15, fig. 7. I have found fragments in the washings of Mr. Maw.¹ Another specimen of the same species, from the Wenlock Limestone, Dudley, encrusting a small coral, is in the cabinet of Mr. Longe, F.G.S., of Cheltenham. In the Devonian collection of Polyzoa, at the School of Mines, a species marked *Berenicea M. Coyii*, Salter, Middle Devonian, Padstow, bears a very close resemblance to this Silurian type. Unfortunately the Devonian specimen is very poorly preserved, but I can trace in the zoarium a sufficient number of cells to afford me some idea of the general character. The specimen in Mr. Longe's cabinet I have carefully studied, and I now give a description with very accurate measurements.

Zoaria encrusting by a single layer a fragment of coral. *Zoecia* tubular, rather regular, in series. As several colonies are found upon the same coral, a remarkably irregular character is given to the associated *zoaria*. For the purpose of this diagnosis I isolate a single colony. Cell-mouths circular, with a well-formed peristome, and slightly less than the diameter of the tubes. Six *zoecia* occupy the space of a line measured across the mouth of the cells, and two and half, to three, lengthwise in the same space.²

The habit of Lonsdale's species in the School of Mines, and also Salter's Devonian *Berenicea*, is that of the ordinary *Diastopora*. The habit of the species here described, and also the measurements, correspond with Nicholson's *Alecto confusa*. If these be true *Diastopora*—for I cannot ignore the existence of *D. consimilis* and *Berenicea M. Coyii*—we have a true tubular *Diastopora* carried backward in time to the Wenlock Limestone; consequently the *Berenicea* which I left provisionally with the *Diastoporidæ*³ will be displaced by undoubted tubular species. The measurement of *Alecto confusa*, Nich., is five cells to the line, measured across the mouth.⁴ This is slightly less than my own, and may be accounted for by the more compact arrangement of the cells in the Dudley specimen.

1826. *Ceriopora*, Goldfuss.

Several species of this genus are given as Up. Silurian by authors,

Ceriopora affinis, Goldfuss.

„ *granulosa*, „

„ *punctata*, „

and Nicholson in his New Devonian Fossils adds *Ceriopora? Hamiltonensis*, of which he says, "This beautiful little fossil (about five cells occupy the space of a line vertically) occurs in great abundance

¹ In plate 15, Silurian System, reproduced as pl. xli., Silurian, ed. 1859, marked 7. *Diastopora? consimilis*, probably a Bryozoon.

² This was written in December, 1880, a copy of which was furnished shortly after to Mr. Longe, for his correction and approval for publication in this Report, as *Alecto confusa*, Nicholson? var. *regularis*. I have seen since that a paper has been furnished for reading on *Diastopora*, at the Geol. Soc. May, 1881. I have no desire to press my own name in preference to his, seeing that I wrote my description previously to the examination of Lonsdale's and M. Coy's Silurian and Devonian species in the School of Mines.

³ Review of the Fam. *Diastoporidæ*, Quart. Journ. Geol. Soc. Aug. 1880.

⁴ Nicholson does not say this, but I infer it from his remarks.

in some of the beds of the Hamilton Formation. It is allied to *C. punctata*, Gold., and *Millepora interporosa*, Phill. (Geol. of York). I am at present unable to decide as to its true generic affinities, and have simply referred it provisionally to *Ceriopora*." I will also leave it and the other species alone for the present. The whole of the *Cerioporidae* will have to be revised, and species from the Silurian to the Crag will have to be re-worked.

1821. *Spiropora*, Lamx.

In some of the shale-washings supplied to me by Mr. Maw from strata below the Wenlock Limestone, I have come across many beautiful fragments of this genus, which will enable me to carry back the type to Silurian times. Mr. Ralfe Tate has already carried back the genus to the Lias,¹ but the specific differences between the Liassic and Silurian forms are very marked. The Silurian species I shall describe under the name of *Spiropora regularis*, Vine.

1874. *Botryllopora*, Nicholson.²

This curious genus, founded by Nicholson for Devonian species, is allied to *Defrancia* and *Lichenopora*, but unlike either. The author says, "I have been unable to refer these singular Polyzoa to any existing group, and have therefore been compelled to found a new genus for their reception. Zoarium calcareous, sessile, and encrusting, forming systems of small circular discs, the upper surfaces of which are marked with radiating ridges, upon which the cells are carried. Each disc is attached by its entire lower surface, slightly convex above, with a central nonporiferous space, round which a number of radiating poriferous ridges occupy an exterior, slightly elevated zone. Cells forming a double series on each ridge, immersed with rounded mouths, which are not elevated in any part of their circumference above the general surface."³

One species is given, *B. socialis*, Nich. pl. ix. fig. 16, and it is not of very rare occurrence in the Hamilton Formation. I have not seen among any of our own Palæozoic Polyzoa any approach to this genus. It may be well to direct attention to the characters, because workers may find even this amongst the group of our hitherto most neglected fossils.

In my first Report ("British Carboniferous Polyzoa," 1880⁴) I said that "to the Palæontologist the study of the Palæozoic Polyzoa opens up many very important biological details; for the connexion of the Polyzoa with the Graptolites is a question that must be dealt with in detail."

Since this was written I have gone over much that has been written in this country on this debatable subject. Professor Huxley, Mr. Salter, and Professor H. Alleyne Nicholson have severally occupied themselves with this question of affinity. Mr. Salter says, "I think Professor Huxley first suggested the resemblance to *Defran-*

¹ *Spiropora liassica*, Tate, GEOL. MAG. 1875.

² Canadian Journ. No. 80; GEOL. MAG. 1874, p. 23.

³ *Ibid.* p. 23.

⁴ British Association Reports.

VERTICAL RANGE OF SILURIAN POLYZOEA OR SPECIES DESCRIBED.

MUSEUM OF PRACTICAL GEOLOGY; SILURIA AND SILURIAN SYSTEM.

Genus.	Species.	Author.	Formation.	Catalogue page.	My own Collection marked *
<i>Phyllopora</i>	sp. ... ..	... ..	Lower Llandeilo	20	
<i>Ptilodictya</i>	<i>dichotoma</i>	Portlock	Upper " ...	28	
"	"	"	"	"	
<i>Fenestella</i>	sp.	"	"	"	
<i>Diastopora</i> ?	<i>heterogyra</i>	M'Coy, Berenicea	Caradoc	44	*
<i>Fenestella</i>	<i>assimilis</i>	Lonsdale	"	"	
"	<i>Milleri</i>	"	"	"	*
"	<i>regularis</i> and sp.	Portlock	"	"	
<i>Glaucanome</i>	<i>disticha</i> (?)	Goldfuss.	"	"	*
<i>Heteropora</i> ?	<i>Alecto confusa</i>	type	Nicholson	"	
<i>Phyllopora</i>	<i>Hisingeri</i>	M'Coy	"	"	*
"	<i>ornata</i>	MS., Wyatt Edg.	"	"	
<i>Ptilodictya</i>	<i>acuta</i>	Hall	"	45	
"	<i>dichotoma</i>	Portlock	"	"	*
"	<i>explanata</i>	M'Coy	"	"	*
"	<i>papillata</i>	MS., Etheridge	"	"	
"	<i>ramosa</i>	"	"	"	
"	<i>recta</i>	Hall	"	"	
"	<i>scutata</i>	MS., Etheridge	"	"	
<i>Retepora</i> ?	<i>ramosa</i>	Hisinger	"	"	
<i>Fenestella</i>	sp. ... ..	... ..	Lower Llandovery	64	
<i>Glaucanome</i>	<i>innexa</i>	Salter	"	"	
<i>Phyllopora</i>	sp. ... ..	... ..	" ... ..	"
<i>Ptilodictya</i>	<i>fucoides</i>	M'Coy, cast of cells only	"	"	
<i>Fenestella</i>	<i>sub-antiqua</i>	D'Orb.	Upper " ...	72	
<i>Ptilodictya</i>	<i>lanceolata</i> (Lonsdalii, Vine)	Lonsdale	"	"	*
"	<i>scalpellum</i>	"	"	"	
<i>Fenestella</i>	sp. ... ..	... ..	Wenlock Shales ¹	85	<i>Stomatopora dissimilis</i> , Vine.
<i>Ptilodictya</i>	<i>lanceolata</i>	"	Wenlock Limestn.	104	*
<i>Ceripora</i>	<i>oculata</i>	Goldfuss	"	"	*From W. Shale.
<i>Diastopora</i>	<i>consimilis</i>	Lonsdale	"	"	*
<i>Discopora</i>	<i>favosa</i>	"	"	"	*
<i>Fenestella</i>	<i>assimilis</i> ?	"	"	"	<i>F. intermedia</i> , Shrub.*
"	<i>Lonsdalii</i> ?	D'Orb.	"	"	<i>F. reteporata</i> , Shrub.*
"	<i>Milleri</i> ?	Lonsdale	"	"	<i>F. lineata</i> , Shrub.*
"	<i>reticulata</i> ?	"	"	"	
"	<i>rigidula</i>	M'Coy	"	"	
"	<i>sub-antiqua</i>	D'Orb.	"	"	
<i>Glaucanome</i>	<i>disticha</i>	Goldfuss.	"	105	*
<i>Polypora</i> ?	<i>crassa</i>	Lonsdale	"	"	*
<i>Ptilodictya</i>	<i>lanceolata</i>	Goldfuss.	"	"	*
"	<i>scalpellum</i>	Lonsdale	"	"	
<i>Phyllopora</i>	marked <i>Bryozoon</i>	Reverse only	"	"	<i>Berenicea irregularis</i> Lonsdale*
<i>Ceripora</i>	<i>oculata</i>	Goldfuss.	Lower Ludlow ...	119 ²	
<i>Diastopora</i>	<i>Berenicea</i> sp. ... ..	... ..	" ... ..	"
<i>Ptilodictya</i>	<i>lanceolata</i>	Lonsdale ³	"	"	
"	<i>lanceolata</i>	"	Aymestry Limest.	125	
<i>Ceripora</i>	<i>granulosa</i>	Goldfuss.	Upper Ludlow ...	131	
<i>Discopora</i>	sp. ... ..	... ..	" ... ..	"
<i>Ptilodictya</i>	n. sp. ... ..	... ..	" ... ..	"

¹ From these shales I have obtained several specimens of species of *Stomatopora*, *Ascodictyon*, 2 sp., and *Spiropora*, 2 sp. Species also of *Ptilodictya Lonsdalii*, *P. scalpellum*, *Polypora*? *Glaucanome*, and *Ceripora*, etc.

² I have several other unworked species of Polyzoa from the Wenlock Limestone series.

³ This is more of the type *P. lanceolata*, Goldfuss.

cia;”¹ his own opinion, however, was very decidedly expressed. “The point I would chiefly call attention to is that there is a complete series up to the most compound in this remarkable family;” and after pointing out the varied features of the leading types of the *Graptolitiæ*, he concludes by saying, “*Dendrograptus* has the branches numerous, unsymmetrical, and crowded, while *Dictyonema* completes the series by showing the numerous rod-like stems each with their cells in double rows, connected by numerous transverse bars into a network like that of *Fenestella*, to which, indeed, I believe it forms the passage group.”² Professor Nicholson, after examining in detail the various points raised by Mr. Salter, says, “The ‘polyzoarium’ (of the Polyzoa) is commonly more or less highly charged with lime, and this is especially the case with the fossil forms. The polyzary of the Graptolites, on the other hand, are invariably corneous (or chitinous).”³ Notwithstanding these varied opinions, I very reluctantly reviewed the whole of the points mooted by Nicholson and others, and then submitted my notes to Mr. Lapworth’s scrutiny before publication. He has gone over every one of these notes critically, and, as his decision is adverse to my own views (founded to a large extent upon facial resemblances), I cannot do otherwise than bow to his dictum. “If the Polyzoa and the Graptolithina had a common ancestor—a view I have always been disposed to adopt myself—it must have existed at an antiquity far more greatly removed from Silurian time than Silurian time is from our own ages; for the differences which then separated the two groups appear to have been almost as gigantic in importance as those which divide the Hydrozoa and Polyzoa of the present day.”⁴

For the purpose of comparison I append a list of the leading genera of the Graptolites with the genera of Polyzoa found in the same formations.

VERTICAL RANGE OF GRAPTOLITES, ACCORDING TO NICHOLSON, LAPWORTH, AND CATALOGUE OF CAMBRIAN AND SILURIAN FOSSILS, SCHOOL OF MINES.

(L.) Lapworth. (N.) Nicholson. (S.M.C.) School of Mines Catalogue.

FORMATION.	Genera only given, with corresponding increase of Polyzoa.
Cambrian.	<i>Oldhamia antiqua</i> , Forbes; <i>O. radiata</i> , Forbes (S.M.C. p. 8).
Upper Lingula Flags.	<i>Dictyonema sociale</i> , Salter (S.M.C. p. 12), also in Tremadoc slates (N.)
Arenig and Llandeilo.	<i>Dichrograptus</i> , <i>Didymograptus</i> , <i>Tetragraptus</i> , <i>Climacograptus</i> , <i>Diplograptus</i> , <i>Graptolithus</i> , <i>Rastrites</i> , <i>Dictyonema</i> ? <i>Phyllograptus</i> , <i>Graptolithus</i> (S.M.C. pp. 17-18), <i>Trigonograptus</i> , <i>Ptilograptus</i> , <i>Dendrograptus</i> , <i>Callograptus</i> , <i>Dictyograptus</i> (Lap.). POLYZOA: <i>Phyllopora</i> , <i>Ptilodictya</i> (Lower Llandeilo), Branching polyzoon (S.M.C. p. 20), hardly distinguishable in form from <i>Graptolithina</i> , only it is calcareous.
Up. Llandeilo.	<i>Didymograptus</i> , <i>Tetragraptus</i> , <i>Climacograptus</i> , <i>Diplograptus</i> , <i>Dicranograptus</i> , <i>Graptolithus</i> , <i>Rastrites</i> , <i>Dictyonema</i> , <i>Protovirgularia</i> , <i>Helicograptus</i> , <i>Pleurograptus</i> , <i>Dicellograptus</i> , <i>Cyrtograptus</i> (S.M.C. pp. 23-24). POLYZOA: <i>Ptilodictya</i> and <i>Fenestella</i> ? n. sp. (Ibid. p. 25).

¹ Geological Memoirs of North Wales, p. 328, 1866.

² *Ibid.*

³ British *Graptolitiæ*, p. 85.

⁴ Concluding remark in Mr. Lapworth’s letter to me, May 16, 1881.

- Caradoc. *Climacograptus, Diplograptus, Dicranograptus, Dendrograptus, Graptolithus* (S.M.C. p. 81). POLYZOA: *Berenicea, Fenestella? Glaucanome, Phyllopora, Ptilodictya*, great increase of species (Ibid. p. 44).
- L. Llandovery. No Graptolites in S. M. Cat., *Climacograptus* one sp., *Graptolites priodon*, Bronn (Nich. Mono. pp. 97, 98). POLYZOA: *Fenestella? Glaucanome innexa, Phyllopora, Ptilodictya*.
- U. Llandovery. *Graptolithus priodon, Dictyonema* (S.M.C. p. 69). POLYZOA: *Ptilodictya, Fenestella*.
- Wenlock Shale. *Cladograptus, Cyrtograptus, Graptolithus, Retiolites, Dictyonema* (S.M.C. p. 81). POLYZOA: *Fenestella, Ptilodictya* (Stomatopora species, Vine).
- Wenlock Lime-stone. *Graptolithus priodon*, Bronn (S.M.C. p. 93), *Graptolites colonos, Retiolites, Cyrtograptus, Ptilograptus* (Fich. p. 98). POLYZOA: great increase of species, see list.
- Lower Ludlow. *Dendrograptus, Graptolithus* (S.M.C. p. 115). Four species recorded both in Catalogue and the same by Nicholson.
- Upper Ludlow. *Graptolithus* sp. recorded (S.M.C. p. 128).

112, HILL TOP, ATTERCLIFFE, SHEFFIELD.¹

ERRATA, etc.

Page 471—3 lines from bottom remove bracket after “sub-order”) and place it after “remains”) in line above.

Page 473—Between “Branches,” and “Gonocœcium” insert—
DISSEPIMENTS. “Bars which connect together the branches.”

R E V I E W S.

I.—ON THE ORGANIZATION OF THE FOSSIL PLANTS OF THE COAL-MEASURES. Part XI. By Prof. W. C. WILLIAMSON, F.R.S. Phil. Trans. Roy. Soc., Vol. 172, Pt. 2, 1881, p. 283, and Plates 47-54.

THE contributions of Prof. Williamson to the Royal Society on the organization of the fossil plants of the Coal-measures have now reached the eleventh part, which indicates the same amount of labour and is of equal interest and importance as the preceding series. Throughout these researches the author has shown his intimate acquaintance with the views of both English and foreign writers on the subject, while his study of the recent Cryptogamia, which he has cultivated for the especial purpose of comparison, has been of material importance in these investigations, and although some few points in the structure and affinities of the fossils may be differently interpreted by other palæobotanists, the carefully executed and enlarged figures prepared by himself will be invaluable for the study of coal plants.

In the present paper the author discusses the opinion of M. Renault on the relation of *Sigillaria* and *Lepidodendron*, and after describing some new sections of these plants, Prof. Williamson considers there is “a clear proof that, contrary to the conclusions of M. Renault, age does bring about very important changes in the form and arrangement of the tissues in the branches of these plants.” Further, his most recent researches have brought to light another very remarkable series of facts indicating the Lycopodiaceae

¹ My next Report will be “Jurassic Polyzoa.” Any help which can be given to me, either by the loan or “gift” of specimens; any notes of species in different localities; or help of any sort, will be duly acknowledged. I desire to make the Report as full and exact as possible.—G. B. V.