

riddles nearer home than Siberia. We will postpone a survey of them to another communication.

The following Errata refer to the previous article by me in the GEOL. MAG. Sept. 1880, p. 408.

Page 409	line 25	for Nurnan	read Russian.
„	„	„ 46	„ p. 387 „ vol. ii. p. 387.
„	411	„ 11	„ Duduo „ Dudins.
„	„	„ 42	„ Kiachtu „ Kiachta.
„	„	„ 46	„ Tutungian read Tai-tun-gian.
„	412	„ 2	„ Bun zoo gan rom read Bun-zoo-gan-mu.
„	„	„ 24	„ Observations read Observatio.
„	413,	last line,	for days read months.

IV.—ON THE CARBONIFEROUS POLYZOA.¹

By G. R. VINE, Esq.

AS so much remains to be done before the Palæozoic Polyzoa can be properly classified—more particularly the Carboniferous species—it seems to me that the wisest course to adopt is to go carefully over the work of other authors, reviewing their labours generally, and giving, in as condensed a form as possible, the results of their varied efforts.

David Ure,² the son of a working weaver in Glasgow, is the first, so far as I am aware, who drew attention by figures to British Carboniferous Polyzoa; and Martin³ gives some good figures of Zoophyta, but species of these belong to both the Corals and Polyzoa. Thirty-five years after the publication of Ure's work, Dr. Fleming⁴ named some of the species figured, and the Zoophyta he called *Cellepora Uriei* and *Retepora elongata*. The first of these, according to Mr. Robert Etheridge, Jun.,⁵ is *Chaetetes tumidus*, Phillips, and the other is a *Fenestella*.

In 1826, the work of August Goldfuss⁶ was published. In this a system of nomenclature was adopted, and many figures of Polyzoa and Corals given, which to a large extent assisted investigators and helped them to identify species found in this country. The generic terms used by Goldfuss were accepted by authors who followed him, but as no distinction was made by the earlier investigator in separating true Polyzoa from true Corals, those who worked from his types and descriptions fell into his error, and mingled, for a time, Corals and Polyzoa together whenever they had fresh forms to describe.

The chief of the generic terms used by Goldfuss were:—

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|-------------------------------------|---------------------------------------|
| 1. <i>Gorgonia</i> , Linnæus, 1745. | 3. <i>Retepora</i> , Lamarck, 1816. |
| 2. <i>Cellepora</i> , Gmelin, 1788? | 4. <i>Ceriopora</i> , Goldfuss, 1826. |

The type of Linnæus' *Gorgonia* was altogether different from the

¹ British Association—Section C. (Geology).—Report of the Committee, consisting of Prof. P. M. Duncan and Mr. G. R. Vine, appointed for the purpose of reporting on the Carboniferous Polyzoa. Drawn up by Mr. Vine, Secretary.

² History of Rutherglen and East Kilbride, 1793.

³ Petrefactions of Derbyshire, 1809, *Petrefacta Derbiensia*.

⁴ History of British Animals, 1828.

⁵ Ann. Mag. Nat. Hist. 1874.

⁶ *Petrefacta Germaniæ*.

types of Goldfuss's genus. The first had reference to the fixed Polypiferous masses which are still known by the same name, but the last are now referred to the *Fenestellidæ*.

The species of *Cellepora* are now placed with *Chætetes*, and most, if not all, of the *Ceriopora* of the Palæozoic era are also referred to *Chætetes* and to *Alveolites*.

The use of the term *Retepora*, as applied to Palæozoic forms, has been abandoned, and the better defined generic term *Fenestella* used instead; but Lonsdale,¹ in his otherwise clearly defined characters of this genus, included both *Fenestella* and *Polypora* types in the one description of the genus.

However we may differ, at the present time, from Professor Phillips² in his arrangement of the 'Zoophyta' found in the Carboniferous rocks of Yorkshire, we must give him the credit for being amongst the first to attempt a division between Corals and Polyzoa; but in the use of Lamarck's genus *Millepora* for some of his species, he seems to have been very undecided as to the true character of his fossils.

Phillips describes eight species of *Retepora*, defining certain terms which he uses, such as fenestrule, dissepiments, and interstices—terms still used in later descriptions of *Fenestella*. His species were *R. membranacea*, *flabellata*, *tenuifila undulata*, *irregularis*, *polyporata*, *nodulosa*, and *laxa*. The poverty of Phillips's diagnosis renders identification of his species a very difficult matter, but some of his species were so truly typical in their general, as well as in their minute characters, as to enable Mr. G. W. Shrubsole, in his elaborate review of the *Fenestellidæ*,³ to retain three of them as types of his very restricted Carboniferous forms. The retained species are:—

Fenestella membranacea, syn. *F. tenuifila*, Phill., and *F. flabellata*, Phill.

„ *nodulosa*, Phill.

„ *polyporata* „

The *Retepora flustriformis*, Phill., has been placed as a synonym of *F. plebeia*, M'Coy, by Mr. Shrubsole,⁴ and as *Ptylopora* by Morris.⁵ By Phillips it was regarded as the *Millepora flustriformis*⁶ of Martin, and he also said it resembled the *Gorgonia antiqua* of Goldfuss. *Retepora pluma*, Phill., is now *Glaucanome*; and *Flustra*? *parallela*, which Phillips describes as "Linear: longitudinally and deeply furrowed, cells in the furrows, in quincunx, their apertures oval, prominent"⁷:—M'Coy⁸ refers to the genus *Vincularia*, DeFrance, and Morris⁹ places it and another species of M'Coy's with the genus *Sulcoretepora*, D'Orb. The species has no affinities with any of these genera, it appears to me to be the Carboniferous descendant of the more ancient *Ptilodictya*, Lonsd. (= *Stictopora*, Hall). The non-celluliferous, striated, sometimes rugose margin, and the central laminar axis or septum, which divides the cells of opposite sides,

¹ Geology of Russia.

³ Quarterly Journ. Geol. Soc. 1879.

⁵ Catalogue of British Fossils.

⁷ Geology of Yorkshire.

⁹ Catalogue of British Fossils.

² Geology of Yorkshire, 1836.

⁴ Ibid. p. 278.

⁶ *Petrefac. Derbiensia*.

⁸ Syn. Carb. Foss. of Ireland.

are almost always present in the Carboniferous species. I therefore, prefer to leave the *Flustra*? which Phillips describes with *Ptilodictya* as *P. parallela*, Phill., and this reference is founded upon original investigation of various specimens of *Ptilodictya*, of the American Silurian species,¹ *Ptilodictya Meeki*, Nicholson, Devonian species,² as well as all the known species of *Sulcoretepora* of the Carboniferous Limestone series.

The *Millepora* of Lamarck seems to have been the generic type of both Goldfuss and Phillips, and in describing the Carboniferous species, the latter author adopted the class Polyiparia of the Radiate Division of the Animal Kingdom at that time current among naturalists. It was Phillips's misfortune, rather than his fault, that he had to follow in his classification the authority of those who preceded him. Of the six species of *Millepora* described, four are easily identified—the other two are not so easily recognized.

Millepora rhombifera, Phill., Geol. of Yorkshire.

„ *interporosa* „ „ „

„ *spicularis* „ „ „

„ *oculata* „ „ „

„ *gracilis* „ Palæozoic Foss. of Devon, etc.

„ *similis* „ „ „ Torquay.

„ *verrucosa*, Goldfuss. „ Of this Phillips says, “a species like this appears at Florence Court, Ireland.”³

No group of Polyzoa, recent or fossil,⁴ has caused so much trouble to palæontologists as the little group here tabulated from Phillips. Members of it have been referred to no fewer than five distinct genera, and even now they may be safely referred to three, if not to four. Rather than postpone the analysis of the species, I shall prefer to draw upon later work, and do it here instead of elsewhere.

Millepora gracilis is referred to by Phillips in his later work,⁵ for he seems not to have noticed it in the limestone, Yoredale limestone, or shales of Yorkshire; yet it is most common everywhere, whilst the *M. rhombifera* is by far the rarer species. We have the authority of Phillips himself, that the species I am dealing with were his; for in a letter which he addressed to Prof. J. Young, and Mr. J. Young, of Glasgow,⁶ he says, “I agree with you in referring your beautiful specimens to the three species (*M. gracilis*, *M. rhombifera*, and *M. interporosa*) named in my books (“Yorkshire,” vol. ii. and “Palæozoic Foss.”). Your examples are better than mine were; but I have no doubt of the reference, etc.” Morris places the whole of Phillips's species—with the exception of *M. spicularis* and *M. oculata*—with the *Cerriopora*;⁷ the exceptions, for what reason I cannot explain, he places with the *Pustulopora* of Blainville, a genus that had no existence in the Palæozoic seas.

¹ Niagara Group: Hall, Palæontol. of New York, vol. ii.; Nat. Hist. New York, part 4.

² GEOL. MAG., 1875, pp. 19-20, Pl. 6, Fig. 14.

³ Geol. of Yorkshire.

⁴ Palæozoic Foss. of Cornwall, Devon, etc., 1841.

⁵ April 3, 1874; Ann. Mag. of Nat. Hist., May, 1875.

⁶ Catalogue of British Fossils, 1854.

⁷ Excepting *Lepralia*.

Millepora rhombifera, Phill., Geol. Yorkshire.

„ *gracilis* „ Palæozoic Foss.

Both *Ceriopora*, Morris, Catalogue.

Rhabdomeson gracile and *R. rhombiferum*, Young and Young.

Gen. Ch.—*R. gracile*. “Stem slender, cylindrical, branching at right angles to the stem never less than an inch apart; and consists of a hollow axis formed by a thin calcareous tube, and of a series of cells ranged round the axis . . . apertures of cells, oval . . . ridges tuberculated.”¹

R. rhombiferum. “Stem slender, cylindrical, free; branches of nearly equal diameter given off at wide intervals . . . cells in quincunx all round the stem; surrounded by tuberculated ridges . . . cell-area more numerous on one face than on the other . . . central axis slender, slightly flexuous, and without transverse septa.”²

For these two species, the Messrs. Young of Glasgow have founded a new genus—*Rhabdomeson*—on account of the peculiar central hollow axis which they possess, and on which the cells are arranged. This peculiarity is unique—for I know of no other Polyzoan having a rod or mesial axis similar to these. Some of the *Graptoloidea*, sub-order *Rhabdophora*, Allman, possess a mesial axis, and so do the *Rhabdopleura*, class Polyzoa, order *Phylactolemata*; but whether we should be justified in assuming on this account either Hydroid or Phylactolematous affinities for these fossils is a very serious question to decide. The assumption in either case would involve the discussion of many problems into which I cannot enter here. The Messrs. Young, in the two papers referred to, have gone into the question very fairly, and those who follow them in their critical remarks must remember that they are contending for the antiquity of a type of Polyzoa organization not—previous to their discoveries—known to exist in a fossil state. I have carefully followed the authors in all their investigations of this intricate question, but I am not prepared to use this fossil type as in any way indicative of the existence of *Phylactolematous* Polyzoa in Carboniferous times. At the same time it would be mere carping on my part to ignore its existence as indicative of peculiar structural characters that may help us in our future classification of the Palæozoic Polyzoa.

Millepora interporosa, Phill., Geol. of Yorkshire.

Ceriopora interporosa, Morris' Catalogue of Brit. Foss.

Vincularia Binniei, Etheridge, jun.³

This species is a very variable one. Phillips speaks of it as having “oval pores,” whilst the *Millepora similis* has more elongated pores; on the other hand, *Vincularia Binniei* is spoken of as having “oval to hexagonal cells arranged in quincunx; or in oblique ascending lines.” The magnified figure of a series of cells given by Mr. Etheridge as an illustration of his species, is one of the rarer

¹ Messrs. Young, Ann. Mag. Nat. Hist., May, 1874.

² Ibid. 1875.

³ GEOL. MAG., April, 1876.

varieties of *M. interporosa*. Had Mr. Etheridge contended for the variety, I should not have disputed his claim, but as he introduces a most anomalous genus into the classification of our Carboniferous Polyzoa, I cannot do otherwise than point out the anomaly. DeFrance's genus *Vincularia* had no existence whatever in Palæozoic times. D'Eichwald, on whose authority Mr. Etheridge rests, is most unreliable on this point.¹

It is on account of their importance that I have dwelt so fully upon these species. They had a wide geographical range in Carboniferous times, and though their variability is great, they have many structural characters in common with the *Ceriopora* which range into the Mesozoic and Tertiary strata.

Under the auspices of Sir Richard Griffith, Bart., Frederick M'Coy published his "Synopsis."² There is ample evidence in this work that M'Coy had much better material than Phillips, and his drawings and diagnosis of species are more elaborate. M'Coy adds no fewer than twelve species of *Fenestella* to our British Polyzoa. They are *F. plebeia*, *carinata*, *formosa*, *crassa*, *multioporata*, *ejuncida*, *frutex*, *hemispherica*, *Morrisii*, *oculata*, *quadri-decimalis*, and *varicosa*. As I shall have to speak of these farther on, I will leave the list without any further comment.

M'Coy retains a few puzzling forms under the name of *Gorgonia*. These are *G. assimilis*, Lonsd.; *G. Lonsdaliana*, M'Coy; and *G. ziczac*, M'Coy.

Another fenestrate genus, introduced by M'Coy, bears the name of *Ptylopora*. There is a feather-like arrangement in this genus; a central stem giving off lateral branches which are connected by dissepiments having oval fenestrules. *Fenestella* owes its expansion to the bifurcation of its branches. *Ptylopora* very rarely bifurcates, there is a basal extension of the polyzoary along the central stem. One species is recorded by M'Coy—*P. pluma*—but it is a genus that deserves to be more closely studied than it has been. In naming some fossils lately for Mr. John Aitken, F.G.S., from the neighbourhood of Castleton, Derbyshire, I detected several small fragments of this beautiful genus. The broad central stem, whenever fenestration was absent, might easily be mistaken for a robust *Glaucanome*.

The *Glaucanome* which M'Coy figures and gives descriptions of are, *G. grandis*, *G. gracilis*, and by his discoveries he extends the range of Phillips's *G. bipinnata*.³

Vincularia I have already repudiated, and the *V. parallela*, Phill., which M'Coy accepts as a type, I have alluded to when describing Phillips's species. The *Berenicea megastoma*, M'Coy = *Diastopora*, Mor. Cat., will be placed in the genus *Ceramopora*, on account of its many well-marked characters.⁴

Having all the material at hand for the work, I shall now discuss

¹ See paper on *Vinculariæ*, mihi. Read before the Geol. Soc. June 23, 1880.

² Synopsis of the Carb. Foss. of Ireland, 1844.

³ Upper Devonian, Croyde, Pilton, Devon, Phill., Palæozoic Foss.

⁴ See paper on *Diastoporiæ*, mihi; read before the Geol. Soc. May, 1880.

the relative value of the genera and species introduced by various authors since the publication of the volumes alluded to.

Synocladia, King, 1849.

1873. *Synocladia biserialis*, Swal., var. *carbonaria*, Etheridge.

1878. *Synocladia*? *scotica*, Young and Young.¹

The type of this genus is very peculiar, and as it is well illustrated in King's Permian Fossils, once seen it can hardly ever be forgotten. "The corallum is cup-shaped, with a small central root-like base: reticulated, composed of rounded narrow, often branched interstices, bearing on the inner face from *three to five alternating* longitudinal rows of prominent edged *pores*, separated by narrow keels, studded with *small irregular vesicles* alternating with the cell pores." The essential characters of this genus I have put in italics.

In the "Ann. and Mag. of Nat. Hist.,"² Mr. Robert Etheridge, jun., described a "peculiar polyzoon from the Lower Limestone Series of Gilmerton, under the name of *Synocladia carbonaria*." An almost identical form had been previously referred, by Mr. Meek,³ to *Synocladia biserialis*, Swallow.⁴ After very minute investigations, kindly supplied to him by Mr. King, Mr. Etheridge says, "I have ascertained that our Scotch fossil agrees so closely in its main characters" with the American species, "that it can be only regarded as a variety of it."⁵

To *Synocladia biserialis* Mr. Meek also refers *Septopora cestriensis*, Prout, "a form which appears to differ only from the typical species of *Synocladia* by having from one to four rows of cell-apertures on the dissepiment instead of two."⁶

In 1878, Prof. Young and Mr. John Young published⁷ details of another *Synocladia*, which they called *Synocladia* (?) *scotica*, from the Upper Limestone Shales, Gillfoot and Garple Burn, stating that "in both localities it is very rare." If we accept the departure from the original type of *Synocladia*, which I have no objection to, seeing that Prof. King uses the term for Palæozoic Polyzoa alone, then these two species of the genus may be recorded as existing in Carboniferous times. They have the "small irregular vesicles alternating with the pores," not unique with this genus, for several others contain a "secondary pore." Having examined this secondary pore in thin sections of Carboniferous species, I can only account for its presence as being indicative of the existence of a vibracula in these ancient types. There are, however, most essentially definite characters in the Carboniferous *Synocladia* yet to be accounted for. Very frequently, in even the smallest fragments, pores, similar to the secondary pores on the face, are constantly found on the reverse also. I know of no analogy in more recent fossil or living species to which I can refer to account for this feature in this ancient type.

¹ Proceedings Nat. Hist. Soc. of Glasgow, April, 1878. (The (?) is Messrs. Young's.) ² September, 1873.

³ Palæontology of E. Nebraska, Washington, 1872.

⁴ Transactions of St. Louis Acad., 1858, vol. i.

⁵ Sheet 23, Scotch Geol. Survey.

⁶ *Ibid.* Explanation of Sheet 23.

⁷ See foot-note 1.

1873. *Carinella cellulifera*, R. Etheridge, jun.

1876. *Goniocladia cellulifera*, R. Etheridge, jun.

This is a good typical genus and species, both well described.

Generic and Specific Ch.—Polyzoarium composed of angular, irregularly disposed anastomosing branches, strongly carinate on both aspects, but celluliferous only on one. No regular dissepiments; the branches bifurcate and reunite with one another to form hexagonal, pentagonal, or polygonal fenestrules of most irregular form. On each side the keel of the poriferous aspect are three alternating lines of cell-apertures.¹ The genus and species, for there is only one, is well illustrated in the GEOL. MAG. 1873.

1849. *Thamniscus*, King, Permian Foss.

1873. Mr. R. Etheridge, jun., indicates the possible existence of a species of this genus in our Scotch Carboniferous rocks. "The portions obtained are fragments of a robust, branching coralline, with a nearly circular section. . . . The cells are very pustulose or wartlike, with prominent raised margins. . . . The disposition of the cells and mode of branching is exceedingly like that seen in *Thamniscus dubius*, Schl. . . . As the margins (of the cells) in the present form are decidedly raised and prominent, might it not probably be a species of *Thamniscus*? If it be a new species of *Polypora*, I would propose for it the specific designation of *P. pustulata*.²

1875. The Messrs. Young of Glasgow, after recording the opinions of Mr. Etheridge,³ describe *Thamniscus Rankini*, Young and Young, inserting between the generic and specific names "Stem free, dichotomous, circular, about $\frac{1}{8}$ inch in diameter, branches in one plane. . . . Cells arranged in spirals. . . . Cell-apertures circular when entire, oval when worn; lower lip prominent. . . . Non-celluliferous aspect finely granulated, faintly striate." . . . "The generic position of the fossil is uncertain. . . . Meanwhile, though strongly disposed to regard this fossil as a true *Hornera*, or a member of a closely allied genus, we think it safer to leave it in the Palæozoic genus." In this the Messrs. Young are wise, but younger and less cautious observers, on the strength of the many peculiar affinities which this species has to *Hornera*, would have eagerly embraced this opportunity. I cannot, however, regard this species as a Palæozoic *Hornera*, but I must candidly confess that it comes very near to the generic description accepted by Busk.⁴

Glaucome, Munster, syn. *Vincularia*, Def. 1829. *Glaucome*, Goldfuss, 1826. Revised by Lonsdale, 1839. *G. disticha*, Lonsdale, type of D'Orb.'s *Penniretepora*; *Acanthocladia*, King, 1849.

It is very doubtful whether this term can be used for other than Palæozoic Polyzoa. It was originally used by Munster for cylindri-

¹ GEOL. MAG. 1873 and 1876. Expl. of Sheet 23, Scotch Survey, p. 101.

² Explanation of Sheet 23, Appendix, p. 102.

³ Ann. and Mag. Nat. Hist., May, 1875, p. 335, pl. ix. bis.

⁴ Marine Polyzoa, pt. iii. Cyclostomata, p. 16.

cal forms, for the *Glaucanome marginata*, Munst., in Goldfuss's Petrefac. of Germany, is given by Hincks as a synonym of *Cellaria fistulosa*, Linn. It was, however, established by Goldfuss, and afterwards revised by Lonsdale. M'Coy,¹ improving upon Phillips's² poor description, does not make any reference to the number of pores between the branchlets. In his later work he defines the genus more minutely thus:—

“Corallum composed of a narrow central stem, with numerous pinnules, or lateral branches *unconnected* with each other: both stems and branches have two rows of cells on one face, which is usually carinated between them, carina in some species tuberculated; opposite face striated.”³

In a paper read at the Nat. Hist. Soc. Glasgow, the Messrs. Young describe several new species of *Glaucanome*.

1875.	<i>Glaucanome marginalis</i> ,	Young and Young.
	„	<i>stellipora</i> „ „
	„	<i>elegans</i> „ „
	„	<i>aspera</i> „ „
	„	<i>flexicarinata</i> „ „
	„	<i>retroflexa</i> „ „
	„	<i>laxa</i> „ „
1877. ⁴	„	<i>robusta</i> „ „
1877.	„	<i>elegantula</i> , R. Etheridge, jun.

In describing *G. elegantula* Mr. Etheridge defines and criticizes the genus *Glaucanome* with especial reference to the *Acanthocladia*.⁵

1875. *Hyphasmopora*, R. Etheridge, jun.⁶

The generic and specific characters of this new provisional genus are well described by Mr. Etheridge in the paper referred to. There is only one species—*H. Buskii*, and I am glad that after submitting the specimens to Mr. Busk, Mr. Etheridge followed his own judgment and established a new genus, rather than adopt the suggestion of Mr. Busk, “That the above resembled the genus *Vincularia*, DeFrance”—adding afterwards, “It is probably the type of a new genus, perhaps allied to the latter.” This beautiful species is found in several localities of Scotland, but I have found it in Yorkshire, and also in N. Wales. It cannot, however, be considered a common form anywhere.

1850. *Sulcoretepora*, D'Orbigny.

This genus has been accepted by Morris (Catal.) and by the Messrs. Young, of Glasgow, for certain species of Carboniferous Polyzoa. Morris gives the above date, but the Messrs. Young in their paper⁷ say, “The genus *Sulcoretepora* was formed by D'Orbigny in 1847, with the following definition: Cells in furrows on one side of simple depressed branches.”

¹ Syn. Carb. Foss. Ireland.

² *Retepora pluma*, Geol. of Yorkshire.

³ Brit. Palæozoic Foss.

⁴ Proc. Nat. Hist. Soc. of Glasgow, 1878. Paper read 1877.

⁵ “Notes on Carb. Polyzoa,” Annals and Mag. Nat. Hist. vol. xx. 1877.

⁶ Provisional Genus of Polyzoa, *ibid.* vol. xv. 1875.

⁷ Proceedings of Nat. Hist. Soc. Glas. 1877.

All the Carboniferous species that have been referred to this genus have cells on both sides, and, as I have already referred one of the accepted species to another genus, I will deal now with the *Sulcoretopora Robertsoni*, Y. and Y. As there are characters in this species altogether different from any known species of *Ptilodictya*, the same reference for this, as appears feasible for *Flustra? parallela*, Phill., is altogether out of the question. The *S. Robertsoni* has none of the characters in common with Phillips's species, and I should strongly recommend the Messrs. Young to construct for this typical species a new genus, especially so as "Between each pair of cells in a longitudinal series, 1 to 3 pores occur, normally above each cell-aperture, and in well-preserved specimens tubercles surround each cell-area more or less completely."¹ The *facies* of Phillips's species and the species of the Messrs. Young may at first sight appear identical, but the forms described by the later authors are destitute of the non-poriferous, rugose, and striated margins of *Flustra? parallela*. It is upon the presence of this particularly constant character that I refer Phillips's species to *Ptilodictya*.

Archæopora nexilis, De Koninck.

This genus and species, classified as it is with the Polyzoa, is a most peculiar one. I have not by me De Koninck's work for reference, and the remarks that I may offer upon the species—for I shall accept the genus without discussion—are the results of original investigation. The species is tolerably common in a few localities of Scotland. I have no record of it in this country except in doubtful fragments in Wales—and my type specimen was presented to me by Mr. John Young, and I believe I may safely conclude that this, with other specimens, was seen and approved of by De Koninck when he visited the Hunterian Museum of Glasgow.

Sp. Char.—Polyzoary adherent to stems of encrinurites, shells, fragments of *Rhabdomeson*, *Cerriopora interporosa*, spines of Mollusca, etc., spreading irregularly, forming large patches, at other times mere minute specs; pores generally oval, separated from each other by smaller openings. I cannot call them 'interstitial or cænenchymal tubuli'—for that would convey a false impression, for pores and cells are netted together. The number of small openings surrounding a cell varies; sometimes there are as many as fifteen, in other places not more than five or seven. About twelve cells with their interposed pores occupy the space of a line and a half across the cells, from nine to ten in the same space in their length. The polyzoary is separated from the foreign objects to which it is attached by a very thin lamina formed by the bases of the cells. There is no evidence of tabulæ in thin sections, but the interjacent pores do not reach quite to the bases of the cells. I have never seen a specimen, on which a fresh colony is found spreading over an older one, but sometimes a colony of *Stenopora* is found upon the polyzoary of *Archæopora*. In a thin transparent section of a small fragment of another specimen, adherent to a portion of shell, a most peculiar

¹ *Ibid.* p. 167.

structure is revealed, which for a long time puzzled me, because the peculiar biserial cells appeared like an analogous structure referred to by Prof. Nicholson when describing *Carinopora Hindei*, Nich.¹ His figures, however, are said to be transverse, mine are longitudinal, or in a line with the bases of the cells. These tail-like processes are constant characters at certain intervals even in a very small section, and may help in the recognition of the genus in sections of limestone. At first sight *Archæopora* has the appearance of *Callopora incrassata*, as described and figured by Nicholson,² but a very little examination will show the difference between the two forms, whereas one is a Polyzoan and the other a Tabulate coral.

I have now gone over the whole of the recorded genera and species of British Carboniferous Polyzoa, with the exception of the *Fenestellidæ*. These having been so lately and so ably reviewed by Mr. G. W. Shrubsole, F.G.S., their omission from this report will not be so much felt as the omission of any of the other lesser known forms. Mr. Shrubsole, after very elaborate investigations, and after the careful comparison of nearly all the known so-called species, is inclined to restrict the twenty-six species to five typical ones, namely: ³—

<i>Fenestella plebeia</i> , M'Coy	<i>Fenestella nodulosa</i> , Phillips.
" <i>crassa</i> "	" <i>membranacea</i> , " sp.
" <i>polyporata</i> , Phillips.	

all the other "species" falling into the rank of synonyms of one or other of the five here received by him. But this does *not* confine the number of known species to five. When his labours on the family are completed several new forms will be described, together with at least two more species of *Polypora*—the results of laborious investigations in North Wales. There are also some references to the Polyzoa of the Carboniferous Limestone of the districts between Llanymynech and Minerva, N.W., in the lately published work ⁴ of G. H. Morton, F.G.S., Hon. Sec. of the Liverpool Geological Society.

Several other papers on special points, having reference to Polyzoa, have been published during the last ten or twelve years. The vexed question as to the Hydrozoal or Polyzoal affinities of *Palæocoryne* has been debated by Prof. Duncan,⁵ Prof. Young, and Mr. John Young,⁶ and by myself;⁷ but the question as to their real affinities is still an open one. Another paper by Mr. A. W. Waters,⁸ entitled 'Remarks on some *Fenestellidæ*,' contains some debatable matter, and the papers of Mr. Robert Etheridge, jun., on the genus *Glaucome*, Messrs. Young on the genus *Ceripora*, and the paper on the "Perfect Condition of the Cell-pores and other points of structure,"⁹ are valuable additions to our knowledge of Carboniferous Polyzoa. Before any attempt can be made to construct a system of classification which will embrace—naturally—the several genera of the

¹ Annals and Mag. Nat. Hist., Feb. 1874, p. 81, figs. *f* and *i*.

² New Devonian Foss., GEOL. MAG., Vol. I. 1874, p. 2, Plate I.

³ "Carboniferous Fenestellidæ," Quart. Journ. Geol. Soc., May, 1879.

⁴ The Carb. Limestone and Cefn-y-fedw Sandstone, London, David Bogue, 1880.

⁵ Phil. Transac., 1869.; Journ. Geol. Soc., 1873.; Journ. Geol. Soc., Dec. 1874.

⁶ Journ. Geol. Soc. Dec. 1874.

⁷ Science Gossip, 1879.

⁸ Proc. of Manchester Geol. Soc., 1879.

⁹ Newspaper Report, Oct. 9, 1879.

Palæozoic Polyzoa, many, at present, very doubtful points must be cleared up by a more complete study of all the species of the Palæozoic and Mesozoic ages of our earth's history. It is a difficult matter with present classifications to place the genera of Palæozoic Polyzoa without doing violence to constructed definitions. In the absence, therefore, of any well-defined families in which the Carboniferous Polyzoa can be placed, I venture to group the whole of the forms under separate headings, which must be considered as provisional only. But to prevent any misconception as to the special characters of each group, I shall refer to the shape of the cell or zoecia especially, as the basis of my arrangement, allowing all the other characters to fall into their places as subordinate only.

Fam. I.—FENESTELLIDÆ.

Primary Char.—Polyzoary forming small or large fenestrated or non-fenestrated expansions. Cells placed biserially, or alternate, so as to form branches or "interstices," similar in many respects to the genus *Scrupocellaria* among living Polyzoa: cells bladder-like, margin of mouth raised and covered? by "operculum" during the life of the animal. The nearest living representative cell among the British Polyzoa figured by Hincks¹ is that of *Aleyonidium albidum*, with which I can compare generally the cells of the *Fenestellidæ*. The following genera are grouped provisionally, many details having yet to be worked out:—

- Genus I. FENESTELLA—*plebeia*, *polyporata*, *membranacea*, in which the cells are biserially placed.
 ,, II. FENESTELLINA—*nodulosa*, *actinostoma*, in which the cells are alternate, literally forming single rows.
 ,, III. GLAUCONOME—Only some of the species studied.

Fam. II.—POLYPORIDÆ.

Primary Char.—Polyzoary forming small and large fenestrated expansions. Branches robust, cells placed contiguously in a slanting direction over the branch, opening on one side only; the cells on the margins of the branches (younger cells) nearly of the same shape as in the *Fenestellidæ*; the older cells in the innermost portion of the branches much compressed, but never partaking of a tubular character.

Genus IV. POLYPORA.

The cell-structure of the following genera is such as to warrant their separation from the whole of the above genera, but they are not sufficiently studied, neither are their details so well worked out as to enable me to suggest a proper place for them at present.

- Genus I. *Goniocladia*, Etheridge, jun.
 ,, II. *Synocladia*, ,, } Two most distinct
 Synocladia, Young and Young. } species.
 ,, III. *Hyphasmopora*, Etheridge, jun.
 ,, IV. *Thamiscus*, Young and Young.
 ,, V. *Sulcorettopora Robertsoni*, Young and Young.
 ,, VI. *Archæopora*, De Koninck.

All the above are types of distinct genera, and before they can be

¹ Brit. Marine Polyzoa, 1880, p. 500; vol. i. p. lxx; vol. ii. figs. 8 to 10.

properly placed, the Silurian, as well as the Permian Polyzoa, must be carefully studied in the way that I have already suggested.

For the present, too, I will catalogue the remainder of the Carboniferous genera, reserving for the future more detailed arrangements.

- Genus VII. *Rhabdomeson*, Young and Young.
 „ VIII. *Cerriopora*, Morris.
 „ IX. *Berenicea*, M^cCoy = *Ceramopora*, Hall.

I thus, for the present, conclude my summary of the British species of Carboniferous Polyzoa. It would have been comparatively easy for me to have made it longer—it would have been difficult indeed to have made it shorter. 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; and the relationship of the Palæozoic to all other Polyzoa must be grappled with intelligently and dispassionately; and for this purpose collectors could help either myself or others by furnishing materials for the study.

ATTERCLIFFE, SHEFFIELD.

V.—ON THE CAVES AND KITCHEN-MIDDEN AT CARRIGAWER,
 CO. CORK.

By R. J. USSHER, ESQ.

THESE caves, whose original mouths are now probably destroyed or concealed by rubbish, open at present into a quarry in a limestone knoll on the townland of Carrigawer ('Rock of the Goat'), three or four miles south of Middleton. They are not broad nor lofty, but have extensive ramifications, especially that one which opens into the north-west part of the quarry. At its eastern end, and at a depth of 20 feet from the surface, the quarry is crossed by a cave now exposed by the removal of its western side. This cave runs in the line of a joint or fissure, and penetrates the rock north and south. The floor of this cave, where it remains (through the northern half of the exposed portion), is of stalagmite resting on pale sandy clay that overlies the limestone bottom. On this stalagmite floor, among the *débris* of broken stalactites, loose charcoal was found, and, on removing a layer of the solid stalagmite, from one inch to two inches in thickness, much charcoal was found embedded in it with sandstone gravel and some shells of a small *Helix*, marking the horizon of an old floor that had been encrusted by the subsequent formation of stalagmite. The portion of the cave laid open appeared in its southern part to have had no stalagmite floor, but to have had an upward opening to the sky, through which an accumulation of brown surface-earth and kitchen waste had been introduced, extending downwards into the cave so as to have completely filled this vertical opening. The accumulation was uniform in character, containing much charcoal, often in large lumps, and a great profusion of bones and teeth of ox, sheep or goat, and pig, with some remains of horse, dog, and cat, and a few of hare and rabbit. The bones were usually broken. Their colour was generally yellowish, but often