1. Observations on Some Carboniferous Polyzoa.

By Robert Etheridge, Esq., jun., F.G.S.

The following observations consist of a few notes on certain Carboniferous Polyzoa which have come under my notice during some investigations into the structure of various members of the Class more commonly found in the Scotch Carboniferous Limestone series.

Genus Synocladia, *King*, 1849.*

Until recently *Synocladia* was known in this country only from rocks of Permian age, as one of the characteristic corallines (*S. virgulacea*, Phill.) of the Magnesian Limestone. In America, however, a species has been recognised in various portions of the Carboniferous series, originally found in, and described by Professor Swallow, from the Lower Permian strata of the Cottonwood Valley, Texas, under the provisional name of *S. biserialis*.† (Figs. 1 and 2).

In general habit this agrees with the typical *S. virgulacea*, but in some of the more essential characters differs widely.

In the "Palæontology of Eastern Nebraska," ‡ Mr. F. B. Meek has figured and described this fossil from various horizons in the Carboniferous strata of that state, Texas, and Iowa, giving the specific characters in greater detail than Professor Swallow had done in provisionally applying his name. Mr. Meek further gives good and sufficient reasons for regarding *S. biserialis* as a separate species, distinct from *S. virgulacea*, a point on which some doubt had been cast.

In the September number of the *Annals and Magazine of Natural History*,§ I described a Carboniferous species of *Synocladia*, under the name of *S. carbonaria* (Figs. 3 and 4), which at that time I took to be quite specifically distinct from any described species, but through the kindness of Professor W. King, who has favoured me with photographs of American specimens (Figs. 1 and 2), and extracts from Mr. Meek's previously quoted work, I have ascertained that our Scotch Polyzoon must cease to be regarded as a distinct species, but may be con-

* *Annals and Magazine of Natural History*, 2nd ser., vol. iii., p. 388.
† *Transactions St. Louis Academy of Natural Sciences*, vol. i., p. 179.
‡ Washington, 1872, p. 156.
§ 1873, vol. xii., 4th ser., p. 189.

sidered as a well marked variety of the American Permio-Carboniferous *S. biserialis*, Swallow, under the varietal name of *carbonaria*.*

It was only whilst my notice of the Scotch variety was in course of printing that I had access to Mr. Meek's description of *S. biserialis*; it therefore becomes satisfactory to find that the two independent descriptions more or less closely corresponded.

As in the typical *S. virgulacea*, the frond is composed of numerous rib-like stems, rising from a common root and frequently bifurcating; the branches or dissepiments are short and simple, and spring at an ascending angle from one stem to meet those of the opposite stem, and thus form the peculiar arch-like dissepiments so characteristic of the genus (Fig. 3). The latter occasionally lose their normal form, and become mere ordinary connecting bars, so enclosing irregular fenestrules; this is more apparent in the lower parts of the frond towards the root. The two species, *S. virgulacea* and *S. biserialis*, including the variety *carbonaria*, differ essentially in the arrangement of the cells on the celluliferous or obverse face. In the former the cells are placed on the stems in from three to five furrows, separated by angular keels, on which may be seen small papillæ-like elevations or projections ("gemmuliferous vesicles" of King), whilst on the branches the cells are restricted to two rows with a dividing keel, those of one row set alternately with those of the other. In the latter, on the other hand, there are only two rows of cells on both stems and branches, separated by a keel set with "gemmuliferous vesicles" as in *S. virgulacea* (Fig. 5). Furthermore, scattered in a most irregular manner amongst the cells proper, are a number of supplementary cells, without any attempt at definite arrangement; these may be easily distinguished by their much smaller apertures. Again, the papillæ-like elevations to which Professor King has given the name of "gemmuliferous vesicles,"† are found in *S. virgulacea* only on the keels of the stems, whilst in *S. biserialis* they are continuous from the keels of the stems to those of the branches (Fig. 5). Lastly, the reverse face of the Carboniferous form is striate, and scattered over it here and there, generally however at the setting off of the branches, are additional cell apertures (Fig. 3). I do not think that any structure of this description is to be seen on the reverse of *S. virgulacea*, which, according to Professor King's figure,‡ is

* *Memoirs Geological Survey, Explanation* 23, *Scotland*, 1873, p. 102.
† *Permian Fossils*, 1850, p. 37.
‡ *Permian Fossils*, plate 4, fig. 8.

plain, and non-striate; perhaps, however, the absence of striæ, may be due only to the state of preservation of the specimens from which the original descriptions were made.

From an examination of indifferent specimens I was led, in my original description, to attribute these supplementary cells on the reverse face of *S. biserialis* and variety to the broken bases of the "root-like processes" met with on the reverse face of *S. virgulacea*, but I now believe that my conjecture was wrong, and that they are, perhaps, true cells in the same sense as those on the obverse face.

So far as I am able to judge, without an actual comparison of specimens, the Scotch fossil appears to present a more irregular method of branching than that seen in the American *S. biserialis*. It is principally on this account that I regard the former as a variety of the latter. I am the more inclined to this, as I find Mr. Meek appears to regard the *Septopora Cestriensis*, Prout,* from the Upper Archimides Limestone of Chester, Illinois, as a synonym of *Synocladia biserialis*. From the late Dr. Prout's description, this appears to differ only from a typical *Synocladia* in having the branches or dissepiments more celluliferous (cells in from one to four rows) than the stems or interstices (cells in two lines). Should *Septopora Cestriensis* be only a synonym of *Synocladia biserialis*, the larger number of cells on the dissepiments would be another point in favour of the Scotch fossil being considered a variety, for in all specimens which have come under my notice, the cells were found to be constantly in two lines only, one on each side of the median keel.

There is one specimen in the Geological Survey collection in which one of the stems is stronger than the others, and from which the latter take their rise, closely resembling the general habit of *Ptylopora pluma* (Scouler), McCoy,† but still retaining the intermediate arch-like dissepiments. The following is a brief diagnosis of the British specimens:—

SYNOCLADIA BISERIALIS, *Swallow*, var. CARBONARIA, *mihi; S. carbonaria*, R. Etheridge, jun. (Annals and Mag. Nat. Hist., 1873, 4th ser., Vol. xii, p. 189, pl. 10); *S. biserilais*, Swallow (Pro. Acad. Nat. Sciences, St. Louis, Vol. i., p. 179); var. *carbonaria*, R. Etheridge, jun. (Mem. Geol. Surv., Expl. 23, Scotland, 1873, p. 102).

* *Transactions Academy Natural Sciences, St. Louis*, vol. i., p. 448, pl. 18, fig 2.
† *Synopsis Carboniferous Fossils*, 1844, p. 200, pl. 28, fig. 6.

Polyzoarium, a plumose expansion, springing from a common root of attachment. Interstices or stems, rib-like, frequently bifurcating, much stouter and stronger than the branches; obverse celluliferous, with a rounded median keel; reverse round and striate; dissepiments or branches short; opposite halves given off at an oblique angle from their respective stems, which meeting give rise to arched or reversed V-shaped branches; obverse angular and celluliferous; reverse rounded and striate, sometimes becoming modified into stems. Dividing ridges or keels, on the obverse face of both stems and branches, separating the two lines of cell-apertures, those on the stems rounded, those on the branches slightly angular. Fenestrules arch-shaped when the stems and branches assume their normal character, otherwise irregular. Cell-apertures arranged in two alternating lines, both on the stems and branches, separated by the median keel, and with prominent margins. Supplementary cell-apertures scattered irregularly amongst the primary cell-apertures, either singly or grouped in twos and threes, whilst open or closed papillæ-like protuberances are placed on the keels of both stems and branches, apparently alternating with the cell-apertures. Reverse, regularly and finely striate, rounded; scattered over the surface are open wart-like projections, or papillæ probably cell-apertures. These are often placed at the setting off of the branches, and sometimes at the apex of the V-shaped arch.

Localities.—Lower Carboniferous Limestone Group—Shale over the Gilmerton Limestone, Gilmerton, near Edinburgh; Shale between the 1st and 2nd Calderwood Limestones, Calder Water, opposite old mines of Calderside and Newfield Quarry, both near East Kilbride, Lanarkshire; Shale connected with the Raesgill Ironstones, Wilton Ironstone Pit (Coltness Iron Company), near Carluke (collection of the Geological Survey of Scotland, collected by Mr. J. Bennie).* Upper Carboniferous Limestone Group—Shale between two beds of Limestone, Mouse Water, opposite Lambcatch, near Wilsontown, Lanarkshire; Shale above a bed of limestone, near Laigh Longridge, Stonehouse, Lanarkshire (Collection of the Geological Survey of Scotland, collected by Mr. A. Macconochie).

* Dr. Rankin, of Carluke, has obtained *S. biserialis*, var. *carbonaria*, from the shale in connection with the Lingula Ironstone of that district, which he kindly allowed me to examine.

Genus Polypora, *McCoy*, 1844.*

McCoy proposed this genus for those flat and fan-shaped Carboniferous Polyzoa, with the general habit and appearance of *Fenestella*, but distinguished from the latter by the absence of any median keel on the interstices, and the presence always of more than two rows of cells, which are, however, as in *Fenestella*, confined to the interstices, and do not occur on the crossbars or dessepiments.

In a paper read before the Geological Society,† "On some Fossils from India, &c.," Professor de Koninck described several new species of Polyzoa from the Carboniferous rocks of the Punjaub. In his description of *Polypora fastuosa* attention was drawn to the internal characters of the cells, which appear to be arranged on the same plan as that seen in *Fenestella* or *Synocladia*, where they spring from the basal plate of the polyzoarium in an obliquely inclined direction, curving outwards to the surface of the interstice, where they open parallel to the immaginary axis.‡

In a specimen of a *Polypora*, from Longniddry Quarry, Haddingtonshire, I observed the position of similar papillæ-like elevations, as in *Synocladia* and other genera, called by Professor King "gemmuliferous vesicles." These, in the specimen referred to, are placed one over each cell aperture, a little to the right side of the cell, and are very prominent, still, however, retaining their wart-like character. In another specimen of a *Polypora*, from Hairmyres Quarry, Lanarkshire, in the Geological Survey collection, these little bodies are found to occupy a somewhat different position—placed in linear series between the rows of cells, arising from the ordinary surface of the dissepiment.

Genus Thamniscus, *King*, 1849.§

A genus of Permian Polyzoa in which the stems or interstices frequently and irregularly bifurcate at their distal extremities, the dessepiments are free, and the gemmuliferous vesicles overlie the cell apertures.

In addition to the typical species *T. dubius*, Schlotheim, there is a Carboniferous coralline indicated by Professor King‖ as pro-

* *Synopsis Carboniferous Fossils*, 1844, p. 206.
† *Quart. Journ. Geol. Soc.*, 1863, vol. xix., p. 1.
‡ Ibid pl. 1, f. 4a.
§ *Annals and Magazine of Natural History*, 2nd ser., vol. iii., p. 389.
‖ *Permian Fossils*, p. 44.

bably congeneric, the *Fenestella intertexta*, Portlock.* In this species the growth commenced from a centre, resulting in thick interstices or branches, forming by anastomosis very irregular fenestrules, and in all probability free at their extremities. Lastly, the Chevalier D'Eichwald has described a third form of this genus from the Orthoceratite Limestone of Erras, Russia, under the name of *T. bifidus*.† It appears to be characterised chiefly by the lateral branches arising from one side of the principal stem only; the cell apertures are round, and arranged in quincunx.

Amongst many other Carboniferous Polyzoa collected at Longniddry Quarry, Haddingtonshire, by Mr. D. J. Brown, of Edinburgh, was one slab of shale with, weathered out on one of its surfaces, several fragmentary, but well preserved specimens of a species of *Thamniscus*. Unfortunately in each case the non-celluliferous face is presented to us, so that the precise specific identity remains somewhat doubtful. Nevertheless, the general characters are such as to place the Longniddry specimen close to *T.* (*Fenestella*) *intertexta*. The stems and branches (Fig. 7) are thick and robust, frequently bifurcate, are rounded, and the termination of many of the branches in the upper part of the specimens are free, whilst towards the root or base they join, and so form more or less irregular fenestrules. Of the three species mentioned, our *Thamniscus* is certainly very nearly allied, if not identical with Portlock's species, but until specimens showing the characters of the celluliferous face are preserved, it would not be wise to definitely refer it to the latter. It is delicately striate.

It becomes an interesting fact to note the increasing number of forms which are gradually becoming recognised as common in our own country to the Carboniferous and Permian Systems. On the Continent Dr. Geinitz and M. Göppert have indicated the large series of plants common to the two groups, whilst in this country the researches of Mr. Davidson,‡ Professor King,§ Mr. J. W. Kirkby,‖ and many others have thrown much light upon the specific relations existing between the Brachiopoda, Entomostraca, and other Classes of the Carboniferous and Permian faunæ. In America this comparison has extended to perhaps a greater extent than elsewhere, as may be seen by a perusal of the writings of Dr.

* *Geological Report, Londonderry*, 1843, p. 324, pl. 22 A., fg. 3, a, b, & c.
† *Lethæa Rossica*, 1860, vol. i., p. 386, pl. 23, f. 17, a & b.
‡ *Monograph of Carboniferous Brachiopoda, Pal. Soc.*
§ *Edinburgh New Philosophical Journal*, vol. xiv., p. 37, xv., p. 251.
‖ *Annals. and Magazine of Natural History*, 3rd ser., vol. x., p. 202.

F. B. Shennard, Mr. F. B. Meek, the late Dr. Prout,* and other authors. The occurrence of a variety of *Synocladia biserialis*, Swallow, in our Scotch Carboniferous beds, adds another link in Great Britain to the chain of evidence which tends to unite the Carboniferous and Permian, and from its occurrence in American rocks is a point of some interest. A well-digested account of the species common to British Carboniferous and Permian Rocks will be found in a paper by Mr. J. W. Kirkby, "On some additional species that are common to Carboniferous and Permian Strata; with Remarks on the Recurrency of Carboniferous species" *(op. cit.)*. In conclusion I have to thank my friend Mr. H. M. Skae for the very careful drawings which accompany these notes.

Description of the Figures.

Fig. 1.—*Synocladia biserialis*. Swallow. Obverse face, showing the arrangement of the cell-apertures, and other characters.

Fig. 2.—Reverse face of the same. Both these figures are taken from enlarged photographs of American specimens, for which I am indebted to the kindness of Professor W. King.

Fig. 3.—*Synocladia biserialis*, Swallow, var. *carbonaria*. R. Eth. Jun. Reverse face, enlarged three diameters, showing the arch-like form of some of the dissepiments, and the scattered supplementary cell-apertures. From the shale over the Gilmerton Limestone, Gilmerton, near Edinburgh (Lower Carboniferous Limestone).

Fig. 4.—Reverse face of another specimen from the same locality, natural size.

Fig. 5.—Portion of obverse face of another specimen, showing the cell-apertures, and the papillæ on the keels. From shale between the Calderwood Limestones, Calderside, East Kilbride, Lanarkshire. Enlarged six diameters.

Fig. 6.—Another portion of the same taken from near the root, showing the large cell-apertures, and smaller supplementary cell-apertures. From same locality. Enlarged six diameters.

Fig. 7.—Reverse or non-celluliferous face of a portion of *Thamniscus* sp. From shale of the Lower Carboniferous Limestone Group, Longniddry Quarry, Haddingtonshire. Enlarged four diameters.

2. On Some Geological Puzzles.

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* *Transactions of the Academy of Natural Sciences, St. Louis*, vol. i., p. 440.