

XLVI.—On *Ascodictyon*, a new Provisional and Anomalous Genus of Palæozoic Fossils. By H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., and R. ETHERIDGE, Jun., F.G.S.

[Plate XIX.]

THE curious little fossils for which we propose the generic title of *Ascodictyon* are parasitic in their habits, and are found adhering to the shells of Brachiopods, the exterior of corals, or the stems of Crinoids. We are acquainted with at least three distinct forms, one of which occurs in the Carboniferous rocks of Scotland, whilst the other two have been detected in the Devonian deposits of North America. In all the members of this group the organism, though visible to the naked eye, can only be properly examined by means of the microscope, and consists of minute calcareous vesicles, the walls of which are more or less extensively perforated by microscopic foramina. The vesicles or "cells," whatever their shape or arrangement may be, are always hollow; but they exhibit no definite aperture, save the very minute pores just spoken of. In some cases they open into one another by short contracted necks or stolons, thus forming a loosely reticulate network; whilst more typically they are arranged in regular, usually stellate clusters, which in turn are united with one another by delicate thread-like hollow tubes, which often ramify and anastomose.

The above being the general characters of *Ascodictyon*, a provisional generic diagnosis may be framed as follows:—

Gen. char. Organism composite, parasitic, adherent on foreign bodies, composed of numerous calcareous cells or vesicles, the walls of which are perforated by a greater or less number of microscopic foramina, but which possess no single large aperture. The cells may be united almost directly by the intervention of short tubular necks; or they may be disposed in clusters connected with one another by hollow filamentous tubes, which usually anastomose, and which in some cases, at any rate, are likewise perforated by microscopic pores.

As before remarked, the genus, so far as our present knowledge goes, is confined to the Devonian and Carboniferous periods; and the following are the characters of the three species with which we are as yet acquainted.

Ascodictyon fusiforme, Nich. and Eth., Jun.
(Pl. XIX. figs. 7, 8.)

Spec. char. Colony composed of fusiform, sometimes pyri-

form calcareous vesicles, which vary in length from a third of a line to more than half a line, and which have their walls perforated by numerous circular microscopic foramina, covering the whole surface, and placed about their own diameter, or rather more, apart. The cells are produced by budding from one another directly, and are connected by short, contracted, tubular stolons in such a manner as to form an open network.

Obs. *A. fusiforme* is readily distinguished from *A. stellatum* by the fact that the vesicles are directly connected with one another, that they are not arranged in clusters, and that the pores are, on the whole, of larger size, and show no traces of a linear arrangement, whilst the vesicles themselves are also of larger size. The absence of a clustered arrangement and of a network of connecting filaments equally separate this species from *A. radians*, with the additional distinction that the pores are distributed over the whole surface instead of being confined to a single median row on each vesicle. When the vesicles of *A. fusiforme* are fractured, they are seen to contain a large central cavity; but there are no traces of any other opening in each except the numerous minute pores. These pores sometimes exhibit the appearance of being elevated above the general surface; but it is difficult to say how far this appearance may not be deceptive. Owing also to the adherent habit of this and the other members of the genus, and the small size of the vesicles, we have been unable to examine specimens by the method of transparent sections, and can therefore offer no observations on the minute structure of the chamber-wall.

Form. and Loc. Hamilton formation (Middle Devonian), Widder, township of Bosanquet, Ontario. Rare, and adherent on *Spirifera mucronata*, Conrad.

Collected by, and in the cabinet of, Prof. Nicholson.

Ascodictyon stellatum, Nich. and Eth., Jun.
(Pl. XIX. figs. 1-6.)

Spec. char. Colony composed of ovoid or pyriform calcareous vesicles, varying in length from one fifth to one third of a line, and usually disposed in stellate clusters, each containing from three to six cells, or sometimes more. The walls of the vesicles are perforated by microscopic foramina, usually showing a distinctly linear arrangement. The clusters are connected together by creeping filamentous tubes, the free surfaces of which are perforated by a single row of minute foramina, and which generally anastomose so as to form a network.

Obs. In its youngest stage (Pl. XIX. fig. 6), *A. stellatum* presents itself simply in the form of scattered oviform or pyriform calcareous vesicles attached to the exterior of foreign bodies. When mature, it consists of similar vesicles combined into clusters, generally of three to six in each, these being connected by ramifying and anastomosing tubular stolons (Pl. XIX. fig. 1). The new vesicles are produced from the sides of the stolons, or are budded forth in rosettes from the nodal points where the stolons intersect one another. The rosettes may be comparatively remote; in other instances they become so aggregated together as almost to constitute a continuous crust. The walls of the vesicles are perforated by minute apertures (Pl. XIX. fig. 2), which are generally arranged in lines, and are not so numerous as in *A. fusiforme*, whilst they can only with difficulty be detected in specimens infiltrated with carbonate of lime. The vesicles are seen, on fracture (fig. 5), to be hollow; and they may coalesce in the centre of each rosette, or there may be a central chamber, the nature of which we have been unable to determine. The connecting tubes or stolons are also undoubtedly hollow; and they carry a single row of pores (fig. 3) on their free surfaces, though these openings can only be detected in well-preserved specimens. The stolons may arise from one another, from the central points of the rosettes, or occasionally by direct prolongation from the distal extremity of a vesicle (Pl. XIX. fig. 4).

In the fact that the vesicles are, typically, disposed in rosettes, and are connected together by a creeping network of tubes, *A. stellatum* resembles *A. radians*. It is, however, readily distinguished from the latter species by the ovoid or pyriform shape of the vesicles, and the fact that there is always more than a single row of pores to each vesicle.

Form. and Loc. Not very rare in the Hamilton formation (Middle Devonian) of Widder, township of Bosanquet, Ontario. Parasitic on *Spirifera mucronata*, Conrad, and *Cyrtina hamiltonensis*, Hall.

Collected by, and in the cabinet of, Prof. Nicholson.

Ascodictyon radians, Nich. and Eth., Jun.
(Pl. XIX. figs. 9-11.)

Spec. char. Colony composed of elongated vesicles, broad at their bases, thickened out in the middle of their length, and gradually attenuated towards their extremities, disposed in stellate clusters or rosettes. The bases of the tongue-like or somewhat fusiform vesicles are placed round a central circular depression; and their length varies from a sixth to more

than a fourth of a line. Each rosette consists of from ten (sometimes fewer) to fifteen or twenty vesicles; and the free surface of each carries a single median row of excessively minute, somewhat slit-like, closely approximated pores. The rosettes are connected together by delicate creeping filaments, which may spring from the bases of the rosettes or from the attenuated extremities of the vesicles, and which generally anastomose, so as to form a network or mycelium.

Obs. In its general structure and arrangement this species is related to *A. stellatum*, though sharply distinguished by the very elongated form of the vesicles and the presence of but a single row of pores on each. All the rosettes, when well preserved, show a circular central cavity or depression, with a distinct bounding wall; but we have been unable to make out the true nature of this or its relation to the vesicles. When the vesicles are very numerous, they are smaller in size than when the rosette consists of fewer; but in all cases each shows a dark median line, which, when highly magnified, resolves itself into a line of minute close-set pores (fig. 11). The stolons may ramify and form a network; or a single stolon, proceeding directly from the end of a vesicle in one rosette, may be prolonged at once into the attenuated termination of a vesicle belonging to another rosette (fig. 10, *a*). Weathered specimens show clearly that the vesicles are traversed by a long tubular cavity, corresponding in form with the shape of these structures themselves; and they sometimes show what appear to be apertures at their bases. The stolons also are, doubtless, tubular, and they probably carry a median row of pores on their free faces, though we have not been able to determine either of these points to our satisfaction.

There appear to be two well-marked varieties amongst the forms which we have placed under *A. radians* :—

Var. *a*. Vesicles few, lobate, and larger than in *b*.

Var. *b*. Vesicles very numerous, smaller and finer than in *a*, and the individuals always more crowded together.

Form. and Loc. Boghead Quarry, near East Kilbride, Lanarkshire, in shale of the Calderwood series, L. Carboniferous Limestone group.

Collected by, and in the cabinet of, Mr. James Bennie, Edinburgh.

Systematic Position and Affinities.

After a very careful examination of a considerable number of specimens of the singular organisms which we have grouped together under the name of *Ascodictyon*, and after taking the opinion of several of our fellow workers, we are still unable to

express a positive opinion as to their precise zoological position and relationships. The Scotch specimens were shown to the late Dr. Strethill Wright, who was unable to throw any light upon their nature. The same specimens have also been examined by Prof. Huxley, F.R.S., who, after considerable hesitation, suggested that they might be Protozoans. Our own opinion was at first in favour of their Foraminiferal affinities, as indicated by their calcareous walls and the presence of microscopic foramina, combined with the absence of any aperture to each cell. Our friend Mr. H. B. Brady, F.G.S., however, after a protracted examination of both the Scotch and the American forms, has arrived at the conclusion that they cannot be referred to this group. As regards the Scotch specimens (*A. radians*), this distinguished authority, in a letter addressed some time ago to one of the present writers, says, "I suspect they are rudimentary portions of rooted Crinoids, but am not at all sure. There has been, in some of them, a central pillar growing perpendicularly to the stellate roots." At this time, however, Mr. Brady had not the advantage of having the American specimens for comparison; and the unquestionable generic identity of *A. radians* and *A. stellatum* renders this hypothesis as to the affinities of the former clearly untenable, to say nothing of the fact that we should still have to find an explanation for the foramina.

Leaving the Foraminifera out of sight, the only other group that suggests itself prominently as one to which these problematical organisms might be referred is that of the Polyzoa. In their perforated walls they present a close resemblance to many of the Cheilostomatous Polyzoa, especially to some of the *Lepraliæ*; and their general habit and mode of growth would also favour this view. On the other hand, it seems difficult to reconcile this view as to their affinities with the unquestionable fact that the cells or vesicles have no other means by which the internal cavity is placed in communication with the exterior, except the microscopic pores in the walls.

Some of our American specimens (*A. fusiforme* and *A. stellatum*) were kindly submitted by Mr. H. B. Brady to the Rev. Mr. Hincks, who suggested that they were possibly allied to the recent *Anguinariæ*. Our *A. fusiforme* certainly presents a close superficial resemblance to the creeping base of *Anguinaria* (*Ætea*) *spatulata*; but in the absence of any evidence in the fossils of the existence of erect cells with distinct apertures for the polypides, it would be hazardous to regard this suggestion as being more than a conjecture. The

only other recent forms to which we can find any likeness with *Ascodictyon* are some of the Sertularians (e. g. *S. pumila*), there being a decided resemblance between the thread-like fibres which creep along the foreign bodies to which these organisms are attached, and which connect the polypiferous shoots, and the netted stolons of *A. radians* and *A. stellatum*. In other respects, however, the structure of *Ascodictyon* is by no means Hydrozoal. Upon the whole, therefore, we can only leave the question as to the systematic position of *Ascodictyon* in the meanwhile undecided, in the hope that future researches may enable us to find a definite niche in the system for these interesting fossils.

We are much indebted to our friend Mr. James Bennie for the loan of his beautiful specimen of *A. radians*.

EXPLANATION OF PLATE XIX.

- Fig. 1.* Portion of a colony of *Ascodictyon stellatum*, Nich. & Eth., Jun., growing upon the hinge-area of *Cyrtina hamiltonensis*, Hall, magnified 10 diameters.
- Fig. 2.* A single group or rosette of the same, enlarged 20 diameters. The connexion of the vesicles with one another and with the basal stolons is here hidden by adherent matrix.
- Fig. 3.* Portion of the creeping stolon of a colony of the same, highly magnified, showing the single row of pores along the free face.
- Fig. 4.* Two rosettes of the same species, enlarged 25 diameters. The lower rosette is complete; but one of the vesicles is partially fractured, showing its internal cavity, and another has its extremity directly prolonged into a stolon.
- Fig. 5.* A single rosette of the same, enlarged 30 diameters. In the centre of the rosette is a central chamber (?); and several of the vesicles have their internal cavities exposed by fracture.
- Fig. 6.* Four detached young (?) vesicles of the same, growing on the hinge-area of *Cyrtina hamiltonensis*, Hall, greatly enlarged.
- Fig. 7.* Portion of a colony of *Ascodictyon fusiforme*, Nich. & Eth., Jun., growing upon the mesial fold of *Spirifera mucronata*, Conrad, enlarged 15 diameters.
- Fig. 8.* A single cellule of the same, enlarged 30 diameters.
- Fig. 9.* Fragment of the stem of a Crinoid, to which is attached a colony of *Ascodictyon radians*, Nich. & Eth., Jun., of the natural size.
- Fig. 10.* A single rosette of the same, magnified 30 diameters. At a stolon given out by the extremity of one of the vesicles is seen to connect itself directly with the corresponding extremity of a vesicle belonging to another rosette.
- Fig. 11.* A single vesicle of *A. radians*, magnified to show the central line of pores.

