

contortum, with stem-leaves very widely auricled at the base. Hayward Heath, Sussex, Mr. Mitten.

Anæctangium pellucidum, Wils. MS. Near Inverary, Mr. Wilson, but probably a form only of *A. compactum*.

Hypnum (*Stereodon*) *canariense*, Mitt. Like *H. cupressiforme*, var. *mamillatum*, but differing in the sharply serrulate leaves, with shorter and wider cells. Turk Mountain, Ireland, Mr. Wilson, 1859.

Orthotrichum patens, Br. Dailly, Ayrshire, Dr. Schimper.

Dicranum robustum, mentioned in Schimper's Syn. and Berkeley's Handbook as perhaps occurring near Warrington, is not this species, but *D. Schraderi*. To the kindness of Mr. Wilson I am indebted for the sight of the plant in this habitat. He also mentioned to me the error.

XV. On *Polymorphina tubulosa*.

By THOMAS ALCOCK, M.D.

Read January 7th, 1867.

IN the course of examinations of the Dogs Bay sand, I have collected great numbers of detached branches of *Polymorphina tubulosa*, a form of foraminifer which is not likely ever to be found perfect in shore-sand. I have, however, met with several fine specimens of it with only the tips of the branches broken away; but the most interesting examples are some which are more damaged, and show several structural features difficult, if not impossible, to be seen in any perfect specimens. The main body of the shell of *Polymorphina tubulosa* has the form of Prof.

Williamson's *P. communis*, and appears to be identical with it, this form, so far as I have seen, only taking on the peculiar final development characteristic of *P. tubulosa*. It consists, in the mature state, of the rounded shell of *P. communis*, more or less concealed by several covered passages, commencing at the mouth and taking a direction towards the base of the shell; these passages have their arched walls developed into tubular prolongations, extending in all directions, and soon dividing irregularly into small branches, which, in one or two instances in the specimens shown, will be found to anastomose; they are either closed at their tips, as a small glass tube might be closed in the flame of a blowpipe, or they expand into little cauliflower-like excrescences, which are also apparently closed. The shell composing the parts just described is very delicate and thin compared with that forming the rounded nucleus; and its outer surface is frosted with small glassy projections of an irregularly squared figure, like imperfectly formed crystals. It is evident that this is a hastily deposited shell-covering on the sarcode, developed since the last regular chamber of the shell was formed, and which, instead of collecting itself into a definite shape, to produce a chamber similar to the others, had been surprised, as it were, while fully expanded, by the calcifying process, which consequently gives us a petrified representation of the ordinary appearance of this external sarcode with its pseudopodia protruded, the probable suddenness of the process being illustrated by the cauliflower excrescences which terminate many of the branches, and which have resulted from the contraction of the extremely fine terminal filaments of sarcode. It would appear that this is the final act in the life of the *Polymorphina*, its enfeebled vital power having been insufficient to gather together the sarcode for the formation of another regular chamber; and therefore, properly speak-

ing, the shell is fully formed and perfect before this last addition is made to it. There is evidence, however, in the specimens I have now, to show that the animal must have lived for a considerable time in a full-grown state before it thus terminated its existence by producing a permanent likeness of its living self. These specimens have their arched coverings, with the branches proceeding from them, more or less broken away, so as to expose the floor beneath them, which consists of parts of the strong outer wall of the rounded nucleus, and which in all the cases examined presents the same peculiar appearance. It is riddled through with many large holes, sometimes nearly circular, but oftener oval or kidney-shaped, and so numerous as to open a very free communication between the external sarcode and that in the interior of the shell. It is not unusual to find *Polymorphinæ* (of a different type from these) with a few small round holes in their outer walls; but they are scattered irregularly, are few in number, and have no evident relation either to one another, or to any structural peculiarity of the animal; whereas in the present case they are invariably contained within the area of the floor of the covered passages, and are so numerous, and encroach so much on each other, that in some parts they leave only narrow isthmuses of the original shell-wall between them, and the larger holes have every appearance of having been formed by the union of several smaller ones. It is evident from a consideration of their character, that they have been produced by the removal of shell-material previously deposited; and this gives them a physiological interest; for though it is natural to suppose that a creature which has the power of precipitating carbonate of lime on its surface would also have the power of removing portions of it by solution or absorption, if required, the foraminifera are so structureless that we should hesitate to attribute to them this function without clear and positive proof.

In order to follow the successive changes in the latter part of the life of this *Polymorphina*, as they are illustrated in the specimens before you, the large rounded shells of *P. communis* should be first noticed, in which no opening is perceptible excepting the mouth, showing that at this stage the numerous large holes which are afterwards formed have no existence. The great thickness of the outer walls, compared with that of the internal parts of the shell, shows that the animal must have existed for a considerable time in this condition, during which the surface has been strengthened by repeated deposits of calcareous matter from its coating of external sarcode; and the smoothness and evenness of this surface shows that the coating was at that time spread uniformly over the whole of it. But broken specimens of *P. tubulosa* show that a change in the disposition of the external sarcode has been afterwards made; for in these it is found to have collected itself into two or three irregular bands, always commencing by one end at the mouth and extending towards the base of the shell—an arrangement clearly mapped out by the remains of its ultimately formed shell covering, fragments of which are seen still attached to the surface of the smooth rounded nucleus.

The next event in the life of this *Polymorphina* is the formation of those numerous openings through the thick shell-walls, the observation of which in the specimens before you has chiefly led me to introduce them to your notice. These show, by their definite position and the evidence they give of their progressive formation, that, when the external sarcode has once taken the form of bands, it remains permanently in that state, and that these bands hold a fixed position on the parts of the shell where they were at first placed. Among the specimens shown are some which only differ from ordinary shells of *P. communis* in being remarkably smooth on the surface, and

in having numerous large holes, arranged in several rows radiating from the mouth towards the base of the shell, exactly as in undoubted specimens of *P. tubulosa*; but they are without the slightest trace of the external arched coverings and tubular branches. These might at first sight be set down as very much rolled and worn specimens of the ordinary *P. tubulosa*; but there is no evidence in the Dogs Bay sand of other kinds of foraminifera being worn to the extent which would be necessary to produce such a result; and the suggestion is uncalled for in this particular case, since it is evident that, at one part of the life of the animal, its shell must have presented the appearance of these specimens—unless it could be admitted that the holes are formed after the production of the shell covering on the expanded pseudopodia. But this last is clearly a single act, and its plan is evidently not such as would be adopted if the protection of sarcode were the object in view—the subdivision into many projecting branches most delicate and fragile at their points exposing it as much as possible to every injury, and therefore presenting a form and arrangement not at all likely to promote the comfort and convenience of the animal if it were to exist long in that state; and when to this we add that the pseudopodia, which are the means by which the foraminifera communicate with the external world, are sheathed by their shell covering so as to be incapable of action, and, moreover, that every part of the animal becomes completely enclosed, the conclusion seems inevitable that this is not a condition in which it passes any considerable portion of its life, but that it is, as already suggested, merely the closing and final act. The holes through the thick shell, however, present a different history; they show, by the quantity of shell-material removed, and by the way in which separate holes have run together, that time has been spent in their formation; and they have also a clear and intelligible use

in the economy of the animal, this being to open free communications between the internal and external sarcode. As to the process by which the shell-matter is removed, it seems impossible under the circumstances to suppose it done in any other way than by absorption by the sarcode in contact with it. Among the specimens shown is one of *P. tubulosa* which has been completely broken open; and this shows that the process of absorption is not confined to the outer walls, but that the inner partitions, which at first formed parts of the walls of the separate chambers, are also in great part removed, throwing the whole of the interior into one large irregular cavity.

The quantity of carbonate of lime deposited, at once in the covering of the external sarcode and its pseudopodia, is so considerable that some unusual source might naturally be looked for to supply it; and this is apparently found in the shell-material redissolved by the process just described, which must eventually lead to the sarcode being excessively charged with mineral matter, and may be considered a sufficient reason for the final catastrophe; and if the view here given of the later stages of the life of *Poly-morphina tubulosa* be correct, it adds another point of interest, by showing that the deposit of shell-material, in this one case at least, is more of a chemical than a vital act.



Alcock, Thomas. 1868. "On Polymorphina Tubulosa." *Memoirs of the Literary and Philosophical Society of Manchester* 3, 244–249.

View This Item Online: <https://www.biodiversitylibrary.org/item/109418>

Permalink: <https://www.biodiversitylibrary.org/partpdf/305239>

Holding Institution

Smithsonian Libraries and Archives

Sponsored by

Biodiversity Heritage Library

Copyright & Reuse

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.