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XXVI. *On* Palæocoryne, *a Genus of Tubularine Hydrozoa from the Carboniferous Formation.*

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I. *Introduction.*—The lower shales of the Carboniferous limestone series of Ayrshire and Lanarkshire are very fossiliferous in many places, and the organic remains found in them are remarkable for their perfect condition of preservation.

There are large numbers of fossil Brachiopoda, Polyzoa, Crinoidea, and Madreporaria in the black shales of Roughwood and Broadstone, near Beith, and of Auchenskeigh, and of Gare, near Carluke. Associated with the Polyzoa are numerous small pedunculated radiata, whose external appearance differs from that of any extinct organism hitherto discovered.

They are usually found attached to the margins of the polyzoarium of *Fenestellæ*, or they may be discovered in a more or less fragmentary condition amongst the small pieces of broken Polyzoa and Crinoid stems which compose the fossiliferous layers of the shales. The attachment is by a dactylose base, which, when broken or cut, is proved to be cellular internally. The base contracts as it increases in height, and is continued upwards in the form of a cylindrical stem, which is faintly enlarged in its middle portion, and which is surmounted by a symmetrical structure resembling a reversed obtuse cone, the margin of whose base is produced into several tentacular processes.

The tentacular processes are in one whorl; they radiate from the margin of the upper part of the conical body, and they are separate at their point of origin. They are long, slender, tapering, and occasionally irregular in their length and thickness. Their direction is not at right angles to the stem, but they project obliquely upwards and outwards. The inferior surface of the tentacles is continuous with the outside of the conical body, and the superior surface is continued on to the upper surface, or reversed base, of the conical body, which has a much greater diameter than the supporting stem. This upper surface is flat in many specimens, but in a few it is elevated centrally into a crateriform process, which has an opening on its apex.

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The height of the form is not more than $\frac{1}{10}$ inch, and the length of the longest tentacular process is about $\frac{1}{2}$ inch. The fossils are composed of carbonate of lime.

The symmetry and elegance of the little fossil are heightened by its minute but elaborate ornamentation. The proportions of the body, stem, and base are those of the most symmetrical architectural pillars; and the elegant outlines of the tentacular processes are rendered more striking and less monotonous by the presence of spicules and of long fluted lines of delicate depressions, whose little spines are occasionally preserved. The upper surface of the body is granular, and the stem is ornamented with longitudinal flutings and minute processes.

The general appearance of the fossil is that of a long straight-armed starfish reversed and fixed on a stiff stem with an expanded base.

There was more than one species of this organism in the blocks of shale examined*, and many specimens had their tentacular processes in different stages of development. It is evident that the organism had attached itself to *Fenestellæ*, but that it did not derive its nourishment from that Polyzoon. The delicate polypary of the *Fenestellæ* being slightly flexible and containing great numbers of ciliated Polyzoa, they afforded an excellent foundation and support to the stiff-stalked and rigid-limbed little radiate animal that forms the subject of this communication.

The associated Brachiopoda, Madreporaria, Crinoidea, Polyzoa, and the small pedunculated radiata were dwellers in rather deep water. Their modern representatives live at considerable depths; and the stoneless condition of the shales in which the fossils are found, and the perfect condition of the organic remains, indicate their deposition on a sea-bottom where there was no rapid current, but, on the contrary, a comparatively quiet state of things.

II. *Minute anatomy.*—The base, stem, body, and tentacular processes are hollow, and their cavity is continuous throughout the cells of the attachment, the ascending stem, the expanding body, and the radiating processes; and it has one upper and central communication with the outside. The cavity occupies a large proportion of the animal, and the enclosing hard structure is but a thin shell.

The body is not, however, a simple hollow cavity surrounded by a thin layer of hard structure through which the canal-like cavities of the tentacular processes enter; for these processes continue to be separate for some distance within the body, and their canals only unite very centrally with the cavity of the body.

The cavity of the body, thus enlarged, opens below into that of the stem, and above by means of a very small foramen, the oral orifice.

This orifice is closed when the upper surface of the body is flat, and then only a continuous granular layer of hard tissue is to be seen. Slight scraping with a knife soon exposes the orifice.

When the upper surface of the body is swollen and projecting, the central opening is

* The specimens were discovered and collected by James Thomson, Esq., F.G.S., of Glasgow, and by him forwarded to us for description, and for the determination of the zoological position and affinities of the fossils.

at the extremity of the crateriform process, whose sides are marked with radiating lines very much like the margins of the oral plates in young *Pentacrini**. It would appear that this projection depended upon the condition of the nutrition of the animal before its entombment.

The tentacular canals diminish in size with the length of the processes, and they are not continuous with the irregular spinules; but whenever the distal end of a long tentacle can be examined, a small central puckering is observed on it. It is very probable that the cavity of the tentacular process was continued into a soft and ciliated prolongation through this orifice. The union of the tentacular canals with the cavity of the body produces, in transverse sections of that part of the animal, an appearance like that of the rosette in the Crinoidea.

Transverse and longitudinal sections of the stem show the papillary and faintly spinose and pitted ornamentation of the outside of the hard parts, and delicate striæ running from the inside externally and horizontally, but there is nothing like an opening between the large internal cavity and the outside to be seen.

The base is formed of the external hard tissue which grasps and includes its own cellular structures and those of the Polyzoon. Its length varies.

III. *Zoological position.*—The absence of any structures resembling basal or basoradial plates and of joints in the tentacular processes, renders the opinion that the fossil should be referred to the Echinodermata untenable.

The isolation of the individuals, each possessing but one external opening, and the general characters of the tentacular processes, preclude any reference to the Polyzoa.

The internal anatomy, the structure of the hard parts, and the nature of the tentacular processes, prevent classification with the Zoantharia.

Were it not for the calcareous investments, there would be no difficulty in admitting the fossil amongst the Hydrozoa; and had we not been able to avail ourselves of the affinities of the very anomalous genus *Bimeria* (Wright) the difficulty could hardly have been overcome.

There are many kinds of periderm amongst the recent Tubularine Hydrozoa, and the genera *Monocaulos* (Allman), *Corymorpha* (Allman), *Eudendrium* (Ehren.), and *Bimeria* (Wright), afford examples of a gradation in structure from a condition of great tenuity and delicacy to one of a chitinous character, and up to the peculiar pergamentaceous nature of the polypary of the last-named genus.

But the cœnosarc of *Monocaulos*, *Corymorpha*, and *Eudendrium* is the only part covered by the periderm. In the genus *Bimeria*, however, the semi-solid investment not only covers the cœnosarc, but is also continued over the greater part of the tentacles and over the upper part of the body, leaving an opening for the mouth on the metastome.

The resemblance of the fossil under consideration to the trophosome of *Bimeria vestita* (Wright) is very decided.

* Researches on the Structure, Physiology, and Development of *Antedon* (*Comatula*, Lamk.) *rosaceus*. By William B. Carpenter, M.D., F.R.S., Phil. Trans. Roy. Soc. vol. clvi. p. 671.

Bimeria vestita (Wright) was found on the Bimer Rock on the west coast of Ireland, and its organs of nutrition and generation have been examined by its discoverer and Dr. Allman*.

In its early period of trophosome it is a simple or solitary hydrozoon; but during growth it becomes compound, and every succeeding branch is terminated by a tentaculate polypite.

The gonosome of the fossil organism may be traced in a stout projection from the junction of the stem with the body in one specimen†, and possibly in the presence of some circular depressions on the under surface of the tentacular processes in others.

As yet our material is not sufficient to enable us to decide upon the nature of the gonosome.

The presence of the spinose ornamentation and the compact nature of the periderm of the new form distinguish it from all other Hydrozoa. It is probable that, like *Bimeria vestita*, the tentacular processes of the fossil form had ciliated ends projecting beyond the periderm, and that the metastome projected at certain times and not invariably.

The zoological position of the fossil is amongst the Hydrozoa in the Order Tubularidæ and near the Eudendridæ.

IV. *Terminology.*—Being satisfied that the fossil should be admitted amongst the Hydrozoa, its anatomical structures must assume the following names. The dactylose base is the hydrorhiza, the stem is the hydrocaulus, the tentacular body with the broad upper surface, with or without an evident metastome, is the polypite. The ornamented hard external tissue is the periderm or polypary. The faintly traced generative structures constitute the gonosome, and the rest are embraced under the term trophosome. The term hydrosome refers to the whole.

V. *Classification.*—

Class Hydrozoa.
Order Tubularidæ.
Family Palæocorynidæ.
Genus Palæocoryne.

Family Palæocorynidæ.—Hydrozoa, whose hydrosoma is fixed by a hydrorhiza. Polypary organized, calcareous, dense and ornamented, investing the whole of the Hydrozoon, except the opening for the mouth and probably the terminations of the tentacles.

Tentacular processes long, and more or less spined.

Genus Palæocoryne, gen. nov.

Trophosome solitary. Tentacles few in number, long, in one verticel and ornamented.

Hydrocaulus shorter than the tentacles, straight, cylindrical, broad and rigid, its ornamentation definite. Polypite either flat on the oral aspect, or elevated more or less

* T. Strethill Wright, M.D., Edin. New. Phil. Journ. vol. x. N. S. 859, p. 105. Allman, Ann. Mag. Nat. Hist. S. 3. No. 77, p. 355 (1864).

† Plate LXVI. fig. 11.

to form a metastome, the periderm being granular and marked with ridges. Hydrorhiza more or less cellular within, broad and dactylose.

Gonosome.—Gonoblastidia at the junction of the hydrocaulus and the body of the polypite (?).

VI. *Description of the species.*—

1. *Palæocoryne Scoticum*, nobis.
2. *Palæocoryne radiatum*, nobis.

1. PALÆOCORYNE SCOTICUM. Plate LXVI. figs. 1 & 6. The trophosome is short. The hydrorhiza and the body of the polypite are nearly equal in size. The tentacles are about seven in number; they are, when fully developed, several times longer than the hydrocaulus and are slender, tapering and irregular in their length, size, and distance; their periderm is spined, and is marked with pits, grooves, dentations, and serrations; and it is generally ornamented above and below with ridges, which are continued on to the oral surface or downwards on to the sides of the polypite. The hydrocaulus is slender, terete or slightly polygonal, and its periderm is ornamented with alternately larger and smaller flutings, pits, and small spines.

The hydrorhiza has one or more cellular processes, and an ornamented polypary, and it grasps the margin of foreign bodies.

The oral surface is either flat or slightly concave and granular; or is convex and marked with radiating ridges terminating at the oral orifice and limiting the metastome. The oral opening is often invisible.

Height of fossil without tentacles $\frac{1}{10}$ inch. Length of tentacles (extreme) $\frac{1}{2}$ inch.

Fixed on *Fenestellæ* in the lower shales of the Carboniferous formation of Ayrshire and Lanarkshire.

2. PALÆOCORYNE RADIATUM. Plate LXVI. figs. 2, 5–8, 11. *Trophosome.*—The polypite body is small. The tentacles are from seven to eleven in number; they are moderately long, equidistant, subequal, rounded, tapering, closely striated, faintly spined, and rarely marked with lateral dentations. The hydrocaulus is short, cylindrical, faintly bulging, ornamented with subequal rounded flutings, the periderm being abundantly pitted, but not spined.

The oral surface is concave, and the projecting metastome is small.

The *gonosome.*—Processes covered with periderm are developed from the base of the polypite near its junction with the hydrocaulus. Gonoblastidia?

Localities.—Auchenskeigh and Roughwood, Ayrshire, in the lower Carboniferous shales.

The tentacles of *Palæocoryne radiatum* are shorter, stouter, and more finely striated than those of the other species.

VII. *Remarks.*—The tenuity and length of the fully developed tentacles, and the manner in which some of them are curved and waved, indicate that, although their periderm was dense, there was some power of movement in them; otherwise the slightest

contact with a moving body would have fractured them. There is much diversity in the length of the tentacles and in their thickness, and most of them are marked with transverse cracks, the result of post-mortem violence.

The distal ends of the longest tentacles are very delicate, yet a long ciliated process might pass out from the free termination as in *Bimeria vestita*. The metastome is visible in a specimen of both species; but usually the granular polypary of the oral surface shows no opening, and it is only when the exact spot of the mouth is worn down to in sections that any trace of it can be found. The ridges of this surface are usually connected by festoon ornamentation.

The development of the periderm of the hydrocaulus from the cœnosarc may be inferred; for in longitudinal sections there is an appearance of horizontal striation, and the striæ indicate the former projection into the periderm of processes belonging to the cœnosarc.

VIII. *Palæontological relations.*—Although the Hydrozoa are very abundant in fresh and in sea-water, they are very rarely found as fossils. Their delicate structure and peculiar periderm would prevent their fossilization under ordinary circumstances.

M. Fischer* has distinguished Hydractiniæ in the Cainozoic deposits of Dax and in the Cenomanien of Mans; and the impressions of Medusæ have been discovered in the Jurassic strata of Solenhofen.

In the Silurian division of the Palæozoic strata are the fossils called Graptolites, which are considered by some Palæontologists to be Hydrozoa. The theory announced by Agassiz respecting the Hydroidean characters of the tabulate division of the Sclerodermic Zoantharia is still under consideration and requires confirmation.

The interest of the discovery of the *Palæocorynidæ* in the moderately deep-sea deposits of the Carboniferous period is therefore great. The form of the Medusæ of the species is of course unknown, but it is evident that they floated in the estuaries and shallow seas, and perhaps in the oceans of those Palæozoic days, and deposited the ova which produced the trophosomes that have descended to the present time in a fossil condition.

The choice by both species of the margin of a polypary of *Fenestella* for their resting-place, suggests that some portions of the economy of the Polyzoon were beneficial to their more or less rigid associates. Doubtless the gentle movement of the frond-like mass and the currents produced by the numberless polypes contributed to the supply of food for the Hydrozoa. The ornamentation of the *Fenestella* is occasionally repeated on the tentacles of the *Palæocoryne Scoticum* in a very striking manner.

Note.—The calcareous investment of *Palæocoryne Scoticum* and *Palæocoryne radiatum* has not the peculiar cleavage of the hard structures of the Echinodermata.—September 6, 1869.

* Bull. de la Soc. Géol. de France, 2 série, tome xxiv. p. 689.

DESCRIPTION OF THE PLATE.

PLATE LXVI.

Illustrating the Structure of Palæocoryne.

Fig. 1. Portion of the trophosome of *Palæocoryne Scoticum*, showing the fluted periderm of the hydrocaulus, the cellular and dactylose processes of the hydrorhiza, and the base of three of the tentacles Magnified 15 diameters.

Fig. 2. Portion of the trophosome of *Palæocoryne radiatum*, showing the same organs as fig. 1. Magnified 15 diameters.

Figs. 3 & 4. Partial sections of similar portions of the trophosome of two individuals, showing the cellular nature of the hydrorhiza, the tubular nature of the hydrocaulus, and its connexion with the cavity of the polypite and the tubulated tentacles. Magnified 15 diameters.

Fig. 5. Hydrocaulus and polypite of *Palæocoryne radiatum*, showing the number and arrangement of the tentacles. Magnified 15 diameters.

Fig. 6. Hydrocaulus of *Palæocoryne Scoticum*, showing the relation of the hydrozoon to a portion of a polyzoarium of *Fenestella*. Magnified 15 diameters.

Fig. 7. Polypite, metastome, and tentacles of a specimen of *Palæocoryne radiatum*, showing their external structure and relations. Magnified 10 diameters.

Fig. 8. Side view of a trophosome of *Palæocoryne radiatum*, showing the hydrorhiza, hydrocaulus, polypite, and portions of the tentacles. Magnified 15 diameters.

Fig. 9. Upper surface of the polypite of a species of *Palæocoryne*, showing the external ornamentation and the arrangement of the tentacles. Magnified 30 diameters.

Fig. 10. A similar specimen ground down to show the internal structure of the polypite. Magnified 30 diameters.

Fig. 11. Portion of the hydrosome of *Palæocoryne radiatum*, showing the upper surface of the polypite, portions of some of the tentacles, part of the hydrocaulus, and an appendage to the latter supposed to form part of the gonosome. Magnified 25 diameters.

Fig. 7.
x. 10.

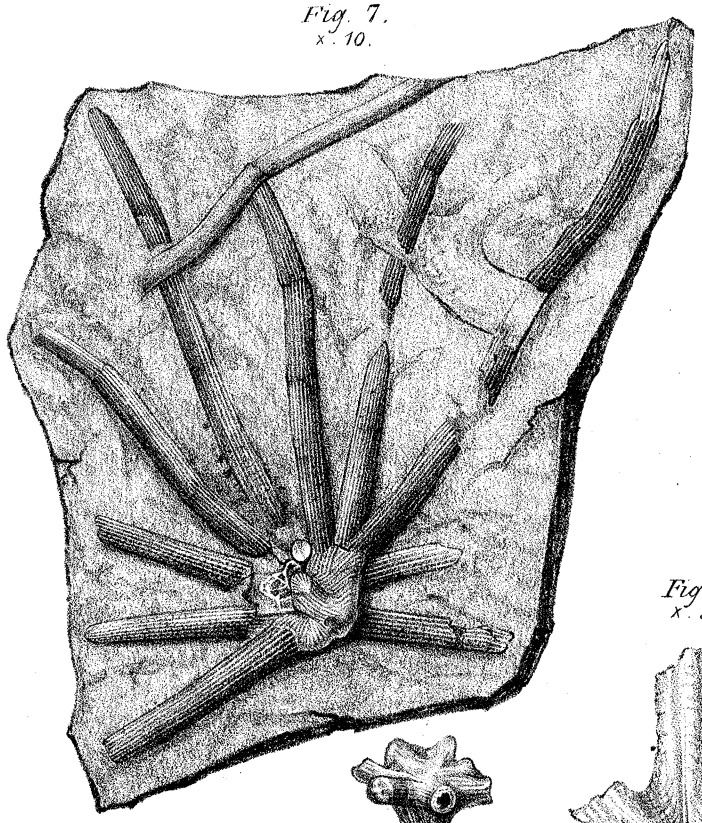


Fig 1.

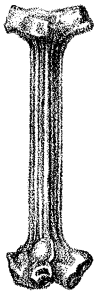


Fig. 6.
x. 15.

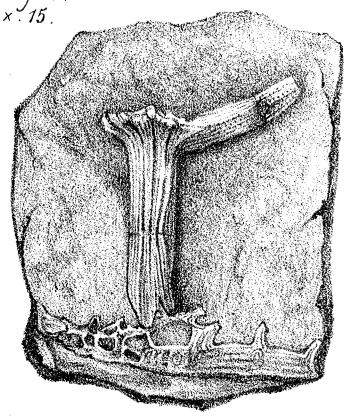


Fig. 4.
x. 15.

Fig. 3.
x. 15.

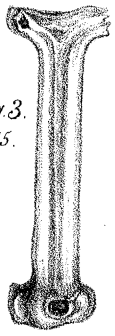
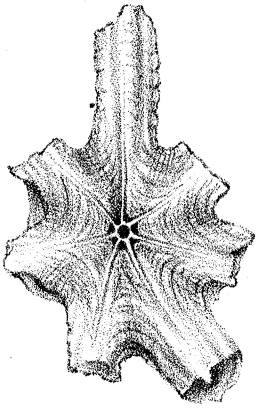


Fig. 10.
x. 30.



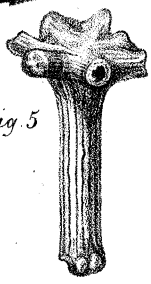


Fig 5

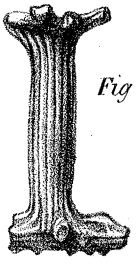
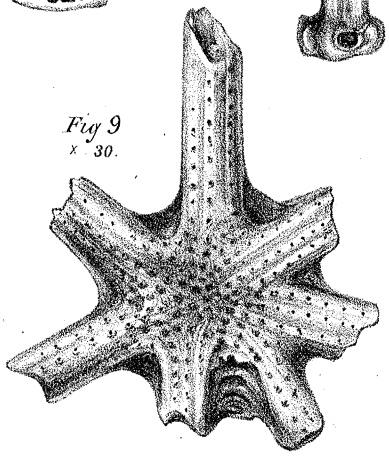


Fig 2.

Fig 9
x. 30.



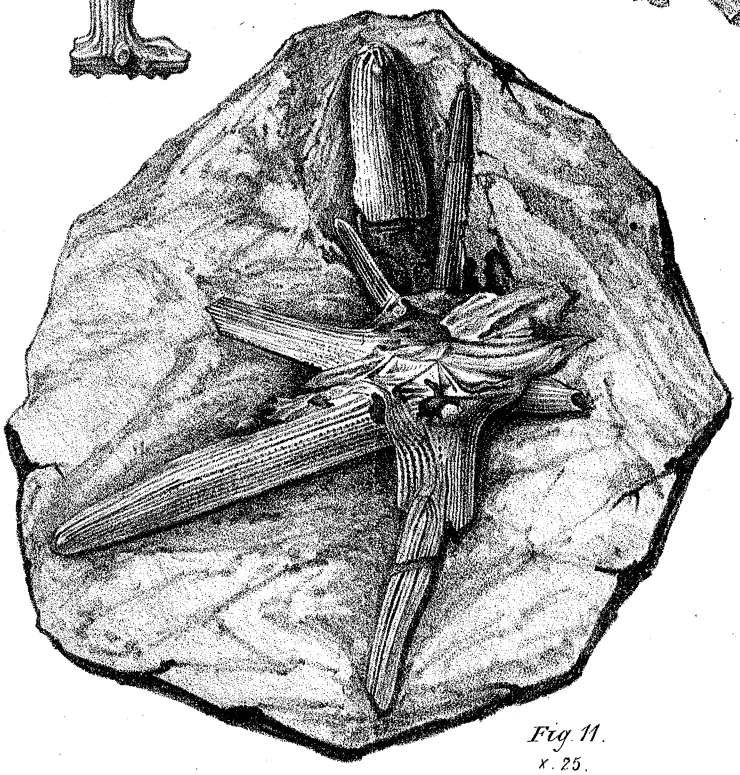


Fig. 11.
x. 25.

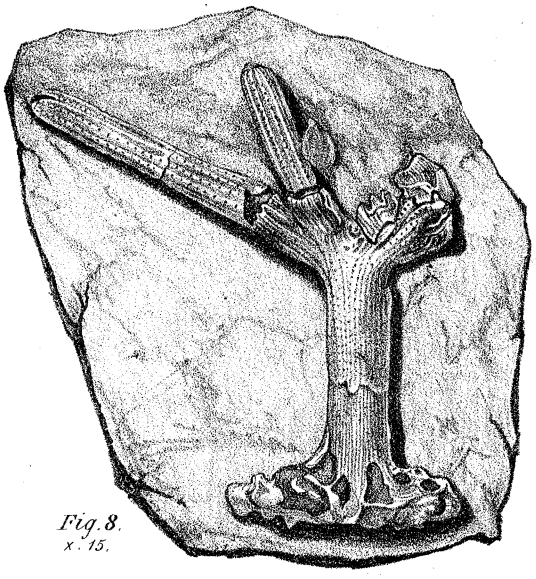


Fig. 8.
x. 15.