sinus or place of the notch, and without any dorsal furrow. Such carapaces are not rare in some Lower Carboniferous strata. 1. *Polycopse Burrovi* is subglobular, from Settle. 2. *P. simplex*, oval, obliquely truncated at the antero-ventral edge, is common at Cork and Duleek, Ireland; and Dr. Rankin found seventeen in one ironstone nodule from Braidwood, near Carlisle. It is somewhat like *Cypridina primæva*; but the want of the notch and beak is its characteristic difference. 3. *P. Youngiana*, from the Lower Limestone of Campsie, near Glasgow, is oval and slightly pinched-in or indented on the antero-ventral quarter, and has a striolate ornament.

This genus is the last described in that portion of the Monograph which is now completed. *Cytherella*, belonging to an allied group, is known to occur in the Mountain Limestone; and *Leperditia*, *Beyrichia*, *Kirkbya*, *Moorea*, and *Entomis*, all palæozoic genera, abound; forms referable probably to *Cythere*, *Cypris*, *Candona*, &c. are also known in the Carboniferous formations.

DISCUSSION.

Mr. GWYN JEFFREYS inquired as to the greatest depth at which recent marine Entomostraca had occurred. So far as he knew, they were abundant in the Littoral and Laminarian zones, and very scarce in the Coralline. He was not aware of their occurrence at a great depth.

Prof. T. RUPERT JONES stated that in the Carboniferous limestone the Cypridinidæ frequently occur in layers, but he thought these were deposited at no great depth, probably not more than 100 fathoms. The greatest depth from which he had seen Entomostraca from the Atlantic was upwards of 1000 fathoms. These, however, belonged to different genera from those which he had been describing. Their modern congeners, though mounting to the surface in the evening, no doubt descended to considerable depths during the day.

MAY 14, 1873.

The following communications were read:—

1. *On the genus PALÆOCORYNE*, Duncan & Jenkins, and its AFFINITIES. By P. MARTIN DUNCAN, M.B.Lond., F.R.S., V.P.G.S., Professor of Geology in King's College, London.

[PLATE XIV.]

FIVE years have elapsed since I completed the description of a very interesting fossil from the lower Carboniferous shales of Ayrshire and Lanarkshire, with the assistance of Mr. H. M. Jenkins, F.G.S.

The results of our labours were read before the Royal Society on June 17, 1869, and were subsequently published in the Philosophical Transactions, vol. clix. p. 693 (1869), under the title of "On Palæo-

coryne, a genus of Tubularine Hydrozoa from the Carboniferous formation."

In 1872 Dr. Allman (Monograph of the Hydroida, Ray Society, vol. ii. pp. 172 & 173) criticised the zoological position we had assigned to the fossil, and, whilst expressing his satisfaction concerning the manner in which it had been described and delineated, gave also his reasons for not including *Palæocoryne* amongst the Hydroida.

Some of these reasons, which are stated with Dr. Allman's usual clearness and force, had occurred to us during the difficult task of assigning a classificatory position to the form; and we wrote (*op. cit.* p. 695), "Were it not for the calcareous investment, 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."

Lately Mr. R. Etheridge, jun., F.G.S., of the Geological Survey of Scotland, has forwarded to me a great number of fragmentary specimens of *Palæocoryne* derived from the lower Carboniferous shales.

These specimens explain certain points of anatomy upon which there was some doubt, and also testify to the correctness of the published descriptions. I have therefore again carefully examined into the whole question of the structures and affinities of the form, and now offer some important additional facts which may influence the decision of palæontologists with regard to the zoological position of this very anomalous form.

The fossils, specimens of which are very numerous, are found associated in the shales with *Fenestellæ*, Crinoidea, and Brachiopoda. Usually they are attached by a dactylose pseudo-cellular base to the margins of the polyzoaria of *Fenestellæ*. The cells of the base communicate, and appear to have a distinct reference to the inequalities of the surface on which it rests. They are covered by a calcareous investment, which contracts as the base 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 expansion resembling in position, and somewhat in appearance, the capital of a pillar.

The erect stem and capitulum are about $\frac{1}{16}$ to $\frac{1}{8}$ inch in height. They were originally hollow, and their cavity was continuous with that of the base. A whorl of elongated and tapering cylindrical processes is given off from the upper margin of the capitulum; and each process is hollow. The processes open by their cavities into the cavity of the capitulum near its upper part. The upper surface of the capitulum thus surrounded is in some specimens projected to form a slight crateriform opening, or metastome, which leads down to the cavity within. The calcareous investment of the stem and capitulum is continued on to the processes, and is elegantly ornamented throughout with grooves, lines, serrations, pits, small spinules and granulations. The grooves and linear ornamentation are longitudinal both on the tentacular processes and on the stem; and the

spinules of the first-mentioned structures often give them a pinnate appearance. Granulation and radiating lines mark the upper part of the capitulum; and these last are especially well seen when the crateriform projection resembling an oral orifice is visible.

The only perforations of the calcareous investment are at the distal end of each tentacular process, and on the upper surface of the capitulum. The general surface is not perforate. There are, however, in a few specimens some few irregular-shaped openings on the underside of one or two tentacular processes; and a few stems present indications of an opening close to the capitulum. It is evident after careful examination that the openings in the distal end of the tentacular processes are normal; and they may have permitted the internal structures to communicate with the outside medium; but the inferior openings are either the result of compression, or of the dislocation of ornamentation. The capitular opening, with its radiating lines and projecting eminence surrounded by the tentacular processes, is a part of the structural economy of the form; and even when the upper capitular surface is flat it may be discovered by gentle scraping. It would appear that several flap-like processes enter into the composition of the prominence which ends in the opening, after the fashion of a metastome. The openings in the stems are to be referred to the fracture of a calcareous and hollow process—which is to be seen intact in a few specimens, and broken across at a short distance in others.

The tentacular processes vary in length and in number. The extreme length may be half an inch; and the position of many of them indicates that they were not absolutely rigid. Some are long and others are short in the same whorl; and one specimen may have seven, whilst others may present four, five, eight, or more tentacles. Usually one process is larger than the others, and not symmetrically placed.

There are no cellular dissepiments within the cavities of the capitulum and stem; and the calcareous investment of these structures is thin, readily scraped, and in no way resembles the calcite of the Echinodermata.

In the communication to the Royal Society, my colleague and I represented the form, which clearly could not belong to the Echinodermata, Zoantharia, or Polyzoa, to be one of the Hydroida, having affinities with the recent *Bimeria vestita* (S. Wright).

In this genus there is a chitinous coat, by which sand grains and spicules are mechanically suspended, covering the base, stem, and body and tentacles, leaving an opening for the metastome and for the distal end of the tentacles.

We considered the fossils to be the trophosomes of a hydroid, and that the process beneath the capitulum on the stem might be the gonosome.

The crateriform aperture we believed to be the mouth; and we assumed that the opening at the distal end of the tentacular processes gave exit to a ciliated tentacle during life.

Parasitic (or, rather, placed) upon a *Fenestella*, the form would

participate in its gentle movements, and also in the benefits accruing from the currents in the water developed by the cilia of the Polyzoon.

It was evident that the ornamentation of the hydroid was mimetic of that of the Polyzoon.

Dr. Allman suggests (*op. cit.*) that the ornamentation and the calcareous test do not resemble the structure of the covering of *Bimeria*, that the opening on the distal end of the tentacles was too small for the passage of a well-developed soft tentacle, and that the chambered base is anomalous amongst the class. He considers that the form should be associated with the Rhizopoda.

The lately discovered specimens indicate the manner of the growth and development.

In specimens consisting of a short stem and broad base without the capitulum the stem does not appear to have been fractured, and it is tapering in form and has a narrow superior orifice.

Another specimen (Pl. XIV. fig. 1) resembles those just mentioned, but is taller. The stem has a branch which has been fractured.

Other specimens (figs. 2 & 3) show that the upper part of the capitulum close to or at the metastome is projected (1) in the form of a closed prominence, or (2) as a stem-like continuation with a small aperture on its distal end.

When this stem-like continuation has grown to a considerable length, the appearance of the whole organism is that of a long stem with a central whorl of tentacles.

Many specimens have very large bases. These cover many cells of the *Fenestella* and the intermediate calcareous tissue. It is very difficult to arrive at a satisfactory conclusion whether or not the base is itself divided into cellular compartments. After due consideration I feel disposed to believe that the wide and dactylose base incrusts the *Fenestella*, and that there is a space in the base which is uneven and very irregular in shape, but not cellular*. The shape and general complexity of this space are determined by the outline of the Polyzoon beneath; and there do not appear to be involutions or septum-like processes of the calcified periderm of the Hydroid.

It would appear from the examination of the specimens that the form grew from the base at first without a hard capitulum and tentacles; that it branched in this condition, or had an offshoot destined either to continue the same trophosomal structures, or give rise to those of a different kind and belonging to the gonosome.

The opening in the distal end of the nascent stem could admit of the passage of a polypiform mass with all its tentacles. Under such circumstances, the calcareous stem would be the periderm of the hydrocaulus. The branch would terminate in the same manner as the stem, or else would, under the theory of the Hydroidean affinities of the animal, be the periderm of the gonosome.

With growth, the more or less bell-shaped polypite surmounting

* The cellular appearance shown in Phil. Trans. 1869, plate lxxi. fig. 4, is due to the cells of the *Fenestella*.

the stem may have had the calcareous periderm formed around it to constitute the capitulum, and the greater or less resemblance to *Bimeria* was established.

The prolongation of the stem upwards, and its environment by a whorl of tentacular appendages which could not lead to a metastome, present a difficulty. If the creature was a Hydroid, these tentacular appendages may have been generative instead of assimilative, and may have belonged to the gonosome and not to the trophosome.

The arrangement is so seldom seen in the fossils, and is so evidently a development superadded to an original condition, that it appears to me, that after the trophosome had fulfilled its duties, growth occurred, and the future trophosome was carried upwards with the new stem, and the old tentacles became the supports of the gonosomal apparatus, or that the stem about to be thus developed was always reproductive in its physiology.

The more the specimens with long tentacles and with those which have been fractured rather close to the capitulum are examined, the stronger must be the belief that these elongated processes were stiff at their origin, but capable of much movement at their distal extremities.

The variation in the number and length of the processes is remarkable.

The distal opening, when visible, is small.

It will be noticed from these observations that Dr. Allman's remarks are not susceptible of much qualification. The form, if it is one of the Hydroida, is anomalous, principally from the ornamentation of a rigid periderm, and from the smallness of the foramen in the distal end of each tentacle. It appears, however, that the cellulosity of the base is doubtful, and that the method of growth is not in opposition to the characteristics of recent Hydroida.

Moreover the anomalous nature of some of the dermal organs of other forms which are found on the same geological horizon must be considered, before abandoning the opinion already expressed concerning the zoological position of *Paleocoryne*.

Thus, there is a group there of cylindrical-shaped corals belonging to the genus *Heterophyllia* (McCoy). Its species are very well marked; but one has rows of long movable spines with ball-and-socket joints arranged longitudinally on its outside surface. There is nothing like this external arrangement (as seen in *Heterophyllia mirabilis*, Duncan, Phil. Trans. 1867, plate xxxi. fig. 5) in any other known Madreporarian, fossil or recent; and if abnormalities existed in one class, they may have done so in another.

The opinion of Dr. Allman that *Paleocoryne* ought to be classed with the Rhizopoda, entitled as it is to great respect, appears difficult of application.

Doubtless he was impressed especially with the cellulosity of the base of the form; and such rhizopodal genera as *Carpenteria* and *Squamulina* (Carter) probably came within his memory.

GH Ford & C.L. Griesbach.

Mintern Bros imp

PALÆOCORYNE.

It would appear, in order that *Palæocoryne* might be a Rhizopod, that a cellular base, the stem, capitulum, and tentacles should have been filled with sarcode which was capable of prolongation in the form of pseudopodia from the ends of the tentacles and from the so-called metastome.

But there should be some calcareous structures within the stem and other cavities resembling the irregular external septa of *Squamulina scopula*, Carter, for instance; or the calcareous periderm should be perforate or minutely tubular.

Such septa and perforations do not exist in *Palæocoryne*, whose external form and ornamentation are in my mind opposed to its proposed Rhizopodal alliance.

I venture, then, to suggest that the form should still remain associated with the Tubularine Hydrozoa, in spite of its abnormalities.

EXPLANATION OF PLATE XIV.

Fig. 1. A specimen of *Palæocoryne*, showing the branching of the stem: magnified. The branches are inferior.

2. Specimen showing the metastoma: magnified.

3. Specimen showing the prolongation of the stem past the whorl of tentacles: magnified.

4. Another view of the same in a different specimen: magnified.

5. *Palæocoryne radiata*, from the Phil. Trans. vol. clix. pl. lxvi. fig. 7.

6. *Palæocoryne scotica*, from the Phil. Trans. vol. clix. pl. lxvi. fig. 1.

7. Stem without the capitulum: magnified.

2. Notes on MARKINGS in the CHALK of the YORKSHIRE WOLDS.

By R. MORTIMER, Esq.

(Communicated by W. Whitaker, Esq., B.A., F.G.S.)

[Abstract.]

IN this paper, which was illustrated by a large series of specimens, the author called attention to some peculiar striated markings resembling structure which he had observed on pieces of chalk from widely distant places on the Yorkshire Wolds. Similar markings had been noticed in the chalk of the south of England; and in 1860 Mr. S. J. Mackie, in an article published in the 'Geologist' (p. 77), alluded to them, and ascribed them to slickensides. From an examination of his own specimens, the author has come to the conclusion that the markings in question are not accidental, nor are they caused by the weathering of the surface of the chalk, or by the percolation of water through overlying chalk. He is of opinion that such needle-shaped striae, running in such various directions, could not have been produced by the chalk being "shifted, squeezed, and rubbed by the creep of the beds," as supposed by Mr. Mackie—as, if such an action could be exerted on small pieces of chalk, scratching them in various directions, the scratches ought to differ much in thickness