

7. On *POLYPHYMA*, a NEW GENUS belonging to the LEPERDITIAE, from the CAMBRIAN SHALES of MALVERN. By Prof. THEODORE GROOM, M.A., D.Sc., F.G.S. (Read December 4th, 1901.)

[PLATE III.]

I. OCCURRENCE.

THE number of lobulated ostracoda at present recorded from the Cambrian formation is very small, and the species are still very imperfectly known. Forms referred to *Beyrichia* have long been known from the Cambrian beds of Scandinavia,¹ Stockingford,² and South Wales.³ The writer some time since detected in the lowest portion of the Malvern Black Shales a species identical with the Stockingford form, which latter had been provisionally identified with the Swedish *Beyrichia Angelini*, Barr. The specimens obtained from the Stockingford Shales were few and imperfect; the Malvern examples are far more abundant and, though for the most part imperfect, are better preserved. They present characters which serve to separate the species from those now placed under the genus *Beyrichia*. Many of the specimens have been submitted to Prof. T. Rupert Jones, who (after an examination kindly made of much of the material) considers it impossible to refer the form to any known genus, and recommends the establishment of a new genus and species. I would propose to describe the species under the name of *Polyphyma Lapworthi*.

The specimens were obtained from the Black Shales (M 257) at the northern extremity of Chase End Hill, in the Southern Malverns, where they were associated with *Acrotreta* sp., *Kutorgina pusilla*, Sars, *Protospongia fenestrata*, Salter, and other fossils. The shales are nowhere actually exposed, and can be reached only by excavation. Some two days' work with the pick and spade produced perhaps a hundredweight of the shale in small pieces. *Polyphyma* is very abundant in certain bands of the shale, and altogether over 300 recognizable individuals were obtained, in addition to many fragments. The shales have been subjected to considerable pressure, consequently the specimens are frequently crushed and indented, and present differences in their appearance so extraordinary that Prof. Rupert Jones and myself at first thought that we might be dealing with several distinct species. In many examples the shell presents a beautifully reticulate appearance; but closer

¹ J. Barrande, 'Syst. Silur. du Centre de la Bohême' vol. i, Suppl. (1872) p. 485.

² C. Lapworth, Geol. Mag. 1886, p. 321.

³ T. Rupert Jones, *ibid.* 1881, p. 343. *Beyrichia Hollii*, Jones, is here recorded from the Menevian, and regarded as an ally of *B. intermedia*, Jones (a form since referred to the genus *Klardenia*); see Jones & Holl, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii (1886) p. 362.

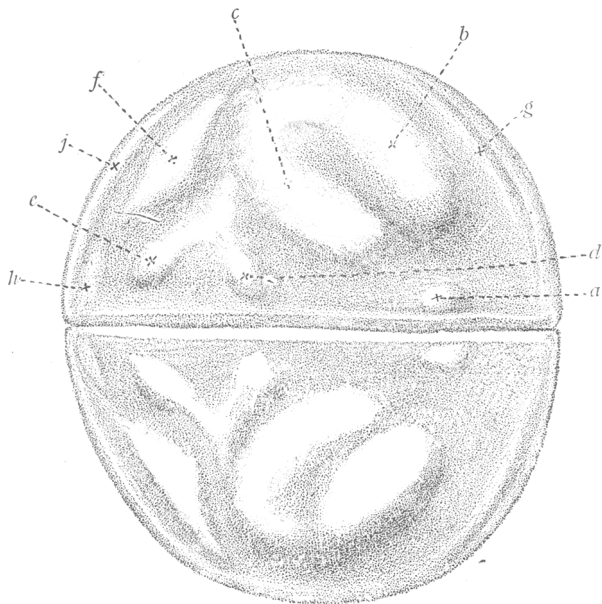
examination shows that the reticulate individuals differ from the rest in no other particular, and, moreover, reveals the fact that the reticulation is due to the presence of a meshwork of intersecting cracks which are clearly of secondary origin. A similar reticulation is seen in some individuals of the associated *Acrotreta*.

With the aid of the more perfect specimens I have now been able to reduce all the individuals, with the exception of one or two of the poorest specimens, to the single type, now to be described.

II. DESCRIPTION.

The chief characteristics of *Polyphyma Lapworthi* are:—A sub-central, obliquely-directed reniform elevation; three tubercles near the dorsal margin; and an anterior subtriangular lobe (see the accompanying text-figure).

Restoration of Polyphyma Lapworthi, gen. et sp. nov.



[$\times 34$ diam.]

The valves, when not flattened by pressure, are convex, and almost semicircular in outline, with a straight dorsal edge, and an almost uniformly and continuously curving ventral edge, the postero-ventral margin alone being slightly protuberant in the larger specimens. The dorsal and ventral margins meet in a well-defined angle. The ventral border is strongly convex, except along the posterior margin

and near the angles; it is marked off from the rest of the valve by a gentle depression, and thus forms a marginal ridge (*j*).¹ Along the posterior margin, in the best-preserved examples, the narrow rim is raised only slightly above the level of the adjacent part of the shell. The dorsal margin, too, is as a rule slightly raised above the general level to form a narrow ridge, and is thence sharply bevelled off towards the hinge-line.

The centre of the valve is occupied by a well-defined, broad reniform elevation, the concavity of which is directed obliquely upward and backward. The ventral limb (*b*) of this is more prominent than the dorsal (*c*), and at or near its free extremity is generally raised up to form a prominent rounded tubercle. Prof. Rupert Jones has suggested to me that this limb represents the 'gigot-lobe' of *Beyrichia*. It is on this supposition that the orientation adopted here is based.

In the antero-dorsal part of the valve are situated two tubercles. Of these, one (*d*), placed in a line with the free ends of the lobes *b* and *c*, is nearly hemispherical; the second (*e*), situated in front, in the best examples is spindle-shaped, the axis of the spindle being directed obliquely upward and forward. These two tubercles, though sometimes apparently isolated, are usually more or less completely connected with the lobe *c* by a low forked ridge. Towards the posterior end of the dorsal margin is a third smaller tubercle (*a*), sometimes very small and hemispherical, but usually elongated in a direction more or less parallel to the dorsal margin of the valve, with the bevelled edge of which it is, as a rule, nearly continuous at one point.

Starting from a point close to the antero-ventral margin is a well-marked lobe (*f*) which, diverging from the margin, runs forward and upward, and ends near the lobe *e*. In the smaller examples it frequently appears to be spindle-shaped, but in larger and better specimens it is subtriangular. From a second point, on the postero-ventral margin, a more slender and less elevated ridge (*g*) runs upward and backward, and at the same time diverges from the edge and becomes submarginal. I have been unable to make certain that this ridge represents a feature originally present, for it is often poorly developed, and seems to occur at variable distances from the margin, sometimes indeed quite close to the latter; but its repetition with identical features in several of the best specimens favours the view that it is not of secondary origin. Indications of a small triangular lobe (*h*) are sometimes seen at the anterior angle in good specimens.

The lobes just described rise up from the adjacent areas with tolerable distinctness, and where close together are separated by well-defined channels with rounded floors. The lobe *c*, however, often subsides gently into a flattened area characteristic of the hinder part of the valve. The two valves of the shell appear to be perfectly similar, and are sometimes preserved in juxtaposition. The dorsal and ventral edges appear to lie wholly in a plane, and

¹ The letters *a-j* in parentheses refer to the text-figure, p. 84.

it is therefore to be presumed that, unless this is due to pressure, the valves when closed did not gape at any point along the ventral margin. No differences between different individuals which could be attributed to sex were observed.

The substance of the valves is thin, black, and shining, and evidently consisted originally of chitinous material.

The length of the valves generally varies from 1 to 3 millimetres, and the height from 0.5 to 1.8 mm. The most abundant individuals measured a little under 2 mm. by a little over 1 mm. Measurements of a number of selected individuals gave the following dimensions (in millimetres):— 1.0×0.5 ; 1.24×0.66 ; 1.6×0.8 ; 1.75×1.0 ; 1.9×1.1 ; 2.0×1.1 ; 2.26×1.32 ; 2.4×1.3 ; 2.6×1.56 ; 2.8×1.65 ; and 2.9×1.8 (the biggest complete individual seen). A few specimens showed indications of greater size; the largest of these, an imperfect specimen measuring 2.6 mm. in height, must have been some 4 or 4.5 mm. in length. The average lengths and heights of sixteen specimens less than 2 mm. in length were 1.6 and 0.9 mm. respectively; the corresponding measurements of ten larger individuals were 2.5 and 1.4 mm. The relative height thus appears to increase with age.

III. RELATION TO ALLIED GENERA.

The genus *Beyrichia* was instituted by McCoy.¹ In subsequent years many new species were referred to this genus by different observers. Latterly, however, certain of these have been separated off to form distinct genera, and other genera having been added, the Leperditiaidae now include a number of lobulate forms. Among the lobulate genera recognized are the following:—*Beyrichia*,² *Ctenobolbina*,³ *Tetradella*,⁴ *Bollia*,⁵ *Strepsula*,⁶ *Polyzygia*,⁷ *Poloniella*,⁸ *Jonesella*,⁹ and *Drepanella*.¹⁰ The mutual relations between many of these forms is very obscure, and it appears doubtful whether all of them are entitled to rank as genera. The genera to which *Polyphyma* appears to be most nearly related are those provided with broad lobes, such as *Kladdenia*, *Beyrichia*, *Ctenobolbina*, and *Tetradella*. The arrangement of the lobes, however, is more complex than that seen in *Kladdenia* or in the simpler forms of *Beyrichia* and *Ctenobolbina*; moreover, it does not seem possible to regard *Polyphyma* as having originated, like the more complex forms of *Beyrichia*, from the simple three-lobed type. On the other hand,

¹ 'Synops. Silur. Foss. Irel.' 1846, p. 57.

² See T. Rupert Jones, Ann. & Mag. Nat. Hist. ser. 2, vol. xvi (1855) pp. 81, 163; & G. Reuter, Zeitschr. Deutsch. Geol. Gesellsch. vol. xxxvii (1885) p. 621.

³ E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist. vol. xiii (1891) p. 108.

⁴ *Ibid.* p. 112.

⁵ T. Rupert Jones & H. B. Holl, Ann. & Mag. Nat. Hist. ser. 5, vol. xvii (1886) p. 360.

⁶ *Ibid.* p. 403.

⁷ G. Gürich, Verh. Russ. Kaiserl. Mineralog. Gesellsch. St. Petersburg. vol. xxxii (1896) p. 387.

⁸ *Ibid.* p. 388.

⁹ E. O. Ulrich, Journ. Cincinnati Soc. Nat. Hist. vol. xiii (1891) p. 121.

¹⁰ *Ibid.* p. 117.

it is conceivable that the lobes *b*, *c*, *d*, and *e* (perhaps together with the lobe *a*, which may belong either to lobe *b* or to lobe *c*) correspond with the four lobes seen in *Tetradella* (and in some forms referred to *Ctenobolbina*).¹ If this comparison be just, the lobes *f* and *g* may be extra lobes, not seen in *Klaedenia*, *Beyrichia*, *Ctenobolbina*, or *Tetradella*, and perhaps comparable with the submarginal lobes seen in *Strepula* and *Polyzygia*, though these differ greatly in form from the broad lobe *f*. But whatever be the interpretation, it appears that *Polyphyma* presents a combination of characters not seen in any other genus. Considering our ignorance of the homologies of the lobes in the majority of the genera, it appears hardly worth while to discuss the question further; the true systematic position of *Polyphyma* will be first understood when, by means of transitional stages between this form and other genera, it has been ascertained what parts correspond in each case.

IV. OCCURRENCE IN OTHER DISTRICTS.

Owing to the kindness of Prof. Lapworth, I have been enabled to examine specimens of '*Beyrichia*' obtained by him from the Oldbury Shales, and I find that the best example among these is referable to *Polyphyma Lapworthi*. In the Oldbury district, as in the Malverns, this species is found in shales beneath the zone of *Sphaerophthalmus alatus*, Boeckh. It seems probable that at Malvern the horizon is that of the uppermost part of the Paradoxidian; it is, however, possible that it corresponds with the zone of *Beyrichia Angelini*, Barr., which in Sweden is situated above that of *Agnostus pisiformis*, Linn.

'*Beyrichia*' *Angelini*, originally figured without description by Angelin, and shortly afterwards briefly described by Barrande,² was later redescribed by Linnarsson.³ The last-mentioned observer remarks that, among the variety of forms described under the name *Beyrichia*, none approach '*Beyrichia*' *Angelini*, and he regarded the generic position of the latter as quite uncertain.

From Linnarsson's description, '*Beyrichia*' *Angelini* appears to present some resemblance to *Polyphyma Lapworthi*; this is seen in the chitinous nature, the size, the semicircular form, the flattening at one end, and the subcentral position of the main tubercle, and perhaps in other respects. But the description is hardly full enough to warrant the inclusion at present of Barrande's species in the genus *Polyphyma*. In reply to a request of mine to be furnished

¹ A. Krause, Zeitschr. Deutsch. Geol. Gesellsch. vol. xlv (1892) pp. 389, 395 & pl. xxi, fig. 2, pl. xxii, fig. 9.

² Angelin's figure (pl. A, figs. 36 *a* & *b*) was apparently intended to appear in a supplement to the '*Paleontologia Scandinavica*,' but was never published, as might be inferred from Barrande's statement, '*Syst. Silur. du Centre de la Bohême*' vol. i, Suppl. (1872) pp. 485 & 495, though proofs of the plate containing it were privately circulated. I may add that the late Dr. Gustav Lindström informed me that Angelin's original specimen was lost before 1876.

³ Öfvers. Kongl. Vetensk.-Akad. Förhandl. vol. xxxii (1875) no. 5, p. 45. & pl. v, fig. 11.

with a large drawing of '*Beyrichia*' *Angelini*, the late Dr. Lindström informed me that Linnarsson's original specimen is the only one now possessed by the Riksmuseum at Stockholm, and that it is well delineated in Linnarsson's paper. Under these circumstances there can be little doubt that the English and Swedish species are different.

V. DIAGNOSIS OF *POLYPHYMA LAPWORTHII*.

Shell thin and chitinous; convex, semicircular, with straight hinge-line and well-defined angles. Ventral border raised into a marginal rim, which narrows posteriorly. Valves, each flat behind, furnished with a large, subcentral, obliquely-directed reniform lobe, the ventral limb of which is commonly provided with a prominent tubercle; a small, elongated, postero-dorsal submarginal lobe; two antero-dorsal lobes, usually connected with the reniform lobe by a low forked ridge: the one hemispherical, the other more anteriorly situated, spindle-shaped, directed towards the anterior angle; a subtriangular anterior submarginal lobe, and probably a slender submarginal posterior ridge. Dorsal margin slightly raised, and sharply bevelled off towards the hinge-line. Valves when closed probably not gaping at any point. Prevailing size: about 2 millimetres by 1.

Horizon.—Lowest Black Shales (Cambrian), Southern Malverns.

EXPLANATION OF PLATE III.

Fig. 1. Left valve of *Polyphyma Lapworthi*, gen. et sp. nov. (No. 305.) $\times 22$.

2. Do. (No. 256.) $\times 14\frac{1}{2}$.

3. Part of do. (No. 21.) $\times 23$.

4. Do. (No. 141.) $\times 25$.

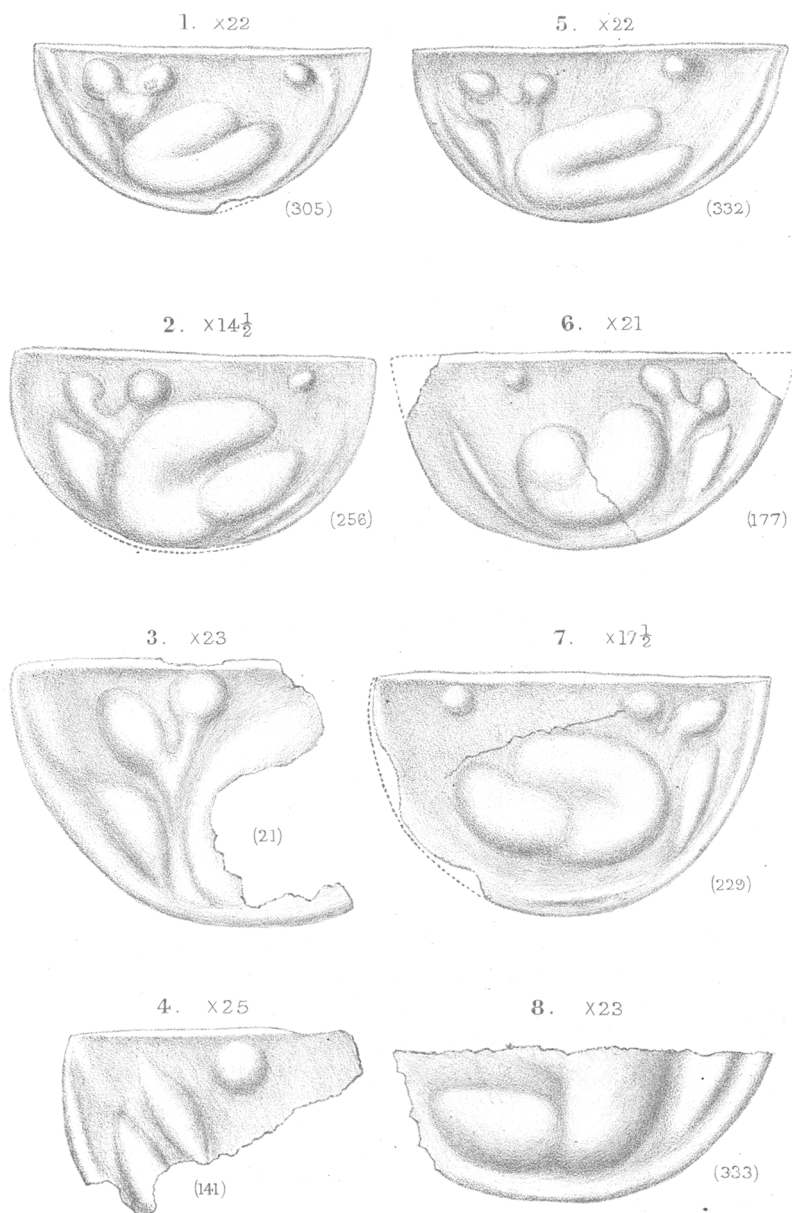
5. Left valve. (No. 332.) $\times 22$.

6. Right valve. (No. 177.) $\times 21$.

7. Do (No. 229.) $\times 17\frac{1}{2}$.

8. Part of do. (No. 333.) $\times 23$.

[The numbers in parentheses are those of the original specimens, which are now in the Museum of the Birmingham University.]



T.T. Groom del.
A.H. Searle lith.

Mintern Bros imp.

POLYPHYMA LAPWORTHII.
GEN ET SP NOV.