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ORIGINAL ARTICLES.

I.—ON A SERIES OF PHYLLOPOD CRUSTACEAN SHIELDS FROM THE
UPPER DEVONIAN OF THE EIFEL; AND ON ONE FROM THE WENLOCK
SHALE OF S. WALES.

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(PLATE IX.)

HAVING in the autumn of 1878 arranged to make a geological excursion to the Eifel, with my friend Mr. John Edward Lee, F.S.A., F.G.S., of Torquay, we were so fortunate, when near Gerolstein, to meet Professor Dr. Ferdinand Roemer, of the University of Breslau, Silesia, who has made the Eifel region his special study, and who cordially joined our party, giving us the benefit of his great knowledge of this most interesting geological region.¹

And here let me say, that to any one interested in Devonian Geology and desirous to collect fossils, for themselves, or to study the volcanic phenomena of the district, I cannot conceive a more delightful and primitive region for a fortnight's hammering. Mr. Lee was particularly anxious to direct our attention to the Upper Devonian beds of Büdesheim (between Gerolstein and Prüm), which he had carefully studied on a former visit in 1875.² Besides abundance of small *Goniatites* and *Orthoceratites*, we found by splitting open the shale that every lamina had numbers of bilobed impressions of some fossil organism on its surface, each being coated with a black pergamous layer, which, owing to the wetness of the shale, from springs, was only too easily removed, and when the specimens were dried it had a propensity to curl up or split and flake off, leaving only an impression behind.

These markings, from their blackness and rounded contour, are called by the natives "tinter-flecken" (ink-spots). My first impression, on examining them, was that they were *opercula* most likely of *Goniatites*, so abundant in these Büdesheim beds, but after visiting the locality and making a more careful examination of the fossils *in situ*, I was convinced they could not be referred to the Cephalopoda, and that their true nature was that of Phyllopod Crustacean shields.

¹ See das Rheinische Uebergangsgebirge. eine paläontologisch-geognostische Darstellung, von Carl Ferdinand Roemer, Phil. Doc. Hannover, 1844, 6 plates, 4to., and numerous other papers on the fossils of this region by the same author.

² See paper by Mr. J. E. Lee, on the Discovery of Upper Devonian fossils in the shales of Saltern Cove, Torbay, identical with those of Büdesheim (Geol. Mag. 1877, p. 100, Pl. V.).

Had it been possible to have described these fossil organisms upon the spot, and make careful drawings of them at the time, I do not doubt but that I should have been enabled to do them fuller justice than I can now after an interval of four years; but other claims upon my time have prevented my undertaking their description earlier.

The specimens selected and figured on Plate IX. (which, *with one exception*, are all from Büdesheim) seem to resolve themselves into three genera and six species.

Fifteen of the Eifel specimens I have referred to one genus, which I propose to name *Cardiocaris*; the sixteenth I propose to call *Pholadocaris*; the seventeenth specimen was obtained by Mr. J. E. Lee at Pencerrig in Wales, and I have referred it to the genus *Aptychopsis*.

(I had at first wished to place the first fifteen of these forms in the genus *Aspidocaris*, but I found that this name was already adopted by the late lamented Prof. Reuss, of Vienna, for a series of Phyllopod shields from the Alpine Trias of Raibl, Austria.¹ These specimens agree so *very closely* with *Discinocaris*,² a genus proposed by me for certain Phyllopod shields from the Moffat Shales, Dumfriesshire, that I am unwilling to complicate matters by adding these Eifel specimens to Reuss's Triassic genus, as a later examination may induce me to refer Reuss's *Aspidocaris* to the genus *Discinocaris*, when the former would sink into a synonym.)

I. *Cardiocaris*,³ gen. nov.

1. *Cardiocaris Roëmeri*, mihi, sp. nov. Pl. IX. Figs. 1-7.

In dedicating this species to my esteemed friend and fellow-worker, Prof. Dr. Ferdinand Roëmer, of Breslau, I feel that I am adding to the value of the specimens which will bear his honoured name, and that Mr. Lee's collection will be the richer for this souvenir of a friendship with this eminent geologist which he has shared for some years with myself.

To this species I have referred three of the largest, and four of the smallest, of these phyllopod shields; all of those having an elliptical outline and in which the anterior angles, formed with the cervical furrow or groove, are more or less acute.

The best preserved of these is depicted in Fig. 1, which measures 35 millimètres in greatest length (and probably measured 45 mm. before the loss of its anterior or cephalic portion), and 20 mm. in greatest breadth. The dorsal suture, if present, seems extremely obscure; the concentric striæ are pretty numerous, and are marked at intervals by a line of greater strength than the rest. There are also numerous delicate radiating striæ which take their rise just behind the base of the V-shaped cervical furrow and spread out fan-wise towards the posterior border, which is slightly emarginated behind.

Fig. 2 is only a fragment of a much larger shield, which must

¹ Sitz. d. K. Akad. d. Wissensch. I. Abth. Februar-Heft, Jahrg. 1867.

² Quart. Journ. Geol. Soc. 1866 (vol. xxii. p. 503, pl. xxv. figs. 4, 5, and 7.)

³ From *καρδία*, a heart; and *καρίς*, a shrimp.

(if entire) have measured fully 65 mm. in length and 40 mm. in breadth. We have only the anterior portion of this shield, but it shows, that in such aged specimens, the fine radiating striæ extended forwards as well as towards the posterior border.

Fig. 3 supplies exactly the portion of a large shield which is wanting in Fig. 1. The two series of striæ upon this specimen are beautifully preserved as impressions on the shale, although the black layer is absent. The concentric striæ bend slightly upwards of the posterior dorsal line. This specimen, when entire, must have measured 50 mm. in length and 30 mm. in greatest breadth.

Figs. 4, 5, 6, and 7 present in miniature all the characters of Fig. 1, and might be disposed of at once, as young examples of *C. Ræmeri*, but Fig. 5 deserves special notice.

In this little specimen the V-shaped cephalic portion, so frequently absent in the shields of these phyllopods, is here preserved *in situ*.

The question very naturally arises, why is the cephalic portion nearly always separated from the rest of the carapace? If we carefully examine the anatomy of specimens of the existing *Apus*, *Lepidurus*, or *Nebalia*, we shall find the answer very readily. The fact is, the muscles of the natatory antennæ, the maxillæ, and maxillipeds in these Phyllopod Crustaceans, all have their attachment to the anterior portion of the cephalic shield, and in the process of decomposition, after death, the carapace appears usually to have separated along the cephalic suture; the anterior part, with the appendages, being entombed in one spot, and the expanded posterior shield-shaped portion floated to another.¹

When occasionally found together, as in *Ceratiocaris papilio*, Salter, from the Upper Silurian of Lesmahagow, Lanarkshire (see Annals and Mag. Nat. Hist., March, 1860, p. 154), the body is often so twisted about in relation to the shield-shaped carapace, that the anterior end has more than once been described as the posterior, and *vice versa*. I pointed this out also in reference to *Dithyrocaris tricornis* of Scouler (see GEOL. MAG. 1873, Vol. X. Pl. XVI. p. 482).

2. *Cardiocaris veneris*, mihi, sp. nov. Plate IX. Figs. 8–12.

Under this specific designation, I have grouped together five carapaces, in which the cervical suture is less acute than in the preceding species, and the anterior angles of the carapace are rounded or obtuse, giving to these shields the traditional outline of an heraldic heart, or the form which is supposed to represent that organ on valentines. It is very difficult in this, as in the preceding species, to determine the presence of a dorsal suture dividing the shield into two equal halves. The surface of the carapace, when closely examined, reveals the same concentric striæ, but not the fine radiating lines seen on the preceding species. The relative proportions of breadth to length differ greatly in *C.*

¹ The carapace, which forms the subject of Fig. 10, on our Plate, has the impression of a *Spirorbis* having been attached to its surface after death. Others also appear to bear scars of organisms having fixed upon them; probably "spat" of *Ostrææ* or other small mollusks.

veneris when compared with *C. Rœmeri*. For whilst the latter is nearly twice as long as it is wide, the former is nearly as wide as it is long. In *C. Rœmeri* the greatest breadth of the shield is measured across the angle at the base of the V-shaped cervical suture; in *C. veneris* the greatest breadth is in front, measured across the summit of the V-shaped suture.

Dimensions of three specimens of *C. veneris*:—

Fig. 8.	Breadth in front	23 mm.,	length	30 mm.
Fig. 11.	" "	10 "	" "	15 "
Fig. 10.	" "	15 "	" "	20 "

3. *Cardiocaris lata*, mihi, sp. nov. Plate IX. Fig. 13.

I have ventured to separate this from the preceding species on account of its broader and rounder contour, and the more obtuse angle of the cervical suture. There is no trace whatever of any dorsal suture, the concentric striæ of the carapace pass completely round the shield in unbroken lines. Breadth of carapace 18 mm., length from anterior border to back of shield 20 mm., length from angle of cervical suture to back of shield 14 mm. This form approaches most nearly to *Discinocaris* from the Moffat Shales, but the anterior angles of the cervical suture are more rounded in the Eifel specimen and the striation is coarser.

4. *Cardiocaris bipartita*, mihi, sp. nov. Plate IX. Figs. 14 and 15.

The two forms I have here distinguished are very near to *C. Rœmeri*, but they have a tolerably well-marked dorsal suture which that species lacks; they are also widest in front. The depth of the V-shaped fold of the cervical suture is rather more than one-third the length of the shield, whereas in *C. Rœmeri* it occupies considerably less than one-third.

The concentric striæ are distinctly marked, but no radiating striæ are visible.

Fig. 14.	Breadth	15 mm.	Length	25 mm.
Fig. 15.	"	17 "	"	30 "

II. *Pholadocaris*, gen. nov.

5. *Pholadocaris Leei*, mihi, sp. nov. Plate IX. Fig. 16.

This singular shield differs greatly in form from every Phyllopod hitherto noticed.¹ In its narrowness it resembles *Caryocaris Wrightii* of Salter from the Skiddaw Slates (see Quart. Journ. Geol. Soc. vol. xix. 1862, p. 139, fig. 15); and but for the fact that the two sides of the shield are united behind by a wedge-shaped dorsal portion,

¹ Whilst these notes were passing through the press my attention was obligingly directed by my colleague, Mr. R. Etheridge, jun., to a singular form of Phyllopod-shield recently described by him, in Part II. of a "Monograph of the Silurian Fossils of the Girvan District," 1880, pp. 207-210, pl. xiv. figs. 17-20, which is singularly like our Eifel fossil. It is named by him *Pinnocaris*. It differs chiefly in its much greater breadth in front, and in being shorter in proportion, and the dorsal line is straighter than in *Pholadocaris*. Another form named *Solenocaris strigata* by Meek (see Geology of Ohio, Columbus, 1875, Paleontology, Part II., p. 321, pl. 18, figs. 4 a b c) is equally narrow, but the striæ are differently arranged, and render this form quite distinct. *Solenocaris* was already preoccupied by Mr. J. Young for a Scottish form from Girvan in 1868 (see op. cit. p. 207).

they might readily be supposed to be the two outspread valves of some *Pholas* or *Leda*-like molluscan shell. The carapace, which is 25 mm. in length by 15 mm. in breadth, has an almost wedge-shaped contour, being widest anteriorly. The front of the shield measures 10 mm. across its cephalic portion, represented by the V-shaped cervical sinus, which is also 10 mm. deep. Behind the cervical notch, is a small elliptical area 5 mm. long and 4 mm. broad (reminding one of the *lumule* of a bivalve shell), having a slightly-raised border; from this area two strongly-marked furrows, commencing 1 mm. apart, pass backwards, diverging gradually to 4 mm. distance from each other, where they join the posterior border. The space between these two furrows is marked by about 10 delicate raised striæ, which diverge slightly like the furrows themselves towards the posterior margin. The lateral portions of the carapace are ornamented with very minute radiating and concentric striæ.

This is the only specimen I have seen from this locality, and I dedicate it with great pleasure to my friend Mr. John Edward Lee, F.S.A., F.G.S., with whom I passed so many agreeable days in the Eifel-district.

III. Genus *Aptychopsis*, H. Woodw. 1872. GEOL. MAG. Vol. IX. p. 564.

6. *Aptychopsis Salteri*, mihi, sp. nov. Plate IX. Fig. 17.

In my report to the British Association, Brighton, 1872, and in the GEOL. MAG. Vol. IX. 1872, p. 564, I gave a notice of several new Phyllopod shields from the Middle Silurian of Hawick, Roxburghshire, three of which I referred to a new genus *Aptychopsis*, and named severally *A. glabra*, *A. Lapworthi*, and *A. Wilsoni*. The last of these is the form which, in point of size, agrees most nearly with the fossil figured in our Plate, Fig. 17, which was obtained by Mr. John E. Lee from the Upper Silurian (Wenlock Shale) of Pencarreg,¹ Caernarthenshire.

This specimen, which exhibits one side of a Phyllopod shield, was marked by the late Mr. J. W. Salter, F.G.S., as the "semi-operculum of a large *Orthoceras*." Although the operculum of *Orthoceras* remains unknown, we are now well acquainted with these Phyllopod shields from many localities, and I have every confidence in referring this fossil to the genus *Aptychopsis*.

In this specimen the carapace is 35 mm. long, by 25 mm. wide; the V-shaped cephalic portion is 10 mm. deep, and the posterior dorsal line is 25 mm. long. The surface of the carapace is finely striated concentrically and the lateral border of each valve seems to have the edge bent downwards and to have been slightly concave. This is a more oblong form than *A. Wilsoni* and the angles of the V-shaped cervical suture are sharp in the Welsh specimen, but rounded off in the Scottish example, which is also a more circular form.

I venture therefore to separate this specimen from Pencarreg specifically from the Roxburgh examples, and have designated it

¹ Mr. Lee spells this place "Penkerrig" on the label.

A. Salteri in memory of my late fellow-worker in the Palæozoic Crustacea, Mr. J. W. Salter, F.G.S., for so many years Palæontologist to the Geological Survey of Great Britain.

Formation.—Upper Silurian (Wenlock Shale).

Locality.—Pencarreg (or “Penkerrig”), Caernarthenshire.

EXPLANATION OF PLATE IX.

- FIGS. 1–7. *Cardiocaris Ræmeri*, H. Woodw., sp. nov.
 „ 8–12. ————— *veneris*, H. Woodw., sp. nov.
 „ 13. ————— *lata*, H. Woodw., sp. nov.
 „ 14 & 15. ————— *bipartita*, H. Woodw., sp. nov.
 „ 16. *Pholadocaris Leeii*, H. Woodw., sp. nov.
 „ 1–16 from the Upper Devonian, Büdesheim, Eifel, Rhenish Prussia.
 „ 17. *Aptychopsis Salteri*, H. Woodw., sp. nov. Upper Silurian (Wenlock Limestone), Pencarreg, Caernarthenshire, S. Wales.

All the specimens are figured of the natural size, and are from the Museum of Mr. John Edward Lee, F.S.A., F.G.S., Villa Syracuse, Torquay.

II.—FIRST IMPRESSIONS OF ASSYNT.

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IT must be admitted that first impressions are to a certain extent instinctive, and need not, therefore, be taken for more than they are worth. To do any really valuable work in such a troubled district as Assynt would require a considerable length of time. Still, after having been nearly a fortnight in the place—a fortnight in which the rainy days and the dry ones were about equally balanced—it is almost impossible to avoid forming some idea as to the respective merits of the interpretations which have been put forth. And this one is all the more apt to do in order to be able to institute comparisons with other districts of the North-West already visited in previous years.

Furnished with Professor Heddle's excellent geological map of Sutherland (Mineralogical Magazine, No. 21), and furthermore enjoying the society and experiences of the Professor himself, I arrived, on the last day of July, in the wild and remote corrie which flanks the north side of Ben More, having walked that morning from the head of Loch Shin over peaty moors which for the most part hide all the rocks.

After wading across the upper Cassley between Fionn Loch More and Fionn Loch Beg, and after toiling through a maze of glacial debris and peat hags, we struck the solid rock at perhaps 1400 feet above the level of the sea. From this point it is easy to perceive that the east slope of Ben More is covered with quartzite, but I was surprised to find that the bulk of the rocks in the corrie, which lies beneath the northern slopes of Ben More and Coniveall, consists of a peculiar gneissic rock which Dr. Heddle terms the “Logan” rock. Some portions of this “Logan” rock are very puzzling, more especially in its relations to a dark green or dull black aphanitic rock which Dr. Heddle at one time was disposed to regard as igneous. Continuing to ascend towards the Bealloch between Coniveall and