

Fourth Report on the Structure and Classification of the Fossil Crustacea. By HENRY WOODWARD, F.G.S., F.Z.S., of the British Museum.

(PLATE II.)

DURING the past year no new Silurian forms of Crustacea have come under my notice, save the series which I had the pleasure to exhibit at Dundee. Of these, belonging to the Order Merostomata, the following have been fully described and figured:—

a. EURYPTERIDÆ*.

- 1 *Eurypterus* (*Pterygotus*) *punctatus*, Salter, sp.
2. ——— *scorpioides*, sp. nov.
3. ——— *obesus*, sp. nov.
4. *Pterygotus* *raniceps*, sp. nov.

b. LIMULIDÆ†.

Neolimulus falcatus, sp. et gen. nov.

Perhaps the most interesting point which I have been able to determine in connexion with these Upper-Silurian forms is the occurrence of gill-plates in *Pterygotus* in precisely the same relative position as we find they occupy in *Limulus* at the present day, but differing in form. These leaf-like branchiæ occur in rows, and still exhibit their highly vascular structure, and indicate by their aspect in the fossil state their extreme tenuity.

It is very interesting to me, and I cannot but believe that it will also interest others working at the *Invertebrata*, to find the number of points which *Pterygotus* possesses in common with the *Scorpionidæ* among the *Arachnida*.

If the organs called “combs,” which are attached to the first *thoracic* segment of *Scorpio*, be rudimentary gills, *not wholly aborted*, we have another point of analogy gained between the two‡.

That rudimentary gills existed in *Pterygotus* at the border of the segments, and in that position in which the pulmonary sacs in *Scorpio* are found, I have evidence both from the Devonian and Silurian species.

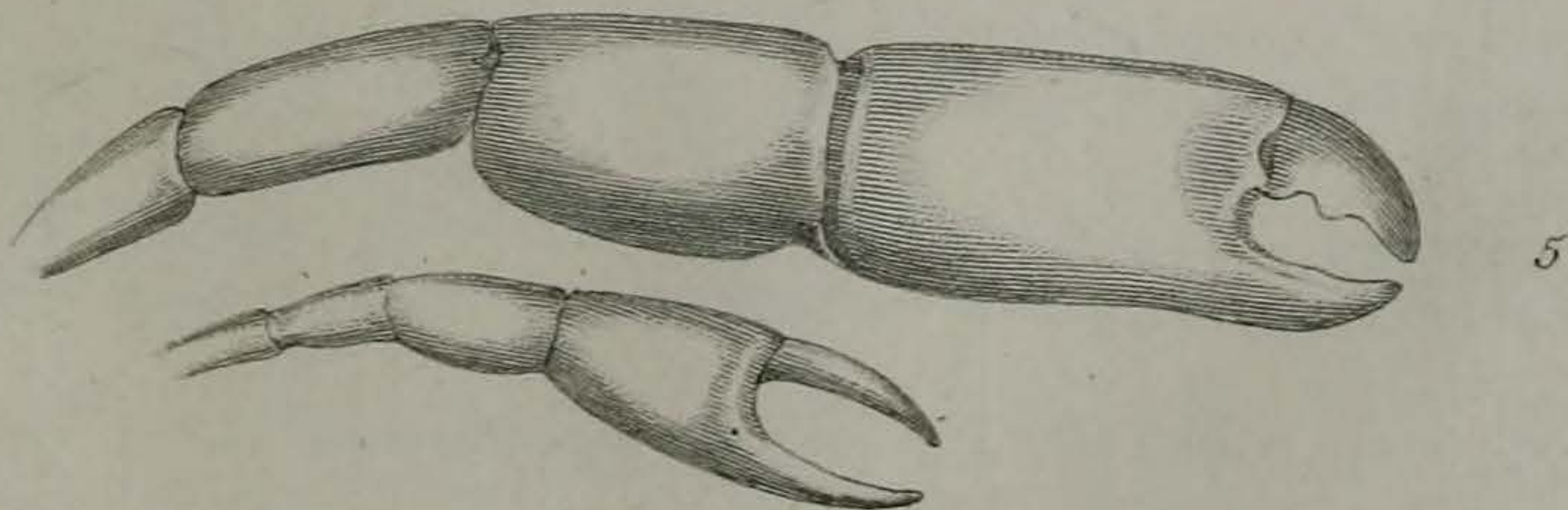
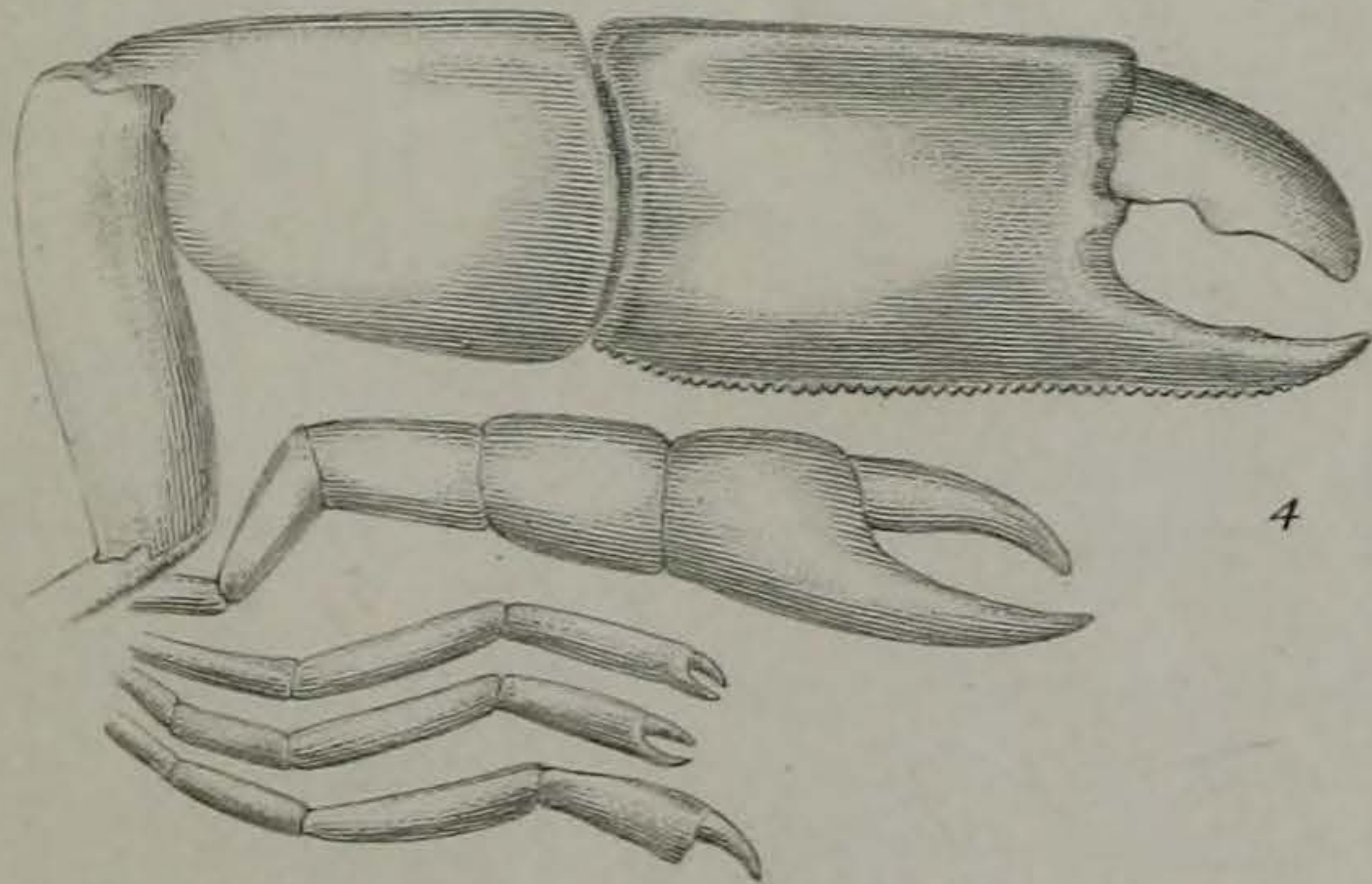
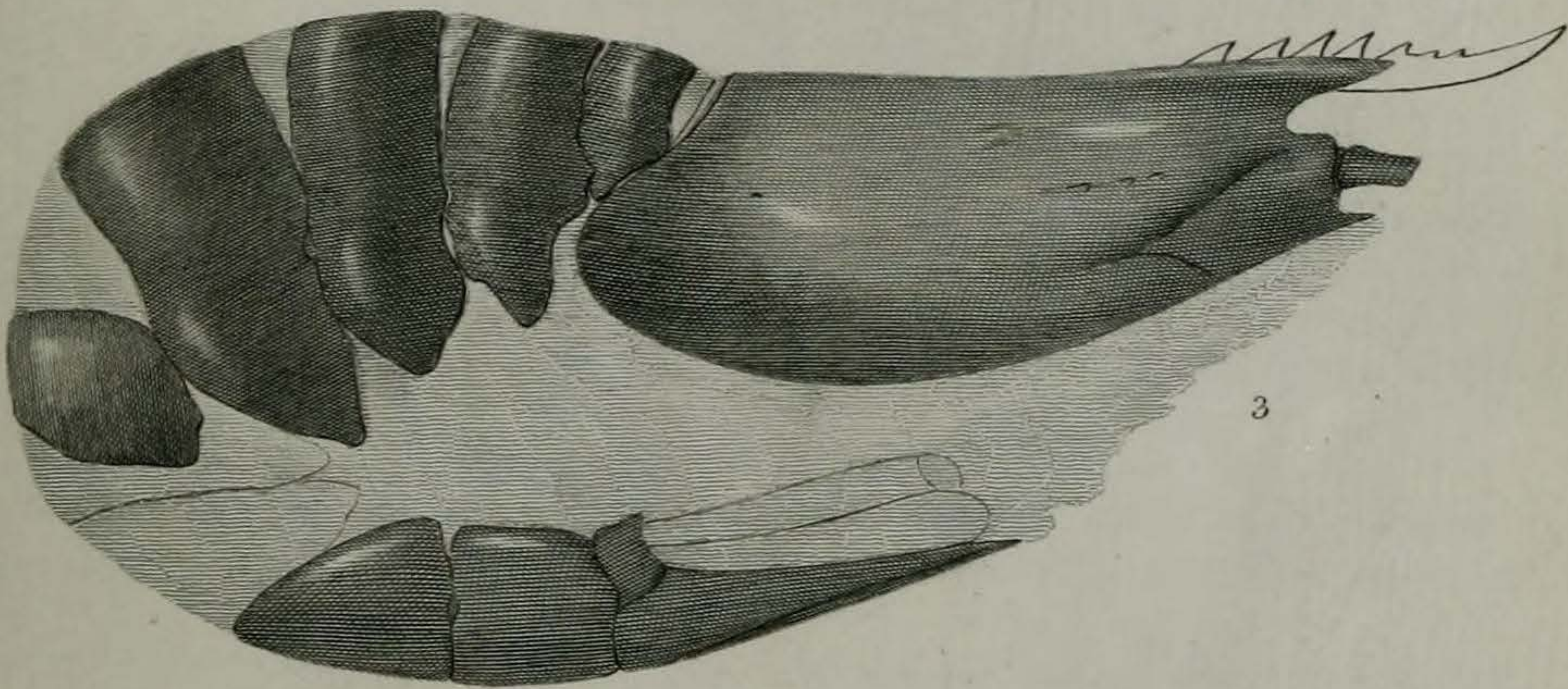
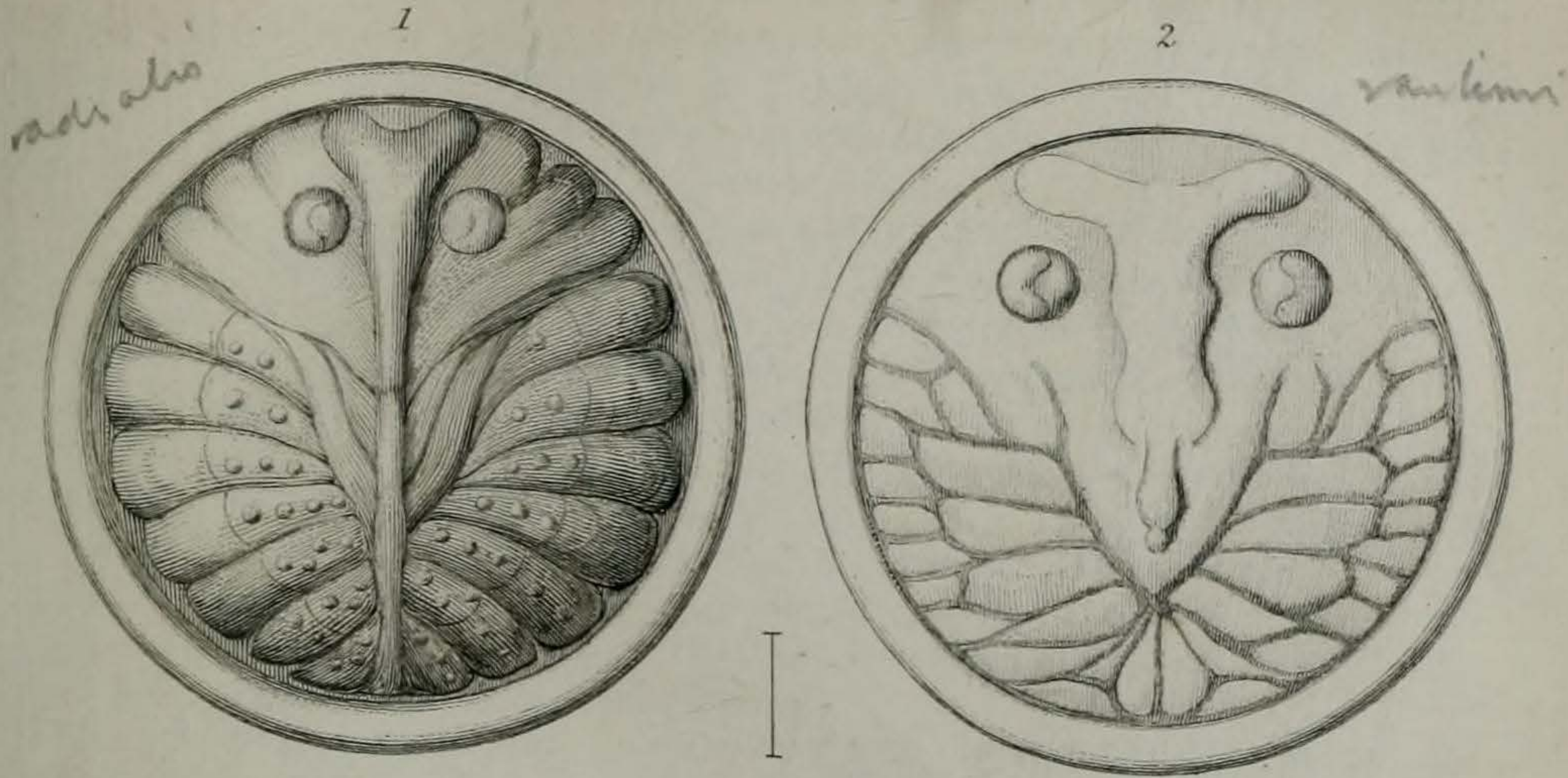
The position also of the ovaries in *Pterygotus* and *Scorpio* is the same, though in the former the opening to the sacs is double, as in *Limulus* and other Crustacea, whereas in *Scorpio* it is *externally* central as in Insects. A bilobed plate conceals the apertures in both forms. My conclusion is that there is good ground for assuming that *Pterygotus* represented, in Palæozoic time, the aquatic condition of *Scorpio*, just as the aquatic larvæ of *Libellula* represent to day the *imago* of a future season.

I have lately received specimens from the Carboniferous shales of Carlisle of a new form of Crustacean allied to *Cyclus*. I was at first doubtful whether the *Cyclus radialis* of M. de Koninck, from Belgium, really represented the *Agnostus radialis* of Prof. Phillips, from the Carboniferous Limestone of Bolland, Yorkshire. I have fortunately been able to see and examine the original specimen of *Cyclus radialis* of De Koninck, and find that it does agree with the figure in Phillips's ‘Geology of Yorkshire’ (vol. ii. t. 22. fig. 25); but it entirely disagrees with M. de Koninck's magnified figure. I have therefore redrawn the Belgian form, and propose to figure it by the side of the new British form from Carlisle. (See Plate II. figs. 1 & 2.)

* See Quart. Journ. Geol. Soc. 1868, vol. xxiv. pp. 289–294, pls. 9 & 10.

† See Geol. Mag. 1868, vol. v. p. 1, pl. 1. figs. 1 & 1a.

‡ I am preparing injections of recent specimens of *Scorpio* in the hope of being able to demonstrate this point certainly.



H. Woodward del^t

J.W. Lowry sculp^t

Cyclus radialis (Pl. II. fig. 1) is an elegant little shield-shaped buckler 5 lines long by 4 in breadth; its general form is hemispherical, with a narrow smooth border; the shield is divided down its centre by a raised longitudinal ridge, from which radiate seven diverging ribs whose rounded ends reach the lateral and posterior border.

The anterior cephalic portion occupies about a quarter of the entire shield, and is ornamented by the spreading out of the raised central ridge, and by two subcentral rounded prominences which correspond in position to eye-spots, but are not faceted. The ribs are ornamented each with from three to five tubercles irregularly disposed over their surface.

The new form of *Cyclus* (Pl. II. fig. 2) discovered by Dr. Rankine of Carlisle, in the Carboniferous shales of that place, is most remarkable in appearance, and certainly far more like a parasitical Crustacean than the *Cyclus radialis*, which certainly seems to have been furnished with a hard calcareous test. A comparison of the two, however, leaves no doubt in my mind in referring them both to one genus.

The shield is about 4 lines in diameter, and conveys the idea of an extremely thin test flattened out on the soft shale by pressure. The eye-spots occupy the same relative position as in *C. radialis*; but the divisions which represent the costæ are six, not seven in number in this species, and these anastomose together on the lateral border, and diverge, not from a median raised ridge, but a broad V-shaped central area. One is reminded by this Crustacean of the appearance of *Argulus*, *Bopyrus*, and other recent parasitic forms, and also of the disk-shaped *Discinocaris*, from which it differs, however, in the prominent eyes and costated shield.

For this new species (Plate II. fig. 2) I propose the name of *Cyclus Rankini*, after its discoverer.

In describing *Cyclus radialis*, M. de Koninck observes:—

“There is no doubt this animal should be ranged with the Crustacea, and in Milne-Edwards’s order Trilobita abnormalia and battoidea, near to *Agnostus*.”

M. de Koninck also thinks it probable that the body of *Cyclus* was soft and very contractile, that it was a parasite, and that the two tubercles which we have called the eyes really covered those organs—and, further, that the ribbed border protected the feet when the animal was in repose.

We must differ from M. de Koninck in referring this form to the Trilobita. If truly an adult, it must be placed near to *Apus* with the other shield-bearing Phyllopoda; if a larval form, it may have been the early stage of *Prestwichia* or some other of the Coal-measures *Limulidæ*. Nor do we think it in the least probable that the shield of *Cyclus radialis* was flexible or contractile, its original segments being completely soldered together into one piece.

Hermann von Meyer has figured a small Crustacean head-shield under the name of *Halicynne agnota*, and a second species, *H. laxa**, from the Muschelkalk of Rottweil in Germany. Goldfuss originally figured it as an *Olenus* (*O. serotinus*); afterwards it was referred to *Limulus* by Münster (Beiträge, 1841, Bd. i. t. v. f. 1). To both these conclusions Meyer demurs—to *Limulus* because no eyes are visible, and to the Trilobita because none are found older than the Carboniferous.

The form of this head-shield is extremely like that of *Agnostus*; but the *Agnostidæ* are confined to the Lower Silurian strata, between which and the

* See Palæontographica, 1847, vol. i. p. 134.

Trias are the long intervening series of Upper Silurian, Devonian, Carboniferous, and Permian formations. I consider this form may more properly be placed with *Bunodes*, *Hemiaspis*, &c. among the aberrant forms of the *Limulidæ*, of which it may possibly have been a larval state.

Among the Secondary forms of Crustacea I have described the following from British specimens during the past year.

Palinurina longipes. Lower Lias, Lyme. (Geol. Mag. 1868, vol. v. p. 260, pl. 14. fig. 5.)

Pseudoglyphea grandis. Lower Lias, Weston. (Ibid. p. 353, pl. 17. fig. 1.)

Glyphea rostrata. Lower Lias, Weston. (Ibid. p. 354, pl. 17. fig. 2.)

—— *Heeri*. Lower Lias, Lyme Regis. (Ibid. p. 355, pl. 17. fig. 3.)

—— *Tomesii*. Lower Lias, Welford Hill, Stratford-on-Avon. (Ibid. p. 356, pl. 17. fig. 4.)

I have now to notice another species, of the genus *Pencæus* of Fabricius, from the Lower Lias, Northampton. This is a remarkably persistent form; and the genus is actually found now living in the Mediterranean, if Dr. Oppel's determination be correct, which I feel little doubt in endorsing.

This handsome Crustacean (see Plate II. fig. 3) was not less than $9\frac{1}{2}$ inches in length when measured along the dorsal line, the carapace being about 3 inches, and the abdomen $6\frac{1}{2}$; the rostrum was very strongly serrated as in the *Palæmonidæ*, but the serrations have been abraded in the fossil. This form most nearly resembles in size and appearance the *Pencæus speciosus* of Münster, but differs slightly in the form of the border of the abdominal segments, and also in the direction of the strong and deeply forked sulcus which marks each side of the latero-anterior portion of the carapace near the base of the great antennæ. The surface of the carapace and segments was highly enamelled, some portions of which may still be observed in the fossil. I have named it *Pencæus Sharpii*, after Mr. Samuel Sharp, F.G.S., who is the discoverer of the fossil.

Of the Cretaceous Crustacea two have been noticed by me, viz. a new Cirripede from the Norwich Chalk, *Pyrgoma cretacea* (Geol. Mag. vol. v. 1868, p. 258, pl. 14. figs. 1 & 2), and *Necrocarcinus tricarinatus*, from the Gault of Folkestone (ibid. p. 259, pl. 14. fig. 4).

I am now enabled to add two new species of a family not hitherto before noticed in a fossil state in Britain, the family of the *Thalassinidæ*.

This curious group contains several genera and species. Those of which we know the habits, burrow in the sand, which they readily excavate with their feet.

Although frequently found fossil, especially in the Upper Chalk of Maestricht, of France, and Bohemia, we rarely see a trace of their bodies. Even in dredging, the usual thing is to find the two fore claws only in the dredge (if any part of them is taken at all). In the fossil state it is to be also anticipated that their occurrence would be rare, as the integument of their bodies (like that of the Hermit-Crab and others which conceal themselves in foreign substances) is extremely thin, and often soft. I may compare the difference of their test to that which exists between a lady's hand encased from infancy in a kid glove, and the hand of a savage who uses his digits constantly for delving in the ground after roots. In the one, the covering membrane is thin and soft; in the other, hard and horny. One might even go further and imagine (by repeated exclusion from use) the nails would be no longer developed; certainly they are less powerful as offensive weapons. This is precisely what we find does take place in the burrowing Crustacea;

the hard and shelly epimeral pieces of the body-segments are not properly developed (as they are in the common lobster and other active *swimming* long-tailed forms), and the lobes of the tail are in like manner rudimentary. Such changes I cannot but conceive to have been the result of long habit, arising from the disuse of the organs of a part of the body, causing first their gradual reduction in size, and finally resulting in their abortion. The two new species of *Thalassinidæ* I have to notice belong to the genus *Callianassa*, hitherto characteristic of the Maestricht Chalk, and found also living in our own seas. We are now able to take it back to the Lower Greensand on the one hand, and link together the Cretaceous and Recent periods by a species in the Eocene beds of Hempstead, Isle of Wight. I have named the first *Callianassa Neocomiensis*, from the Greensand, Colin Glen, Belfast (Pl. II. fig. 5), and the second *Callianassa Batei* (after Mr. C. Spence Bate), from Hempstead Upper Marine series, Isle of Wight. (Plate II. fig. 4.)

This is a genus which should be looked out for by collectors of Upper-Chalk fossils in Norwich.

The Plates exhibited are intended for the second part of my Monograph on the fossil Merostomata, which now awaits its turn of publication. I wish to add a word here in favour of the Palæontographical Society, as deserving of support, as a means of enabling authors writing upon special branches of Palæontology to secure the publication of their researches. If more subscribers would only come forward in its aid, more authors would be enabled to make their work known, and much time would be saved. The last volume issued is an illustration of what they give for their annual guinea subscription*.

Casts of the largest of the Palæozoic Crustacea have already been prepared and coloured, and copies sent to Liverpool, Dublin, Oxford, Cambridge, Edinburgh, Glasgow, Norwich, and elsewhere, for the Museums of those cities.

EXPLANATION OF PLATE II.

- Fig. 1. *Cyclus radialis*, Phillips, sp. From the Carboniferous Limestone of Bolland, Lancashire, and Visé, Belgium. Enlarged five times the natural size.
 Fig. 2. *Cyclus Rankini*, sp. nov. From the Coal-shales, Carlisle, Scotland. Magnified five times.
 Fig. 3. *Penæus Sharpii*, sp. nov. Lower Lias, Northampton. A fourth less than the natural size (the outlined parts are restorations).
 Fig. 4. *Callianassa Batei*, sp. nov. Upper Marine series, Hempstead, Isle of Wight. Natural size.
 Fig. 5. *Callianassa Neocomiensis*, sp. nov. Greensand, Colin Glen, Belfast. Natural size.

First Report on the British Fossil Corals.

By P. MARTIN DUNCAN, M.B. Lond., F.R.S., F.G.S., Sec. Geol. Soc.

THIS Report consists of notes of observations made upon the Coral-faunæ described by MM. Milne-Edwards and Jules Haime in the monograph of the 'British Fossil Corals' (Palæontographical Society, 1850), of descriptions of new and unpublished species, of notices of species published by me in 1867 and 1868, and of examinations into the affinities of the forms and their geological positions.

* The last volume issued contained 45 Plates (9 of which were double quarto) and 238 4to pages of text.