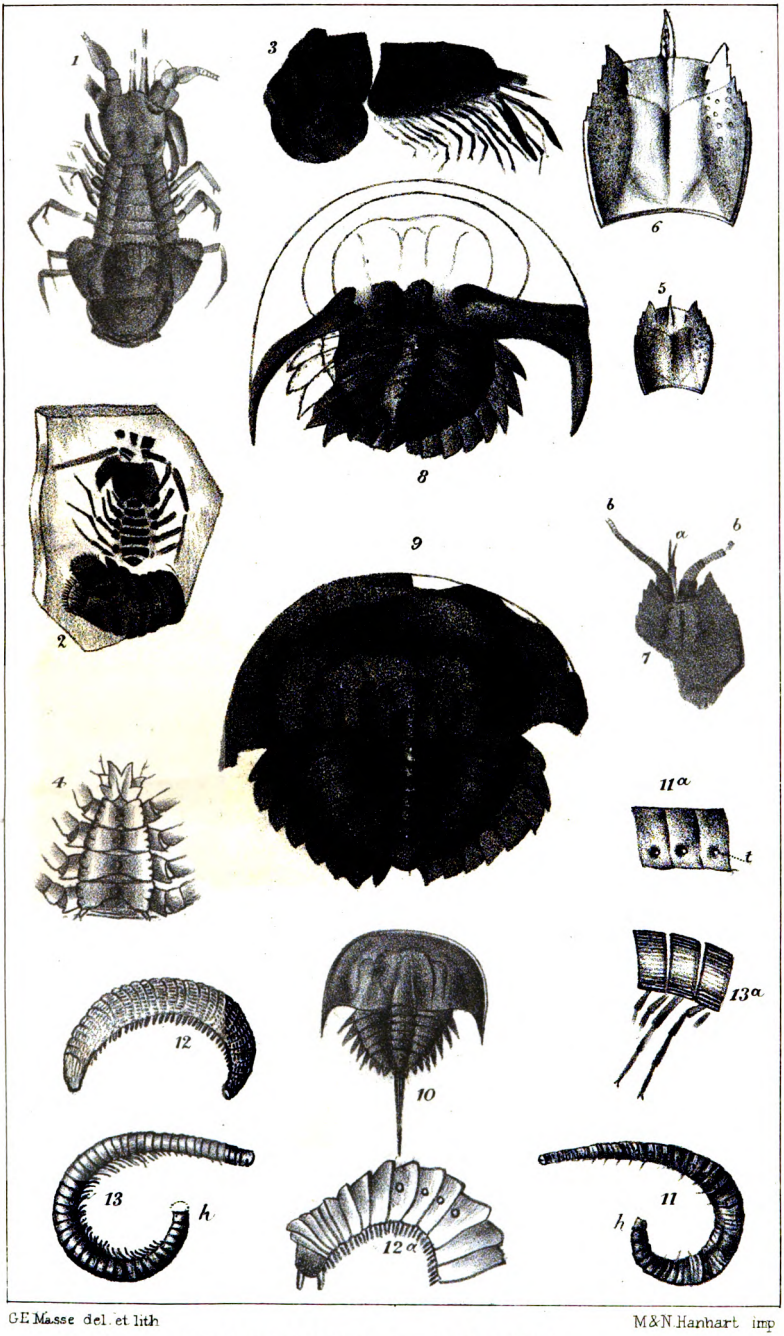

G.E. Masse del. et lith. M&N. Hanhart imp.

CRUSTACEA & INSECTA.

From the Coal-measures of Kilmaurs, and other localities.

can be written without its chapter on the Glacial epoch; and the first page in this chapter must be ascribed to the hand of Mr. Smith.

Many difficulties are undoubtedly unsolved, but it is a rare honour to have been permitted to raise problems so vast as those involved in the existence of an age of ice in Scotland.

One word in conclusion. In this great city there have dwelt many good and illustrious men, whose memories are cherished with reverent regard.

Now there passes from our midst the philanthropist, whose purse has been as open as his heart, and his heart as tender as his soul devout.

Now the poet is taken from us, who learnt music in the midst of our troubled discords, and, through the inspiration of genius, could make melody of this noisy city life.

Now we lose the man, skilful, it may be, in mechanical device, cunning in hand as thought, raising a machine almost into vital existence, and producing a work of genius, as harmonious in plan and parts as a poem, out of iron and brass.

Be it our privilege, gentlemen, as inefficient but not unloving students of a great science, to remember with honour one whose life was adorned by enthusiasm for its service.

In this busy community, there is need for every varied pursuit. Star differeth from star in glory, but we may be permitted to say, that he serves his race who deepens and widens the thoughts of men; and that whosoever can make men love better and follow more faithfully even the most abstract of scientific studies, not only diffuses a pure taste which can save from baser cravings, but ennobles character, by bowing down the heart in lowlier reverence before Him who fastened the foundations of earth, and who hid the corner stones thereof, when the morning stars sang together, and all the Sons of God shouted for joy.

LXIII. Notes *on some* Fossil Crustacea, *and a* Chilognathous Myriapod, *from the* Coal Measures *of the* West *of* Scotland. By Henry Woodward, F.G.S., F.Z.S., of the British Museum.

(Plate III.)

I regret exceedingly that so long a time has elapsed since my attention was first drawn to these specimens by Mr. Farie, before communicating my remarks upon them to the Geological Society

of Glasgow. But the delay has enabled me to obtain from Edward Binney, Esq., F.R.S. (President of the Manchester Geological Society), the loan of the original specimens of *Pygocephalus Cooperi*, described by Professor Huxley, and also those of the coal *Limuli*, from Joseph Prestwich, Esq., F.R.S., for comparison with the specimens from Glasgow.

I have minutely examined the supposed Annelide, but there seems to be no reason to doubt that it is the remains of a Chilognathous Myriapod, allied to *Julus*, and preserved in a similar manner to the specimens discovered by Principal Dawson, F.R.S., of Montreal, in the South Joggins Coal Formation, Nova Scotia.

A carefully prepared drawing of another, and much larger specimen, has been obligingly sent me by Mr. J. Young, of the Hunterian Museum, Glasgow, but I should be unwilling to determine its exact character until I had examined the original specimen. From Mr. Young's drawing, there is reason to believe it may possibly prove distinct from the specimen now under consideration.

In January, 1853, Sir Charles Lyell and Dr. Dawson read, before the Geological Society of London,* an account of their examination of the stump of an erect fossil tree in the Coal-measures of Nova Scotia, containing the remains of a reptile (the *Dendrerpeton Acadianum*, Wyman and Owen), and of a land snail, (the *Pupa vetusta* of Dawson). In December 14th, 1859,† Principal Dawson gave a full description of this earliest known terrestrial mollusk, also some new species of reptiles, and a Chilognathous Myriapod, obtained from the interior of an erect *Sigillaria* in the same coal-field.

The Myriapod is figured and described under the name of *Xylobius Sigillariæ* (Dawson); and a specimen has been presented by Dr. Dawson to the British Museum.

Similar fossil remains have been found at Kilmaurs, by Mr. Thomas Brown, in nodules of light brown coloured clay-ironstone, no doubt corresponding with the "Pennystone" ironstone of Coalbrook-dale, and the "Gubbins" of the Dudley collieries, as they appear to be characterised by similar fossil contents. In the same nodule with the best preserved specimen, are a perfect pinnule, and several fragments of a fern (the *Pecopteris abbreviata*, of Brongniart). It is extremely interesting to find this presumed terrestrial

* Quart. Journ. Geol. Soc., Vol. ix., p. 58.
† Op. cit., Vol. xvi., p. 268.

Myriapod both here and also in America, associated with land vegetation. The evidence of land conditions to be derived from associated fossils must not, however, in this case, be too strongly relied upon, as, in the same bed of nodular ironstone concretions, are likewise found king-crabs, and other undoubted marine organic remains.

The fossil (Plate III., fig. 11) is coiled up somewhat into the form of the letter J, and is two inches in length; two lines across the widest, and one line across the narrowest segment, of which there are upwards of thirty. To the epimera of each of these segments a pair of slender feet one line in length, appear to have been articulated. Towards the more slender end of the fossil these feet can be distinctly seen—not to consist of single bristles, as in the *Annelida*, but to be composed of several articuli as in the recent Myriapoda. (Plate III., fig. 12a and 13a.) Each segment of the body, wherever sufficiently well preserved to show it, bears upon its lateral portion a slightly raised whart, indicating the position of the pores, stomata, or tracheal openings. The segments are marked by alternate ridges and furrows, and the surface presents a somewhat rugose appearance, very different from the smooth and shining articuli of the recent *Julus*. But no soft-bodied annelide would be preserved in this condition—the body-rings of those worms which I have examined, from Solenhofen, in Bavaria, for example, being indicated rather by a stain upon the slab, than by any actual *relievo* evidence of their presence, as shown in the Kilmaurs specimens. We may then be quite sure that this fossil possessed a chitinous exo-skeleton sufficiently firm and strong to leave the impress of its numerous and well-marked articuli in the soft clay, charged with carbonate of iron, in which it was entombed, together with the foliage of land plants, the clay having, by the subsequent segregation of the iron, been converted into nodules, the nucleus of which appears to have been, in every case, some organic body.

In the best preserved specimen, the head of the animal seems to be absent, but it may possibly be discerned upon the counterpart of the half-nodule, which the author has not seen. The details of the other specimen are too obscure to be made out. I do not think the specimens of this fossil entitle us to consider it as specifically distinct from that discovered by Dr. Dawson, although a comparison of the figures may convey that impression; but it is important to record this instance as the *first discovery* of *Xylobius* in Britain.

In the Transactions of the Literary and Philosophical Society of Manchester, recording their meeting on January 8th, 1867,* it is reported that Mr. Binney exhibited some fossil remains collected by Mr. Joseph Tindall of Huddersfield, from the lower Coal-measures near that town. Through the kindness of Mr. Binney, I have been permitted to see and examine them, but I need here only refer to one specimen. It is a remarkably good example of *Xylobius* in a nodule of clay-ironstone, having about 46 well preserved articulations to its body, but, like those which I have seen and examined from Kilmaurs, it is apparently destitute of a head. This specimen shows the segments to have been ornamented with transverse finely undulating lines (Plate III., figs. 13 and 13a.), as noticed in the Nova Scotian specimen, and confirms me in the opinion that it is referable to the same genus and species. Dr. Dawson's diagnosis of the Nova Scotian fossil is as follows :—

"Body crustaceous, elongate, articulate, when recent cylindrical or nearly so, rolling spirally. Feet, small, numerous; segments, 30 or more; anterior segments smooth, posterior with transverse wrinkles, giving a furrowed appearance. In some specimens traces of a series of lateral pores or stigmata are seen. Labrum (?) quadrilateral, divided by notches or joints into three portions. Mandibles two-jointed, last joint ovate and pointed. Eyes, 10 or more on each side."†

It will probably not be without interest to record here the instances already known of the occurrence of true INSECTS in the Coal Formation.

NEUROPTERA.

1. *Corydalis Brongniarti* (wing of), in Clay Ironstone nodule. Coalbrook-dale.
   [Brit. Mus. Collection. Mantell, Medals. p. 578. Murch. Sil. Syst., p. 105, f. 13a.]

COLEOPTERA—*Rynchophora.*

2. *Curculioides Ansticei*, Buckl.. Nodular Ironstone, Coalbrook-dale.
3. *Curculioides Prestvici*, Buckl. Do. do. do.
   [See "Buckland's Bridgewater Treatise" on Geology, vol. ii, p. 76, t. 46, figs. 1 and 2.]

MYRIAPODA—*Chilognatha.*

4. *Xylobius Sigillariæ*, Dawson, 1860. Coal M., Nova Scotia.
   [Quart. Journ. Geol. Soc., vol. xvi., p. 268. a specimen in British Museum.]

——— ———. Coal Measures, Kilmaurs, Glasgow.

——— ——— Lower Coal Measures, Cooper's Bridge.

* See Geol. Mag. for March, 1867, p. 132.

† Quart. Journ. Geol. Soc., 1860, Vol. xvi., p. 272.

ARACHNIDA—*Scorpionidæ.*

5. *Microlabis Sternbergi*, Corda. Coal M., Bohemia.
[Original in the Prague Museum, Cast in the British Museum.]

6. *Cyclophthalmus senior*, Corda. Coal M., Bohemia.
[Original in the Prague Museum. Cast in the British Museum. Figd. in Buckland's Bridgewater Treatise, vol. ii., pl. 46 and 46*.]

ARACHNIDA—*Araneidæ.*

7. *Aranea* ——— Coal Shale, Bohemia.
[Original in Prague Museum, Cast in British Museum.]

8. *Protolycosa anthracophila*, Roemer. Coal Measures, Upper Silesia.
[See Geol. Mag., 1865, vol. ii., p. 468.]

In the foregoing list, then, we have 8 species of land-dwelling, air-breathing *Articulata*, representing 4 orders of *Insects*, 2 orders of *Arachnida*, or spiders and scorpions.

Among the insects it is interesting to notice one form at least (the *Corydalis Brongniarti*), possessed of the highest attribute of the class at the present day, namely, the power of aerial locomotion. It conveys to our mind a wonderful subject for consideration, that at this remote period so great an approach to the present condition both of the terrestrial surface of our globe and the atmosphere enveloping it, should have been arrived at, that even on the very imperfect and limited information we possess, we should be able to note amphibian reptiles, a land snail, and nine kinds of land-dwelling *Articulata*.

Since the description of *Xylobius* was written, the author has received Vol. I. of the tenth edition of the "Principles of Geology," by Sir Charles Lyell, Bart., in which, at chap. ix., p. 157, is the following :—

"Up to the year 1865, only a few insects had been obtained even from the Carboniferous strata, the land-plants of which are well known to us, and none from the Devonian. From this last formation, several have now been brought to light in North America, chiefly of the order *Neuroptera*, found by Mr. Hartt, in rocks near St. John's, New Brunswick, and determined by Mr. Samuel Scudder, of Boston, U.S. Why, then, should we despair of finding in our future researches some air-breathers of a much higher order than insects which may have peopled the forests of the Devonian era, in which pines, *Sigillariæ* and *Lepidodendra*, or gigantic *Lycopodiaceæ* flourished."

In the sixth edition of the "Elements of Geology," by the same author, at chap. xxiv., p. 491, is the following notice:—

"More recently (1854) Mr. Fr. Goldenberg has published descriptions of no less than twelve species of insects from the nodular clay-ironstone of Saarbrück, near Treves.* They are associated with the leaves and branches of fossil ferns. Among them are several *Blattinæ*, three species of *Neuroptera*, one beetle of the *Scarabæus* family, a grasshopper or locust, *Gryllacris*, and several white ants or *Termites*. These newly-added species probably outnumber all we knew before of the fossil insects of the coal."

The following is the list of species described, copied from the original work:—

I. Order—ORTHOPTERA. 1 Fam.—BLATTIDÆ.	
Blattina primæva,	F. Goldenberg.
——— *Lebachensis*,	——
——— *gracilis*,	——
2 Fam.—LOCUSTIDÆ.	
Gryllacris lithanthraca,	——
3 Fam.—TERMITIDÆ.	
Termes Heeri,	——
——— *formosus*,	——
——— *Decheni*,	——
——— *affinis*,	——
II. Order—NEUROPTERA. 1 Fam.—SIALIDÆ.	
Dictyoneura anthracophila,	——
——— *Humboldtiana*,	——
——— *libelluloides*,	——
III. Order—COLEOPTERA. 1 Fam.—TROCHIDÆ.	M'Leay.
Troxites Germari,	F. Goldenberg.

In all, 3 orders, 5 families, 5 genera, and 12 species, all from the Coal formation of Saarbrück, Rhenish Prussia.

At the risk of becoming tedious, I beg to be allowed to append one more additional note upon Fossil Insects, just received from Dr. Dawson, F.R.S., of Montreal, (Proceedings Montreal Nat. Hist. Soc., April 29, 1867,) see Geol. Mag., August, 1867, p. 374.

Dr. Dawson here gives an account of a new genus and species of Neuropterous insect from the coal shale, Cape Breton, and of four other genera from the Devonian shales of St. John's, New Brunswick, with descriptions prepared by Mr. Samuel Scudder, Curator of the Boston Natural History Society's Museum.

* Palæontographica, Dunker & V. Meyer, 1856. Band iv., pp. 17-38. Tab. iii.-vi.

The new Neuropterous insect from the coal is named *Haplophlebium Barnesii*, Scudder, and must have measured fully 7 inches in expanse of wings.

The Devonian insects are:—

Platephemera antiqua,	Scudder.
Homothetus fossilis,	Scudder.
Lithentomum Harttii,	Scudder.
Xenoneura antiquorum,	Scudder.

These latter have been already referred to at p. 238, in our extract from the 10th edition of the "Principles."

On the CRUSTACEA *from the* GLASGOW COAL FIELDS.

I. THE oldest order of this class represented in the series of specimens before me, is the King-Crab *(Xiphosura)*. Of this order, there are representatives of two genera:—1. *Belinurus*, Baily; 2. *Prestwichia*, H. Woodward.

In a paper on the relations between the *Eurypterida* and the *Xiphosura*, read before Section D. (Biology) of the British Association at Nottingham, 1866, and in another paper subsequently communicated to the Geological Society of London,* I have divided the *Limulidæ* or *Xiphosura* into three genera:—

1st. *Belinurus*, having five free and moveable thoracic segments (immediately succeeding the head-shield), and 3 coalesced abdominal segments, to which the telson or tail-spine is attached.

2nd. *Prestwichia*, in which the thoracic and abdominal segments are anchylosed together, but the divisions of the coalesced segments can still be distinguished on the dorsal surface.

3rd. *Limulus*, in which the thoracic and abdominal segments are entirely blended together in one post-cephalic covering.

The two former genera only occur in the Coal Measures; the last named genus appeared first in the upper white Jura of Bavaria (lithographic stone), and thence continued to exist up to the present day, with probably but slight variation in its structure.

The specimen of *Belinurus*, which I identify with *Belinurus trilobitoides*, is enclosed in the half of a nodule of clay ironstone from Kilmaurs; and, though small, is one of the best preserved specimens I have seen. (Plate III., fig. 10). Its total length is fifteen lines,

* See Quart Journ., Geol. Soc., Feb., 1867. Vol. xxiii., pl. i. and ii., pp. 28-37.

of which the head is five lines; the thoracico-abdominal segments, four lines; the telson, six lines. The greatest breadth of the head is eleven lines, or more than twice as wide as long.

The type of *B. trilobitoides*, Buckland, sp., from the Clay Ironstone (Pennystone), of Coalbrook-dale, is not by any means so well preserved as the Kilmaurs specimen, though the former is somewhat larger.

The original specimen will be seen indifferently figured in "Buckland's Bridgewater Treatise" on Geology—(Vol. 2., p. 77; tab. 46, fig. 3.) The specimen itself was presented during last year by the late Mr. W. Anstice, of Madely Wood, to the British Museum.

I hope to be allowed the opportunity to figure this Kilmaurs example for the Palæontographical Society's Monograph on the *Merostomata*, when I come to the division *Xiphosura*.

II. The second genus, *Prestwichia*, is represented by the impression and counterpart of a specimen in Clay Ironstone, also from Kilmaurs; and is referable to *Prestwichia rotundata*, H. Woodw. (Plate III., fig. 8.) It was first noticed as *Limulus rotundatus*, by Mr. Prestwich, who discovered and figured it in his masterly paper on the Geology of Coalbrook-dale.*

The original specimen was referred by Mr. Prestwich to Professor Milne-Edwards, who considered it to be a distinct species; and pointed out the curious membrane-like border to the thoracico-abdominal segments which connects them together.

"The membrane connecting the spines and the circular outline," observes Mr. Prestwich, "are considered to be peculiar."

The circular outline was, however, much aided by the *absence*, in Mr. Prestwich's example, of the cheek-spines, so prominently seen in the Kilmaurs specimen. (Plate III., fig. 8.)

The dimensions of the specimen differ but little in other respects from Mr. Prestwich's type example kindly lent me by that gentleman for comparison, and figured on our Plate. (See fig. 9).

Mr. E. Hollier, of Dudley, sent me in August, 1866, for examination, another well-preserved example of *P. rotundata*, also exhibiting the extremely long cheek-spine.

I have elsewhere † described in detail the points of structure in

* Trans. Geol. Soc., 1840—2nd Series, vol. v., p. 41, figs. 5-7.

† Brit. Assoc. Reports, Nottingham, 1866, edited by Dr. Robertson; also Reports of Sections, published by the Association; see also Quart. Jour. Geol. Soc., for February, 1867.

Limulus, recent and fossil; and the entire group will, in due course, appear in the Monographs of the Palæontographical Society. I shall not, therefore, say more here; but briefly refer to the other forms of Crustacea which have been submitted to me.

III. *Pygocephalus Cooperi*, Huxley. The next Crustacean I identify with the *Pygocephalus Cooperi* of Huxley (Plate III., figs. 1 and 2), described in the Quart. Journ. Geol. Soc., London, 1857, vol. xiii., p. 363, plate xiii. As I have frequently before observed, in the examination of various genera and species of Crustacea from the Solenhofen Limestone, etc., etc., certain species, in dying, always appear to have assumed a particular position—gathering their mantle around them decently, like Cæsar, when assassinated. Certain others, *after death*, appear always to break up in a systematic manner. *Ceratiocaris* is generally found in the Upper Silurian of Lesmahagow, with its tail in its mouth. *Trimerocephalus*, in the Devonian of Newton, always has its head directed towards its tail, and *detached*. Again, one species of Crustacean always occurs with the dorsal aspect exposed upon the matrix; another as invariably presents the ventral. Thus, in *Pygocephalus*, the specimens described by Professor Huxley, in the paper above referred to, have the ventral aspect exposed to view, whilst the dorsal adheres as firmly as possible to the matrix.

Both the specimens from Bilston, and Medlock Park Bridge, Manchester, and the impression and counterpart from Kilmaurs, exhibit the ventral aspect, and closely agree in general appearance. The only additional point of structure which a long and careful examination of the Manchester specimens and the example from Kilmaurs enabled me to detect, has been in the structure of the abdominal segments, and the tail-lobes.

I am able to detect four abdominal segments, and the form of the broad lateral tail-lobes, in the Kilmaurs specimen. (Plate III., fig. 2).

The Manchester example (Plate III., fig. 1), also exhibits the same character, though less distinctly.

Professor Huxley has clearly shown, from the character of the thoracic appendages and the sterna of the thoracic somites, that *Pygocephalus* must be placed near to *Mysis* (the opossum shrimp), among the lower *Decapoda*; but I do not think it has any affinity for the *Stomapoda*, which is the group suggested by him as the

alternative. The only supposed points of resemblance to *Squilla*, in the abdominal somites and caudal fin, disappear when more clearly seen by the additional light afforded by the Kilmaurs specimen; and we are convinced that its affinities are with the higher group. In the transversely divided, half calcareous, half membranous, character of the caudal laminæ, we are reminded of the tail-plates of *Thenus* and *Scyllarus*; and upon comparing the sterna of the thoracic segments in *Scyllarus arctos* (Plate III., fig. 4), the same increase in the width of the posterior segments is observable as in *Pygocephalus*.*

The following is a brief description of *Pygocephalus Cooperi* (Plate III., figs. 2 and 3), in which I have, as nearly as possible, followed Professor Huxley's paper. The *antennules* present two subcylindrical basal joints; the *antennæ* have two large basal joints, giving attachment to a broad oval scale externally and superiorly; while internally, the fusiform base of the internal division of the antennæ is formed by three joints, with the last of which a very long multiarticulate filament is continuous.

The cephalo-thorax has seven pairs of appendages (corresponding, no doubt, to the five pairs of limbs in the ordinary Decapod), and two pair of the external mouth organs (maxillipeds), which, in many of the Macroura, are as large and prominent as the true walking feet. Each limb consists of two parts—the limb proper (or endopodite), and a many-jointed filamentous appendage (or exopodite), which is nearly as large as the limb itself (as in the living *Mysis*).

The segments of the abdomen are well developed and have their epimera produced to a point as in *Scyllarus, Astacus*, &c., not rounded as in the *Palæmonidæ* or undeveloped as in *Mysis*.

The transverse division of the laminæ of the tail can be very distinctly seen in the example from Kilmaurs; but this, like the Manchester specimen, serves to throw no additional light on the carapace.

IV. Another specimen, believed to belong to the same species, was found by the Rev. William Fraser, M.A., in the lower Coal-measures of Paisley; and is figured and described by Professor Huxley, in Quart. Journ. Geol. Soc., Lond., 1862, vol. xviii., p. 420. As it presents a side view of the Crustacean, and all the other specimens

* The sternum of many other Macroura exhibits the same character.

exhibit the ventral aspect, it remains still a very difficult question to decide whether they are really specifically identical.

By the kindness of the Secretary of the Geological Society of London, I have been allowed the use of the original woodcut above referred to, which I here subjoin.

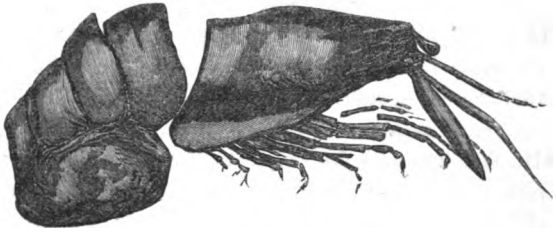

FIG. 1. ORIGINAL FIGURE OF PYGOCEPHALUS (?)
(See Quart Journ. Geol. Soc., London, vol. xviii., p. 421.)

There are two points, however, which appear to indicate distinct characters between the Paisley Crustacean (Plate III., fig. 3),* and the Manchester and Kilmaurs specimens (Plate III., figs. 1 and 2). Professor Huxley suggests (op. cit.) that the interval between the posterior border of the carapace, and the first obvious abdominal segment (see woodcut, fig. 1), was once occupied by the small true first abdominal segment, not much more than half the size of the others. I, however, feel satisfied that the first visible segment is the true first abdominal segment; that the supposed third and fourth segments are really one, and, together with the subjacent portion, form one continuous enamelled surface without any break, thus making the second a large overlying saddle-shaped segment, having a broadly-rounded epimeral border, corresponding with the second segment in the *Palæmonidæ*, which is always larger than the first and third somites.

The subjoined woodcut (fig. 2) is intended to show this altered interpretation, which I venture to offer, of this interesting specimen. I may state that I submitted the original to long and careful examination by myself, and also obtained the opinion of my colleagues, Mr. G. R. Waterhouse and Mr. W. Carruthers, before I ventured to offer this revised outline of the abdominal segments.

* We regret that the artist has failed to convey in this figure a clear idea of the segments, but the woodcut, fig. 2, will supply the deficiency.

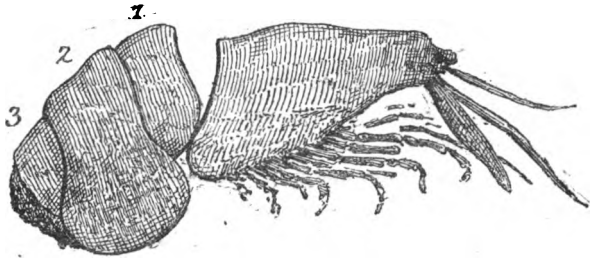

FIG. 2. PYGOCEPHALUS HUXLEYI. H. WOODW.

(Re-drawn from the original specimen in the collection of the Rev. William Fraser, M.A., from the Clay-ironstone of the lower Coal-measures, near Paisley.)

The broad oval scale attached to the antennæ in *Pygocephalus Cooperi*, is long and narrow in the Paisley example (nearly five lines in length). The *Mysis*-like limbs, and the form of the carapace, however, favour their near relationship. Fully believing in its specific, if not generic distinctness, I propose to name it *Pygocephalus* (?) *Huxleyi*, in honour of the original describer.

V. *Anthrapalæmon*, Salter, 1861; Quart. Journ. Geol. Soc., vol. xvii., p. 530. *Palæocarabus*, Salter, 1863; ib., vol. xix., p. 520. Plate III., figs. 5, 6, and 7.

The remaining form to be noticed is that of a Macrourous Decapod Crustacean, found in "Mushet's Black-Band" Ironstone, at Chapel Hall, Airdrie, by Mr. James Russell, and described by Mr. J. W. Salter under the above names.

The earliest known example of this division of the class Crustacea, in the Coal Measures, was obtained by Mr. J. Prestwich, from the "Penny-stone" Ironstone of Coalbrook-dale, Shropshire, and was referred by Dr. Milne Edwards, who examined it, to the *Phyllopoda*, under the name of *Apus dubius* (Trans. Geol. Soc., Lond., 1836, 2nd series, vol. v., p. 413). In 1844 some further remains of this genus were noticed by W. Ick, Esq., F.G.S. (Quart. Journ. Geol. Soc., Lond., vol. i., p. 199). We are indebted to Mr. Salter for the first correct account of these Crustacea in 1861, when he figured the almost entire form from a specimen in the collection of Dr. William Grossart, obtained in the "slaty black-band," 960 feet below the "Ell-coal," at Goodhock Hill, Shotts, Lanarkshire. For this form Mr. Salter proposed the genus *Anthrapalæmon*, a name which, as he observes, "has only a general signification, and is not intended to

indicate a real relation to *Palæmon*," to which genus it has not the least resemblance or affinity.

Mr. Salter also proposed for the Coalbrook-dale form (*Apus dubius*, of Milne Edwards) the sub-generic appellation of *Palæocarabus*. This sub-genus was subsequently (June, 1863) erected into a genus by the same author, and a new species described under the specific appellation of *Russellianus*. I have carefully examined the specimen figured by Mr. Salter (Quarterly Journal, Geol. Soc., Lond., vol xix., p. 520., fig. 1,) which is now in the British Museum, with reference to his description; and I am compelled to conclude that Mr. Salter has been in this instance misled by the displacement of the antennary organs, and that which he has described as the antennæ are, in truth, *the antennules*, and the so-called antennules are the true antennæ.

I am further confirmed in this view by another specimen of *P. Russellianus*, kindly placed in my hands by Professor Huxley, and which I have had figured on the plate (Plate III., fig. 7). By referring to this figure the antenna will be seen (*b b*) almost in their normal position, and one of the antennules (*a*) with its bifid filamentous termination, also remains *in situ*.

If further proof were needed of the correctness of this view, I would simply add, that in all the recent Macroura with which I am acquainted, I know of none in which the antennules are large and simple, and the antennæ small and bifid, the converse being always the case.

As far as the specimens at present found enable me to judge, I see no good grounds upon which to establish two genera on these crustacean remains from the ironstone. The carapaces of both *A. Grossartii* and *P. Russellianus* are similarly ornamented upon their surface, the number of serrations on the margin is the same in both, the rostrum appears to be the same, and the position of the lines dividing the regions of the carapace is alike in both genera; the only differences being apparent, not real, and due rather to mineralization and similar causes. *Palæocarabus* should, therefore, in my opinion, be treated as a synonym of *Anthrapalæmon*, the latter name having two years' priority.

It is so extremely rare to obtain really good crustacean remains in the Coal-measures, that I have been much pleased to be allowed to examine the beautiful little carapace of *Anthrapalæmon*, drawn on the Plate (Plate III., figs. 5 and 6), from Airdrie.

The foregoing brief notice of Carboniferous Articulata which I have submitted would be little worthy a place in the Transactions of this Society, but for the hope that it may induce some of its members to take up more energetically than hitherto the search for insect remains in these Carboniferous ironstone deposits, so rich in fossils, and which have already revealed to us, in our own country, the presence of *Neuroptera*, *Coleoptera*, and *Myriapoda*, and may afford us many more evidences of terrestrial conditions in Palæozoic times.

EXPLANATION OF PLATE III.

Fig. 1. *Pygocephalus Cooperi*, Huxley—natural size—drawn from the original specimen preserved in the Manchester Museum, found in an Ironstone nodule, imbedded in Coal-shale, Medlock Park Bridge, Ashton-under-Lyne. [See Prof. Huxley's paper, Quart. Jour. Geol. Soc., Lond., 1857, vol. xiii. p. 363, plate xiii.]

Fig. 2. *Pygocephalus Cooperi*, Huxley. Coal measures, imbedded in nodule of Ironstone, Kilmaurs, Ayrshire.

Fig. 3. *Pygocephalus Huxleyi*, H. Woodward. Lower Coal-measures, in ironstone nodule, Paisley. [See Prof. Huxley's paper, Quart. Journ. Geol. Soc., Lond., 1862., vol. xviii., p. 420.] See woodcuts, p. 244 and 245.

Fig. 4. Sterna of thoracic somites of a recent crustacean, *Scyllarus arctos*, Linn., for comparison with figs. 1 and 2.

Fig. 5. *Anthrapalæmon Grossarti*, Salter, carapace of (natural size). Coal measures, Airdrie.

Fig. 6. The same enlarged.

Fig. 7. Portion of another specimen from Airdrie, now in the Museum of Practical Geology, Jermyn Street, showing one of the bifurcated antennules *(a)* and the two simple antennæ *(b, b)*.

Fig. 8. *Prestwichia rotundata* (natural size). Coal-measure Ironstone, Kilmaurs, Ayrshire.

Fig. 9. The original specimen of *Limulus rotundatus*, Prestw. re-drawn. [Trans. Geol. Soc. Lond., 2nd Ser., t. 41, f. 5-7.] Clay Ironstone ("Pennystone") Coalbrook-dale, Shropshire.

Fig. 10. *Belinurus trilobitoides*, König. (natural size), from Kilmaurs, in a nodule of Clay-ironstone.

Fig. 11. *Xylobius Sigillariæ*, a chilognathous myriapod, allied to *Julus*, from Coal-measure Ironstone, Kilmaurs Ayrshire (*h* anterior end of specimen).

Fig. 11*a*. Three of the Segments enlarged (showing the tracheæ [t.] ?).

Fig. 12. *Xylobius Sigillariæ*, Dawson, found associated with *Pupa vetusta* in the hollow trunk of a Sigillaria in the Coal measures of the South Joggins Coal formation, Nova Scotia.

Fig. 12*a*. Copy of Dr. Dawson's figure representing a magnified portion of the body with the lateral pores. [See Dr. Dawson's paper, Quart. Jour. Geol. Soc., 1860, vol. xvi. p. 271, figs. 4-9.]

Fig. 13. Mr. Tindall's specimen of *Xylobius Sigillariæ*, from Clay-ironstone band Coal-measures, Cooper's Bridge (drawn of the natural size; *h* head).

Fig. 13*a*. Portion of body of same magnified, showing the legs (as seen under the microscope with a 2-inch lens).

NOTE.—From a careful study of the specimen of *Xylobius Sigillariæ*, from Nova Scotia, in the British Museum, I am convinced that Dr. Dawson's figures—figs. 12 and 12*a*—are intended to be only diagrammatical; the specimen presents much the appearance represented in fig. 11.

LXIV. *On the* IGNEOUS ROCK SECTIONS *at the* RYE WATER, AYRSHIRE. By R. WHYTE SKIPSEY.

(Read January 17, 1867.)

THE length of this stream, taking Blairpark, which is about equidistant from Largs and Kilbirnie, as a starting point, may be roundly stated as seven miles to the town of Dalry. Its course, for the first 2½ miles to the Howrat toll-bar is south-east, from whence it runs south for about two miles, and then taking a sharp turn, almost at a right angle, shortly resumes nearly its former course of south-east into Dalry.

Its upper reaches run nearly along the line of the Largs and Kilbirnie road as far as the toll-bar above mentioned, but it has comparatively little interest for the geologist, as the ground through which it winds its course, although of igneous character, is generally covered with verdure and wanting in any marked features to attract attention. I therefore confine the description to about two miles of the stream below the toll, where the first important section of volcanic rocks occurs, to the upthrown strata of the carboniferous system, about 2¼ miles from Dalry, where it again ceases to possess any novel or more marked character.

As developed at this first section below Howrat toll-bar, water and weathering have worn out considerable cavities, and there are in succession, from the water surface, or rather a little under it, beds of hard porphyritic greenstone, trappean ash, eight feet thick, of a blackish grey colour, graduating into a plain compact amorphous greenstone, ten feet thick, capped by eight feet of dolerite, being a well-defined prismatic trap of rhomboidal form, the whole of these beds being nearly in a horizontal position.

Half a mile farther down another fine outbreak occurs. The beds from the water are successively porphyritic greenstone, and trappean ash, both these varieties being repeated, and all of them somewhat disturbed in position, although not greatly off the horizontal. But the most interesting feature is a dyke of compact blue trap 40 feet broad, vertically intersecting all these beds to the surface, its line being from west to east. It appears on one edge, cutting through the other rocks as straight as a wall, and on the other is oblique, carrying the upper deposits of greenstone and ash on its shoulder, the beds at a very short distance again resuming their natural level; and I wish the position of this intrusive rock kept in view, as I shall afterwards notice the bearing I consider it to have on the upthrow of the ironstone to the westward.

The rocks continue to exhibit this somewhat regular order of deposit, and the same characters, while at one point about a quarter of a mile lower, they are intersected by two remarkable thin beds of hard greenstone, at an angle of 25 degrees, which visibly cut the upper compact greenstone and upper ash bed; but they may not be posterior intrusive ejections, but simply the result of a disturbing upheaval, where the acting power is still invisible. The surface of the ground here distinctly shows considerable deposition of boulder drift.

About three-fourths of a mile below the last described section another occurs, and though the locality had been as barren of other attractions as it is rife of them, this spot alone is one of the finest studies the physical geologist could possibly desire. It is a bold, vertical cliff, of 80 feet in height, from the bed of the burn to the surface, exhibiting a most singular succession of alternations of trappean ash and compact greenstones. Commencing with the water line there are 2½ feet of hard ash, 2½ of soft and friable ash, 1 of hard, 4 of soft, 1½ of hard, 3 of soft, these changes continuing upwards for some distance, till it is capped by a compact greenstone, the beds of harder ash in some instances assuming the character of solid trap. But an actual visit to the locality is the only way to understand this remarkable example of our igneous rocks.

There is another kindred rock found to which I cannot assign a fixed place. It is light purple, with darker spotting of same colour, similar to that found extensively in the Ochill range at Blair Logie, and was long distinguished as Porphyry, or Clay

Porphyry. Rock of this character was formerly used in the manufacture of china ware. It is now classed as Felspar Porphyry.

It is only to be found in detached pieces, often rounded by attrition; and as it occurs both in larger fragments and greater quantity in the higher parts of the stream, I regard its normal position as somewhere in the hilly ground nearer the source, where, though covered with verdure, it would likely be found in some little knolls as a posterior outburst of molten matter to the rocks round it. This appears to be the relation of the similar rock in the Ochills.

Immediately below the section I have last noticed, the stream takes the sudden and short turn to the east already referred to, and the igneous deposits become suddenly arrested by an immense vertical upthrow of carboniferous limestone beds and their concomitant shales, which abut against the trap and ash like a dead wall, as high as the igneous rocks themselves.

This occurs on the north side of the stream, continuing for some hundred yards; and the same calcareous strata are thrown up to the surface on the opposite or south bank, although the lower end of the upthrow, as far as visible, is only to the extent of the sandstones and shales overlying the black band ironstone, these shales being only partially fossiliferous.

Invisible as the agent in this large upheaval is, there can be little doubt of its being an extensive trap dyke of posterior date. Some portions of the limestones and other strata show clear signs of induration and other alterations of their normal characters, and the 40 feet trapfault I have already drawn attention to, forms a good example, on a small scale, of this more extensive upthrow, as in both cases one edge cuts the superincumbent deposits clean through, or entirely disunites them, the other only uplifts them on its shoulder to the extent, at least, of the upper portions.

As this communication is intended mainly to apply to the igneous portions of the locality, there is no need for details as to the carboniferous strata, the general character of these being well enough known; but I may state that the Blackband ironstone partially appears at the lower end of the upthrow of sandstone and shale, and a pit of this metal is wrought about half a mile north-west 50 to 60 fathoms deep, while some little distance farther in the same direction the metalliferous beds (in mining language) "crop out" at the surface.

A "crop out" does not always imply a violent upthrow from

volcanic or earthquake influences, being sometimes the result of extensive denudation of a sloping or angular character, but in this case, as the rise of the ironstone beds lies to the westward, and in something like the direct line of the 40-feet fault across the burn, I regard it as one of the direct results of this intrusive and posterior trap dyke.

The simple minerals disseminated in these rocks are not very varied, and consist of the usual nodules and veins of calcareous spar and quartz, with some fair examples of white and red stilbite, small white prehnites and fine pellucid quartz, approaching in character that of hyalite. Anticipating a natural question, what are the relative positions of these various beds of trap and ash? I may state that in such deposits, as well as in the more regular stratification of our carboniferous system, it is sometimes the case, that in the same line, one class of rock, or other indurated material, is suddenly cut off, and another, in continuation, takes its place. Assuming, therefore, that the Rye Water district may not be altogether an exception to this rule, and also that disturbing forces may have caused some smaller dislocations, I am strongly inclined to the conclusion, that the whole of the often repeated deposits of thin trap beds and ash at the lowest section I have described, underlie, as their true normal position, the upper sections taken from the water's edge, or at least sections from the amorphous greenstone at this point, although the broken and denuded intervals prevent fully tracing this out; because though the stream is neither rapid, nor having much fall as a whole, yet the slope is sufficient, combined with the abrupt breaks occurring in the line of the water at different points, to render this opinion of relative position a probable one; and a closer examination than I had it in my power to make, would be both pleasant and instructive.

Judging from the levels and mineral character of the ground at and near the lime quarry, it is not improbable that the stream there, at a former period, nearly approached the level considerably higher up, that it had then been more widely spread over, with a course for a short distance partially different; and this view appears the most legitimate to account for such total denudation of all other strata at the point, the fossiliferous Limestone being to the very surface, except a few feet of alluvium.

Some of the pools at the upper sections are of a circular form and considerable depth, partly owing to the continuous action of wate

on materials like trappean ash, liable to rapid waste; but this destructive process is greatly facilitated by circular masses of hard trap, occasionally enveloped in the softer rock, as well as by detached pieces of undetermined form falling away from the surrounding mass, and which, when not lying perfectly solid, are kept in motion by the water, and exercise an immense abrading power. They are occasionally seen still in these hollows, but often wear out a path at the lower ends of the pools, and are gradually carried onward by the current.

LXV. Scottish Geology—*its Proofs and Problems.* By David Page, Esq., F.R.S.E., F.G.S.

(Read October 20th, 1867).

Abstract.

The author stated that by its *proofs* he meant what was known, or at least generally admitted, by competent geologists; and by its *problems* what was still doubtful and required further investigation. His object was not to sketch the history of Scottish Geology, which, about the beginning of the century, was a mass of theories and disputations between Wernerians and Huttonians, and which at a later period was little else than a nomenclature of rocks and minerals; but he could not avoid mentioning the names of such men as Hutton, Playfair, Ure, Sir James Hall, M'Culloch, Williams, and Jamieson, as contributing largely, even amidst these unproductive discussions, to the progress of the science. Legitimate geology could date back little more than thirty years, and during that period its advancement in Scotland was indebted in no small degree to the labours of Fleming, Smith, Cunningham, M'Laren, Hugh Miller, and especially to those of Lyell, Murchison, Nicol, Geikie, and others who were still steadily endeavouring to unravel its many complicated physical as well as palæontological problems. He then took in review the various stratified systems, from the Laurentian up to the most recent accumulations, pointing out the known from the unknown, and from the doubtful or what required more minute investigation. Admitting the existence of Laurentian strata in the Hebrides and northwest corner of Scotland, it still required investigation to determine whether these were the true equivalents of the rocks of the St. Laurence, or were merely a set of gneissic schists