2. *On the DISCOVERY, by Mr. ROBERT SLIMON, of FOSSILS in the UPPERMOST SILURIAN ROCKS near LESMAHAGO in SCOTLAND, with OBSERVATIONS on the relations of the PALÆOZOIC STRATA in that part of LANARKSHIRE.* By Sir RODERICK IMPEY MURCHISON, D.C.L., F.R.S., V.P.G.S., and Director-General of the Geological Survey.

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Introduction.—At the last meeting of the British Association, Mr. Robert Slimon brought to Glasgow two remarkable collections of fossils from the extensive parish of Lesmahago, in which he practises as a surgeon. One of these collections was derived from the bands of carboniferous limestone, which there alternate with coal, and are characterized by a great abundance of fine specimens of *Producti*, *Encrinites*, Corals, and other remains peculiar to deposits of that age. The other consisted of specimens of Crustaceans in dark-coloured schist or flag, and to two or three specimens of which my attention, as President of the Geological Section, was fortunately called by Mr. Page. The magnificent collection of Mr. R. Slimon had, in fact, remained almost unobserved, in a hall which few geologists visited.

The moment I cast my eye over these remarkable Crustaceans, which much resembled *Pterygoti*, and saw the matrix in which they were imbedded, it occurred to me that they probably pertained to the Uppermost Silurian zone. It became, therefore, necessary to visit the locality in question, chiefly for the purpose of ascertaining the physical relations of the dark schist with large Crustaceans to the Old Red Sandstone. For, as I was aware that the genus *Pterygotus* had been found as low in the Silurian rocks as the Upper Caradoc band, it might prove that there was the same great hiatus near Lesmahago as had up to this time been supposed to prevail all over Scotland, and that no representative of the Uppermost Silurian existed. On the other hand, the band in question might prove to be that which I shall endeavour to show it is—viz. the true representative of the highest Silurian zone, as developed in Herefordshire, Shropshire, and Westmoreland in England, in Russia on the Continent of Europe, and also in North America.

Having requested Professor Ramsay to accompany me, we visited Lesmahago together, and there found to our gratification, that the worthy and modest Mr. Slimon had not only a much richer collection of the fossils in question than he brought to Glasgow, but had also an accurate acquaintance with many of the prominent and detailed features of the tract. Guided by him to the best natural sections, and particularly to the spot on “Logan Water,” hitherto

famous only in Scottish song, where he had found the Crustacean fossils, we afterwards endeavoured to obtain a general notion of the relations of all the rock-masses of the district. For the better understanding of the subject I induced Mr. Slimon to prepare a rough geological map, which is exhibited, and to the sides of which he has annexed two sections explaining the order of the carboniferous strata of two tracts in his neighbourhood (see Appendix, p. 25). I also submit a rude approximation to what will in the sequel be better worked out, by exhibiting the County Map of Lanark, on which I have endeavoured to combine the outlines of Mr. Slimon's Map as correcting those of other observers; no one having previously indicated any more ancient rock in this tract than the Old Red Sandstone; the tract which I now consider to be Silurian having usually been coloured as Carboniferous*.

I must at once apologize for the imperfections necessarily attached to this slight sketch of a district of which no real map exists. As soon, however, as the Engineer Corps under the able direction of Colonel James shall have published the first outlines of the Ordnance Survey, I can assure my associates that the Geological Surveyors will vigorously set to work to determine all those relations which are now briefly touched upon in an essay, which is simply intended as a temporary frame to hold together a few materials which are of deep interest in palæozoic geology.

General Relations of the Rocks of the Lesmahago District.—In a former communication, I invited attention to the general direction of the great masses of the Silurian rocks of the S. of Scotland, which have been described by various authors under that name since the discovery in them of many well-known Silurian fossils†. I then suggested, that judging from some of those organic remains, as found in the environs of Girvan, there were indications, in that parallel, of an ascending order from the Lower Silurian rocks (which unquestionably form the great mass of the S. Scottish greywacke) to the Upper Silurians. At the same time it was noticed, that the strike of the Girvan strata would carry them nearly to the Silurian rocks of the Pentland Hills S. of Edinburgh, which have the same general direction, *i. e.* nearly from N.E. to S.W. Now, if a line be drawn from the rocks N. of Girvan to the northern face of the Pentland Hills, it is seen to pass over an intervening tract, throughout which basins of carboniferous rocks, surrounded by girdles of old red sandstone and diversified by a great abundance of igneous rocks (porphyry, greenstone, &c.), are represented in all the published geological maps. The discovery made by Mr. Slimon of fossils which prove to be of Upper Silurian age, over a considerable area in the extensive parish of Lesmahago (for this Scottish parish has a length of twenty-five miles), has advanced therefore the northern frontier of the Silurian or slaty rocks; some of the localities in question being not less than twenty miles to the north-west of their previously defined boundary. The extent to which the Lesmahago Silurians may be hereafter shown to

* See the maps of M'Culloch, Phillips, Knipe, &c.

† Quart. Journ. Geol. Soc. vol. vii. p. 137.

be connected upon the surface with those of the tracts around the Lead Hills and other parts of Ayrshire and Dumfriesshire, on the S. and S.E., must be a work of future labour. That work will demonstrate whether these Lesmahago rocks constitute an advanced Silurian promontory or headland, or whether, as is most probable, they form an outlier of that age.

The large parish of Lesmahago is pre-eminently distinguished in its western part by dome-shaped hills, which rise to the S.W. of the River Clyde, and on the left bank of that river, where it forms the well-known beautiful Falls of Bonnington and Stonebyres, near the town of Lanark. The rock over which the Clyde cascades is the Old Red Sandstone, which formation, extending to the W. and S.W. to the village and parish of Lesmahago, is overlaid on the north and south by carboniferous limestones and coal; whilst on the south-west it is underlaid by the dark and schistose rocks to which attention is now specially invited.

Upper Silurian Rocks.—The relations of these dark grey, schistose strata of clay-slate to the Old Red Sandstone are seen on the banks of the Nethan River and also on those of other tributaries of the Clyde, particularly the Logan Water, on each of which rivers Mr. Slimon has marked the junction between the grey Silurian and the Old Red rocks. The Silurian beds rise up into several hills of considerable altitude, one of which (Nutberry, 1715 feet above the sea) we ascended. Judging from the outline of the country, and the extensive range of similar high moorlands, I am disposed to think that these rocks may be found to spread north and westward over the hills

of Dunside and Middlefield, 1300 to 1500 feet high, and may even range to Cairn Table on the south, the summit of which according to the Trigonometrical Surveyors is 1944 feet above the sea. Advancing eastwards from the range of hills on the flank of Nutberry, in one part of which Mr. Slimon discovered an Orthoceratite, and descending the Logan Water to about a mile below the farmhouse of Dunside you reach the uppermost band of the grey strata in which were discovered those remarkable Crustaceans, which have been above referred to.

The lowest portions of the Silurian rocks which fell under the inspection of Prof. Ramsay and myself are those which are traversed by the Nethan River as it flows from the Priest Hill and Nutberry Hill to Cumberhead. Several dislocations and convolutions which are seen on that line among the Silurian strata, as well as in the contiguous Old Red, are well explained by the frequent protrusion of porphyry (usually a red quartziferous porphyry). On the whole, however, it was manifest to both Prof. Ramsay and myself, that in receding from the Old Red boundary, and in ascending to the higher hills by the course of the Nethan, we made a gathering, descending section—because the strata succeeding to each other with a prevalent dip to the N.E. or E.N.E. consisted successively of differently constituted materials. Thus, whilst the uppermost strata were dark grey and schistose, other layers of lighter colours were more siliceous and formed stone-bands. These are followed by other courses of shale and schists in which are nodular concretions, occasionally calcareous, in which we looked in vain to find a few fossils which could have led us to suppose what they might very well prove to be from mineral aspect, the representatives of the Wenlock formation. It is from one of these strata that Mr. Slimon procured the Orthoceratite above alluded to, but which is too imperfect to be specifically determined. With some undulations and several breaks, particularly in the proximity of the intrusive porphyry, all these Silurian strata are inclined towards the E.N.E. and N.E., and at angles varying from 12° and 15° to verticality where they roll over in flexures.

The inferior beds exposed in the section of the Nethan are here and there mineralized, and specially so where trap-rocks, chiefly green-stone, have penetrated the strata; veins of lead-ore and much sulphate of barytes being there apparent on the surface.

The section, however, which best exhibits the relations of the Silurian rocks to the Old Red Sandstone is seen on the banks of Logan Water between the farms of Dunside and Ach Robert. The last of the decidedly dark grey and schistose beds observable in descending from the flanks of the Silurian hills (Nutberry, &c.) are those in which all the fossils described by Mr. Salter (see p. 26) were found by Mr. Slimon. These dark fossiliferous rocks, the clay-slate of mineralogists, are immediately overlaid by and pass up into red sandstone, in which there are several alternations of more or less greyish or greenish-grey bands; the whole, like the beds in the Nethan, dipping to the E.N.E. or N.E., as represented in the generalized Section, p. 17.

Old Red Sandstone.—In the traverse along the Logan Water I did not observe any unconformity between the grey beds with Crustaceans and other fossils and the overlying red sandstones, the lowest

courses of which are marked upon Mr. Slimon's map as "Red Silurians." For my own part, however, I would rather consider these red strata as constituting the base of the Old Red Sandstone, because they graduate up into and alternate with pebbly conglomerates which are largely developed near Ach Robert and Waterside.

Some of the porphyries which are associated with the red rocks in this part of the series seemed to be interstratified and of age contemporaneous with the sandstones with which they dip symmetrically, and like which they are jointed and exhibit the way-boards of sedimentary deposits. In mineral characters and in their interstratification with red sediments, these rocks, though of much older date, present much the aspect of some of the porphyries of the Rothe-todteliengende of the Permian age in Germany.

The conglomerates of the Old Red of this tract differ strikingly from those of the same age in the North Highlands, where the so-called lower conglomerate is usually a very coarse breccia, the huge fragments of which are more or less angular; whilst here they are all worn and rounded pebbles, the largest of which scarcely ever reaches a foot in its greatest diameter.

Most of the pebbles consist of grey and pink quartz-rock, but these are mixed with other varieties of crystalline and some igneous rocks. This conglomerate zone, which is fairly interstratified in red sandstone and ranges from N. to S., as laid down on Mr. Slimon's map, is much nearer to the dark grey Silurian on the Nethan river than it is to the same rock on the Logan Water; whilst on the Kype Water the two rocks are still further removed from each other. Time and detailed examination will determine whether this deviation of outline be due to breaks and unconformable arrangements, or simply to changes in the degree of inclination of the strata. By comparing the only watercourses which we examined, I am led to think that the difference of the angle of dip may sufficiently explain these diversities of superficial area; because on the Logan Water we found the inclination varying from 7° to 12° only on an average; the red beds with imbedded porphyries and conglomerates as well as the inferior grey beds sloping off to the N.E. or E.N.E. at these low angles except where they rolled over bosses of porphyry. On the Nethan banks, on the contrary, the beds are more highly inclined.

In ascending order the Old Red Sandstone, including all that portion of it which lies above the conglomerate and extends by Lesmahago to the Clyde and Lanark, is usually of a lighter colour and freer quality than the subjacent beds, and occupies a very varied outline in reference to the carboniferous limestone and coal-fields on either side of it and under which it is seen to dip. On the banks of the Nethan Water where we examined them, the junctions are much broken, and on the whole it would appear, that the older rocks have been so convoluted as to form the southern edge of the great central Scottish Coal-field, or the complete girdle of the Douglas coal-basin; the S.W. side of which is flanked by the Old Red of the Hawkshaw Hills, and also, according to Mr. Slimon, by the Silurian rock of Bremerside Hill.

Lower Carboniferous Rocks.—The lower edges of the Carboniferous rocks being attained, the ascending series from them through

various bands of limestone and interstratified courses of coal and iron-ore is admirably exposed in the beds of some of the watercourses which flow from the loftier hills of older rocks*.

Upon the only instructive traverse which we made, and to which we were conducted by Mr. Slimon, viz. up the Coal Burn and along the steep banks of the Poniel Water, which flow through grounds now occupied by the productive coal and iron works of Brockley, &c., we were highly gratified in seeing a splendid development of limestones, shales, sandstones, coal, and ironstone, a precise account of which and an accurate register of the fossils in each zone are much to be desired. We examined the so-called "black band" of ironstone at Coal Burn (see Appendix, p. 25), and found it to be associated with an indurated bituminous shale, which in Staffordshire would be called "black bat." The strata being very slightly inclined, the ironstone (8 inches thick) is worked by a gallery on the side of the slope. In this locality the black band dips under a succession of strata of shale and sandstone, to which five seams of coal are subordinate as well as one band of limestone. On the other hand, the black band is here underlaid, as seen indeed in the open sections of the watercourses before alluded to, by a much thicker succession of similar shales and sandstones, including seven seams of coal and three limestones. The lowest of the latter is a hard, concretionary, nodular, white limestone, which immediately lies upon the Old Red Sandstone; but no fossils have yet been found in it. The massive and thick-bedded limestone, however, which overlies it, with the intervention of some sandstone only, is laden with the large and small *Producti*, a profusion of *Encrinites*, and many characteristic shells, some of which are also found in the limestone near the top of the series.

As Mr. Slimon has obliged me by preparing a working section of the beds passed through in this tract of Coal Burn and Brockley, and another of the Auchenheath Pits, situated on the opposite or northern basin, and not far from the junction of the Nethan with the Clyde (see Appendix, p. 25), the geologist who compares them will see how, with a strong general petrographical resemblance, the order of the carboniferous strata on the other side of the dividing Old Red of Lesmahago is distinguished from that upon the south flank of the same formation; particularly in the much fuller development of strata above the "black band" of ironstone. At Auchenheath the shafts pass through a much more copious series of sandstones, shale, and limestone before that iron-ore is reached; there being no fewer than five calcareous zones above it. For, whilst in a much less vertical space in the Coal Burn tract there are five seams of coal above the black band, the very deep sections of Auchenheath there present three seams of coal only superior to that ironstone. If it be objected that the black band is merely a casual and accidental layer of rich iron ore, and that when these fields shall have been elaborately worked out, similar ore may be found to exist in more courses than one, and at various levels—a feature which is by no means improbable,—still in reference to the very limited area now under consideration, where the

* A notice of the Lesmahago and Douglas Coal-field was read by Mr. Bryce at the British Association Meeting at Edinburgh; see Brit. Assoc. Rep. 1850, Sect. p. 77.

two localities compared are a few miles only distant from each other, the geologist must see, by the facts laid before him, how very rapidly mineral matter of one sort thins out and is represented at a short distance only by a very different stratum.

When the trigonometrical surveys of these important mining tracts shall have been published, the geological surveyors will determine the extent to which the coal-fields of Scotland can be distinguished as consisting of lower and upper masses, a subject already treated of by Mr. Page*, and will explain with precision whether to the south of Edinburgh there are or are not strata of younger age than those now alluded to. In the mean time it is clear, that all the coal-tracts around Lesmahago belong to the older or Mountain Limestone series. They are, in short, of the same age as the coal-fields of North Northumberland, Berwickshire, and other tracts in Scotland; and in foreign countries, as those of the Donetz in Southern Russia, and of Kosloo in Asia Minor, both of which are subordinate to bands of Productus-limestone.

Igneous Rocks of the District of Lesmahago.—Allusion has already been made to certain porphyries, some of which alternate with bands of the Old Red Sandstone and conglomerate, and others of which seem to have been erupted through the Upper Silurian rocks and the Old Red also. According to the map of Mr. Slimon, these porphyries, of which there are two varieties, felspathic and quartziferous, are both chiefly associated with the Old Red Sandstone, and never occur in the coal-fields.

One of the largest bands of porphyry traverses the River Clyde below the Fall of Stonebyres, and, trending to the S.W. and S. through the Old Red Sandstone, sends off several branches, three or four of which curve round and cross the Nethan River.

Another branch runs to Dunduf, from whence it ranges to Todlaw. This last-mentioned dome was probably a great centre of eruption, from whence a long course extends from Ach Robert to the flank of Bremerside Hill.

In short, these porphyries seem to have been the active agents, which, at one period alternating with the red sediments, afterwards burst through the Old Red Sandstone and raised it into those dome-shaped masses which separate the great coal-fields of the Clyde from the detached coal-basin of Douglas. Tinto Hill and its south-western ramifications constitute another and much more extensive outburst of similar porphyry, which forms the south-western portion of that long range of igneous rocks which extends on the E.N.E. to the Pentland Hills.

But independently of these porphyries, the parish of Lesmahago is distinguished by a remarkable dyke of greenstone, which Mr. Slimon has traced from the coal-field of Douglas, across the Old Red Sandstone of the Hawkshaw Hills, and then through the porphyry zone of Todlaw and the Old Red Conglomerate, and which he has further followed for several miles across the heath-covered Silurian hills in nearly a rectilinear course. Where Prof. Ramsay and myself examined this dyke, *i. e.* high up the Nethan Water, we found it to be a fine-grained greenstone of about 25 paces in width; having the direction of 33° S. of E. The Silurian schists on either side of it

* See Report British Assoc. Advancement of Science, 1854, Sect. p. 92.

preserved their prevalent slight inclination to the N.E. and seemed to be but slightly altered. The prisms of the greenstone being as usual at right angles to the cooling masses on either side, really resembled beds (slightly disturbed only) in the general mass of the schist or shale—so much do the two classes of dark rock resemble each other, until the hammer is applied to them—and even then the trap-rock is seen to have assumed to a considerable extent the scaly or fissile character of the Silurian deposit which it bisects.

On following this dyke from the Nethan to the very summit of Nutberry Hill which it occupies, we observed that its width (varying somewhat in different spots) was marked by the grassy verdant tint of the vegetation above it, as contrasted with the brown colour of the heath on either side of it upon the schist.

In descending the Logan Water, and at a short distance from the junction of the Upper Silurian and Old Red, a boss of intrusive porphyry appears, and again red sandstones follow with another and stronger course of porphyry which has a hornblendic character. A conglomerate then appears, succeeded by other red fissile sandy schists, and next red rocks alternating with light greenish or bluish-grey and slightly micaceous sandstones, which are, in fact, intercalated in red rocks; other thin courses of porphyry are then observable, and then a pebbly conglomerate, between which and the ordinary Old Red Sandstone of the parish of Lesmahago there is a considerable development of porphyry, which seemed to be regularly bedded and to dip away in conformity with the sandstones.

Whilst some of this porphyry has all the aspect of having been emitted contemporaneously with the sandstone and aggregated under the same waters in which that formation was deposited, other bosses, one of which is hornblendic, have manifestly been intruded into the strata after their formation; for both the conglomerates and the sandstones are seen to be arched over such intruding rock and occasionally dislocated by its protrusion.

Conclusion.—The preceding sketch of the general relations of the palæozoic and igneous rocks of the parish of Lesmahago indicates the value of the researches of Mr. Slimon, more particularly in his discovery of the uppermost Silurian fossils. Having incited that gentleman to send to the Museum of Practical Geology a complete suite of his carboniferous fossils, all observations on the deposits of that age are reserved for a future occasion.

In regard to the Old Red Sandstone it has been shown, that its inferior member in this district is dovetailed into the grey Silurian schists and flagstones beneath it. Hence I conclude, that the greater part of the red rocks exposed on the slopes of the higher greywacke hills of the parish of Lesmahago belong truly to the lower division only of the system of deposits which in the North Highlands (Sutherland, Caithness, and Ross) constitute the Old Red Sandstone, as there composed of inferior sandstone and conglomerate, central flagstones and bituminous schists, and overlying red sandstones. If my readers will refer to the abstract of a communication which I made to the Geological Section at the last meeting of the British Association, copies of which I have addressed to this Society, they will see how

different in grandeur and diversity of structure is the great North Highland Series, when compared with the Old Red Sandstone of Lanarkshire. This last constitutes, as I am disposed to believe, little more than one of the three great divisions of that vast northern series which is, I conceive, a full equivalent in time of all the rocks called Devonian in any region of Europe.

In Lanarkshire neither the micaceous red flagstones associated with the conglomerates, nor the beds beneath or above them, have as yet afforded any trace of fishes, even under the vigilant eye of Mr. Slimon. If such should be discovered in the uppermost of these red strata of Lesmahago, and that they be found to belong to *Holoptychius*, then indeed we may infer that we have here a representative, though on a very small scale only, of the upper member of the group. But, not speculating further on this collateral point, I beg to conclude with a very few observations upon the Crustacean beds of the newly discovered Upper Silurian rocks of Scotland.

Rising out as these dark grey beds do, upon the Logan Water banks, from beneath the Lower Old Red, they occupy precisely the same horizon as that uppermost zone of the Silurians of Shropshire and Herefordshire which includes the bone-bed and the Downton Castle building-stone, and to which, as it graduates up into the Old Red, the name of "Tilestones" has from its flaglike character been given.

Near Ludlow, Hereford, and several other places, the thin course with small fish-bones has been traced over an extensive area, and in several places where the fishes are wanting the band is still well characterized by the associated large Crustaceans, chiefly *Pterygotus*. Recently Mr. Banks has discovered in those strata near Kington which I formerly referred to this age, some very beautiful forms of this genus, of which he sent me the drawings and descriptions, and which have been submitted to the Society. Together with the *Pterygoti* Mr. Banks found fossils formerly confounded with the genus *Cephalaspis*, Ag., but now separated. The species are new, but much like *C. Lloydii*, Ag., hitherto known only in the overlying Old Red.

Large Crustaceans of the group of *Eurypteridæ** (Burmeister), to which the *Pterygotus* belongs, have also been found in the Tilestones of Westmoreland, and it is curious to observe that in most of these localities they are accompanied by the small *Lingula cornea* (Sil. Syst.) of the Ludlow district.

In Podolia similar large Crustaceans analogous to *Pterygoti* were found in strata rising out from beneath rocks which are known to be of Devonian age, and to these Dr. Fischer gave the name of *Eurypterus tetragonophthalmus*. Recently M. Eichwald† has detected several of these large Crustaceans, one of which he figures as *Eurypterus remipes*, Dekay, in the Isle of Oesel in the Baltic,—i. e. in a limestone which my colleagues and myself referred to the highest Silurian stage; so that in the North as in the South of Russia, the zone under consideration, when clearly exposed, is everywhere characterized by large and peculiar Crustaceans of this group, no one of which has ever been found low in the Silurian rocks.

* See Palæoz. Fossils Cambridge Museum, Fasc. 1.

† Bull. Soc. Imp. Nat. Moscou, 1854, vol. xxvii. p. 100.

In North America it has been long known, from the writings of DeKay and Harlan, that large *Eurypteri* occur in a so-called black greywacke slate at Westmoreland in Oneida County, New York, which will probably be found to be on the parallel of the Upper Ludlow Rock. The discovery of the large *Eurypterida* in the same zone as at Lesmahago in other regions is therefore peculiarly satisfactory. It is however to be observed, that in tracts far removed from each other, different, though closely allied, species make their appearance. Thus, whilst the *Pterygotus* is perhaps the usual and most characteristic type, the species found in Scotland* is said to be different from that known in the Silurian region. Near Kendal in Westmoreland the genus *Eurypterus* occurs with *Pterygotus*; whilst in Russia the former seems to be the prevalent genus.

In the Lanarkshire case, Mr. Salter finds the same sculptured plates which have been usually referred to the *Pterygotus*, and also the small *Lingula cornea* and *Trochus helicites* of the Uppermost Ludlow Rock. With these he has also detected in the rich collection of Mr. Slimon five or six new forms of a large crustacean which he terms *Himantopterus*, and describes in the following memoir, p. 26. With them too, another genus, the *Leptocheles* of M'Coy†, has been found, which the fine specimens now collected show to be simply the caudal portion of the *Ceratiocaris*, a genus which is found as low as the Wenlock Limestone. And yet, with these distinctions of varying forms, which are everywhere recognizable in the Silurian zones of similar age in distinct regions, we find this group of animals consistently and uniformly defining the same zone of sediment over the Northern hemisphere.

Wherever these large Crustaceans are found, and with them small *Lingulae* and other fossils, we may be sure that we are at or near the very summit of all rocks to which the term Silurian can be applied, and that the next overlying stratum belongs to the first great æra of fishes, the Devonian or Old Red Sandstone; for the thin transition-band now under consideration still remains what I stated it to be twenty-one years ago, the lowest in which the trace of a true vertebrated animal has been detected.

In Scotland, where we had despaired of finding any representative of the Ludlow formation, the discovery of Mr. Slimon is indeed highly gratifying. Perforated as are the lower edges of the coal-basins which occur along the northern frontier of the Silurian rocks of the South of Scotland, by various igneous rocks which have to a great extent upheaved the Old Red Sandstone, we may, after this discovery, look to the detection of other links to connect the Orthoceratite-rocks of the Pentland Hills with the shelly deposits of Girvan and the younger strata of Lesmahago, and thus evolve a full series of both Lower and Upper Silurian Rocks in North Britain, where their very existence was until recently almost ignored.

* I have directed that these remarkable Crustaceans, as well as others of the same age in Herefordshire, be figured and fully described in a Decade of the Memoirs of the Geological Survey of Britain.—R. I. M., January 1856.

† See Pal. Foss. Cambr. Mus. Pl. I E. fig. 7; Quart. Journ. Geol. Soc. vol. ix. p. 13; and also a full recognition of Prof. M'Coy's ability in separating some of these crustaceans from fishes with which they had been confounded, in "Siluria," p. 236.

APPENDIX.

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Sections of the Coal-measures near Lesmahago, by Mr. R. SLIMON.

<i>Section at Coal Burn.</i>		<i>Section at Auchenheath.</i>	
Superficial soil, sand, and gravel. ft. in.		Superficial soil, sand, and gravel. ft. in.	
Blaise and limestone.....	10 0	Freestone	
Blaise.....	4 0	Sand shales with flowers	
Freestone	15 0	Faikey blaise and freestone.....	40 0
Blaise and blue freestone	4 6	Limestone	1 6
Blaise.....	3 6	Blaise	10 0
Gas and dross coal	1 4	Arden limestone	5 0
Faikey blaise	4 0	Fire clay	1 3
Freestone and blaise	21 0	Hard sandstone	2 0
Dross coal	3 6	Freestone	30 0
Fire clay.....	0 11	Tills	4 0
Dross coal, with 6 inches } Horn coal	3 11	Limestone	1 6
Fire clay.....	2 0	Blaise	8 0
Freestone	7 0	Limestone	3 8
Blue faikes.....	4 0	Fire clay	4 0
Coal	3 0	Freestone	8 0
Fire clay.....	3 6	Blaise	4 0
Coal	2 9	Freestone	60 0
Freestone	6 0	Blaise	10 0
Faikes	2 0	Limestone	5 8
Blaise.....	4 0	Fire clay	5 0
<i>Black band</i> , ironstone	0 8	Freestone	6 0
Blaise.....	3 9	Blaise	5 6
Clay band, iron	0 7	Freestone	43 0
Blaise.....	3 0	Blaise	6 0
Smithy coal	0 9	Whinstone	5 9
Fire clay	1 6	Blaise	9 6
Coal	4 0	Freestone	4 0
Bastard stone	0 7	Blaise	0 10
Coal	4 7	Smithy coal	1 4
Fire clay.....	16 0	Faikes clay	1 6
Faikes and blaise	8 0	Coal	4 0
Clay band, iron	0 3	Faikes	5 0
Blaise.....	6 0	Freestone	4 0
Clay band	0 4	Blaise	4 0
Blaise.....	2 4	Faikes	2 0
Clay band	2 2½	Gas coal	0 10
Blaise.....	12 0	<i>Black band</i> , ironstone	0 5
Fire clay	3 0	Tills, ironstone balls	3 8
Coal	1 6	Coal	0 8
Blaise.....	3 0	Fire clay	1 6
Coal	1 0	Dross coal	3 0
Blaise.....	12 0	Freestone	7 0
Freestone and blaise.....	11 0	Blaise	8 0
Fire clay and blaise	3 0	Freestone	9 0
Coal, with 6 inches of stone... 6 0		Blaise	20 0
Faikes and tills	42 0	Freestone	4 0
Blaise and ironstone band ... 12 0		Blaise	4 6
Coal, stinking	5 0	Freestone	2 0
Fire clay.....	1 6	Coal	0 10
Blaise.....	5 0	Tills	5 0
Freestone	16 0	Gas coal	1 9
Blaise and ironstone.....	12 0	Ironstone	0 4
Limestone	1 8	Fire clay	1 3
Grey blaise	20 0	Coal	0 6
Ironstone	0 8	Freestone.	
Blaise and limestone.....	46 0	Limestone.	
Sandstone.		[The coal is 35 fathoms above this.]	
Nodular limestone.			
Upper Old Red.			
Old Red Sandstone.			
Red Silurian (Slimon).			
Silurian, upper black.			