GASTEROPODA (NUCLEOBRANCHIATA).

Bellerophon decussatus, <i>Flem.</i>	Orchard.
————— Dumontii, <i>D'Orb.</i>	Nitshill.
————— striatus.	 Do. and Orchard.
————— Leveilleanus, <i>De Kon.</i>	Orchard.
————— Urii, <i>Flem.</i>	 Do. and Nitshill.

PTEROPODA.

Conularia quadrisulcata, <i>Sow.</i>	Wauk Mill glen.
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CEPHALOPODA.

Actinoceras giganteum, <i>Sow.</i>	Arden and Orchard.
Cyrtoceras rugosum, <i>Flem.</i>	Orchard.
————— unguis, <i>Phill.</i>	 Do.
Goniatites striolatus, <i>Phill.</i>	 Do.
————— excavatus, <i>Phill.</i>	Nitshill.
————— vesica, <i>Phill.</i>	Orchard.
Nautilus ingens, <i>Mart</i>	Arden.
————— subsulcatus, <i>Phill.</i>	Orchard and Nitshill.
————— globatus, <i>Sow.</i>	Orchard.
Orthoceras attenuatum, <i>Flem.</i>	 Do. and Nitshill.
————— subcentrale, <i>De Kon.</i>	Orchard.
————— undatum, <i>Flem.</i>	Arden and Nitshill.

PISCES.

Cochliodus magnus, <i>Ag.</i>	Arden.
Megalichthys Hibbertii, <i>Ag.</i>	Hurlet.
Psammodus porosus, <i>Ag.</i>	Arden.
Rhizodopsis minor, <i>Ag.</i>	Orchard.

XVII. *Sketch of the CARBONIFEROUS BASIN of DALRY, Ayrshire.*
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(Read January 7, 1869.)

THE part of North Ayrshire to which the following remarks refer is generally known, geologically, by the name of the Dalry basin. It has an area of nearly thirty square miles of carboniferous strata, is of a triangular form, and lies in the parishes of Dalry, Kilbirnie, and Beith. The south-west angle extends into the north of Kil-

winning parish, and, from the other two angles, proceed long narrow extensions, the one running into the Castlesemple valley to near Howood, Renfrewshire, where it is separated from the central Scottish basin by a narrow ridge of trap. The other angle also extends into Renfrewshire, by the Lugton valley, to Shelford, where another ridge of trap separates it from the carboniferous strata of the Levern valley, the breadth of the trap being about two miles. On the south it is separated from the main Ayrshire basin by a very large greenstone dyke, which causes a displacement of the strata to the extent of nearly 200 fathoms.

It is surrounded on two sides by hills formed of trap and volcanic ash, the latter predominating in their base, the former near their summits. A very characteristic bed of ash, found in the base of the hills, extends beneath the lower limestone, and is found to occur wherever the limestone is seen cropping out towards the trap hills. Some of these ash-beds have a thickness of 30 feet, and are of an amorphous character; others have a regularly stratified appearance. Sections of them are to be found in Rye water and Swinlees burn, Dalry; Puduff burn, Garnock; and Maich water, Kilbirnie; Roebank water and Gateside burn, Beith. The varieties of trap in the hills are not great, a kind of porphyritic claystone predominating, with greenstone, and a variety of amygdaloidal porphyry. The greatest difference is to be found at Cuffhill, Beith. Whatever has been the origin of this rock, it has certainly passed through a metamorphism to which the others have not been subjected. It lies on a higher horizon than the surrounding hills, has a porphyritic character near the base, but as it nears the summit it has the appearance of a highly indurated sandstone. It easily splits into thin flags, with a rough irregular cleavage. Outliers of the same kind of rock are found at Brownmuir-hill and Blalochside.

Minerals.—These hills are not rich in minerals. Impure jasper, barytes, prehnite, calcareous spar and rock crystal are found in various places. Some fine specimens of the latter are found at Lochridgehills, Dunlop, in an upthrow of columnar basalt, the finest section of its kind in the district.

It would be beyond the scope of this paper to enter into a discussion upon the age of the igneous rocks of the district; but from evidence furnished by sections in the various glens, it is found that the trap which forms their summit has a higher horizon than the ash upon which the lower limestone rests. I consider

their age to be subsequent to that of the limestone, and from an ash-bed full of water-worn felstone pebbles, which lies in the Kilbirnie hills above the horizon of the limestone, they would seem to be of sub-marine origin.

Lower Limestone.—Sections of this stratum are found cropping out all around the basin towards the hills. To the east of the village of Beith it is well developed, being above 100 feet in thickness. Taking this section as a true representative of its lithological development, a full description of it may serve as a standard of comparison with other parts of the basin. The lowest carboniferous deposit is a bed of white clay about one foot in thickness. It is partly fossiliferous, pieces of carbonised wood being found, but no marine remains as far as I know. Over this lies a bed of coal with the fossil wood changed into the sulphuret of iron. Above the coal lies a bed of shale three feet thick entirely composed of crushed shells, cemented together by a clay paste. These make their appearance so close above the coal that the under surface of the shale is often seen covered with them, especially *Lingula* and *Crania*. The scales, bones, and teeth of *Amphicentrum granulosum*, originally described by Dr. Young, the president of the society, are mostly found in this under layer. A number of finely preserved teeth of *Cochliodus magnus* have been found along with those of *Petalodus Hastingsiae*, *Ctenoptychius serratus*, and the scales of *Megalichthys Hibberti*. These are all rare in this shale, but the specimens are generally well preserved. Good specimens of shells are found, the chief being *Edmondia rudis*, *Modiola elongata*, and various species of *Producti*, especially in the topmost layers, which become changed from an argillaceous to a calcareous character. In the bottom layers, *Lingula* and *Crania* are in considerable abundance, but they soon disappear and are afterwards very rare in the limestones of the district. At Roughwood, to the west, and Lyonshield to the east, of Broadstone, *Myalina crassus* is the representative shell. This is the more worthy of note, as in the quarries opened between these places no specimens of this shell are found. Near the base of the limestone good specimens of crinoid stems are obtained.

Above this lies the limestone divided at Broadstone by forty feet of divisional shales into the lower and upper beds. The "main post" lies at the bottom of the series, and when microscopically examined is found to be composed of very small crinoids, in a

fine calcareous paste. It is the purest carbonate of the lower beds, and averages about five feet in thickness. It is not very fossiliferous, still *Producti* and *Spirifera*, and sometimes large specimens of *Nautilus* and *Orthoceras* have been found, along with fragments of *Trilobites*, and various genera of sharks' teeth, one of which, *Psammodus*, first appears in the Beith limestones. Above this lies the two feet "post." As its name indicates, its average depth is two feet, and it never is found above three feet in thickness. Its fossils are identical with those of the main post, only differing in that, while the latter is encrinital in character, the former is composed of a species of *Lithodendron*, the upper half containing scarcely anything else. Over this lies a calcareous shale about two feet thick, the under half of which is full of corals, some of them very large, belonging to the genera *Cyathophyllum*, *Chsiophyllum*, *Zaphrentis*, and *Amplexus*. The two latter are rather rare, but the two former may be gathered by the bushel while removing the under half of the shale. Above this the limestone becomes more impure and flaggy. The bed above the shale is called the "blue stone" post, from its having a dark blue colour when split open. It is irregularly developed, running from two feet to thirteen feet and more in thickness, the changes taking place at no great distance. This bed is highly fossiliferous, especially in a bed of greyish coloured rock, not very regularly developed. It has yielded above a dozen species of sharks' teeth, with shagreen and fragments of bones. Among the various shells found in this bed *Terebratula hastata* is the most abundant. Above this, lies a bed of coarse, arenaceous limestone of from four to ten feet in thickness. It is not very fossiliferous although not void of shells, a few specimens of *Terebratula* and *Spirifera* being found in it. Over this lie the divisional shales, forty feet in thickness, which vary greatly in character, consisting of hard calcareous shale, argillo-bituminous, and arenaceous shales, the latter often verging into a hard sandstone; impure coal and one or two beds of ash, apparently volcanic, complete the series. They do not contain many fossils fit for the cabinet, the shells, though plentiful, being all crushed; teeth of *Cladodus* with the scales of *Megalichthys* are found, some of them well preserved. These latter are mostly found in a bed of calcareous shale overlying the impure coal. An upper stratum of limestone overlies these shales, called in the locality "Hillhead," from being largely developed, and first wrought at

that place. In its lower part it is in layers of various thickness, with alternate thin layers of shale between them, rather similar in appearance to the "blue stone" of the under series; but as it nears the top the layers become thicker, and the upper fifteen feet are about as pure a carbonate of lime as we have in the district. It has a depth of about forty feet, and is so highly fossiliferous that I have seen beds three feet in thickness entirely composed of *Productus*, a genus which predominates in all the layers, although in the new opening at Trearne, crinoids in a great measure take the place of the *Producti*. Beds of limestone are as entirely composed of the broken stems of the former as those at Hillhead are of the latter. *Psammodus*, *Ctenoptychius*, and *Petalodus*, the latter greatly predominating, are found in all the layers similar to those in the lower beds. Flint bands and nodules, evidently metamorphosed from limestone, are found in the upper beds. They contain the same fossils, and in certain nodules where the limestone and flint are seen running, as it were, into one another, a crinoid stem may be obtained partly embedded in the limestone and partly in the flint.

This concludes the section as exposed at Broadstone. In other parts of the basin it has nearly the same lithological development, but in other parts many of the beds are altogether out of the section. At Roebank Glen, for example, on the east side of the valley, and about one mile north of the village of Beith, the main-post and two-feet bed is fully developed—the calcareous shale and "blue stone" partially so. The forty feet of divisional shales is present with the ten-inch impure coal, but the whole of the upper limestone is wanting. At Netherhouses, about a mile further north, the same beds are out of the section; but the "blue stone" is twelve to fifteen feet in thickness, while in Roebank valley it is little over two feet. Again, on the west side of the valley a section is exposed in the Maich, a stream falling into the north end of Kilbirnie Loch, in which the whole of the limestones and shales comprising more than 90 feet of strata are wanting. The section is therefore reduced to the following, viz.:—main post, two feet thick; calcareous shale, full thickness; blue stone, one foot; the coal with the intervening shale being in position below the main post. From Carse Bridge to this outcrop of the lower limestone, the section is well worthy of a visit from the geologist. The stream has cut into the strata, forming a glen

of much beauty, and exposing about 700 feet of strata, consisting of the shales and sandstones of the coal and ironstone measures, sections of both being exposed. Being a rapid muir-land stream it is only during dry weather in summer that its banks can be properly searched for fossils; but the few shells found are neither abundant nor in a good state of preservation.

Although the limestone crops out all along the hills at an elevation of about 300 feet above sea-level, few quarries have been opened showing good sections, owing to its heavy dip to the east, and to the sandstones and shales belonging to the coal measures which overlie it along this outcrop. In the Garnock, a greenstone dyke has thrown it down, and the only limestone seen are pieces embedded in an overflow of the greenstone. In the Puduff-burn, a small stream which flows into the Garnock, near Kilbirnie, good sections are exposed, and from Kilbirnie to the farm-house of Dikes, the beds are seen to consist of sandstones, shales, and ironstones. From thence to near its source, a distance of nearly two miles, sections of limestones are seen in ever varying form, in some places, as at Auchencloich, where they rise into perpendicular walls, the water having cut a channel of considerable depth. In other places, the result of a downthrow, it is lost in the earth, and the water is seen flowing over its flaggy surface. The limestones and shales exposed have a thickness of about ninety feet, but, if we except the two lower beds they have nothing analogous to the Beith strata. These two lower beds are identical, both in lithological character and in fossils with the main bed and with the two-feet bed of the Beith section. The large series of thin layers of limestone, with alternate layers of shale, has a slight identity with the "blue stone;" but here the identity ends, and we find none of the fine *Productus* and encrinal limestone so well developed at Beith, and the divisional shales are also absent. A thin bed of volcanic ash, one foot six inches thick, and which lies intercalated with the limestone thirty-nine feet above its lower surface, is probably equivalent to a bed of ash which lies on the same horizon at Broadstone. But the forty-four feet of limestone and shale which overtops the ash here, has not the slightest resemblance to the upper beds in the Beith section. They appear to be on the same horizon, with about the same thickness of strata; but at Beith, the rock, as it nears the top, becomes the purest carbonate in the basin, while here it has degenerated

into thin layers of limestone with alternate thick beds of calcareous shale. The limestone is not very fossiliferous, still various species of *Productus* are found, but not very well preserved. Crinoid stems and corals are found, although rather rarely. Below the main or lower bed, a stratum of calcareous shale, which, so far as I am aware, is unique in this part of the basin, is very fossiliferous. It is well exposed in the stream, a little below the road leading to Coldgreen farm-house. The water has cut down through it to the ash below, leaving the shale standing on each side in walls twelve feet high. In these side-walls we find examples of *Productus giganteus*, *P. spinulosus*, *P. longispinus*; with species of *Spirifer* and *Terebratulina* lying in the shale ventral valve downmost, as if they had flourished in placid water, and become silted up, without ever being disturbed by wave or ripple. A break at this place has thrown down the limestone to the depth of its whole thickness, and it continues depressed until its final upthrow, against the trap of Ward Hill, at an elevation of 800 feet above sea-level, the highest outcrop in the basin.

About two miles to the south, at Howrat, the limestone has been largely wrought in the upper beds. Their identity with the same beds in the Beith section is very apparent, but the fine encrinal bed that copes the Beith section is wanting, and its place supplied by a bed of very fine limestone, very like one of fresh-water origin. In this upper bed the fossils are rare, but the beds below it are very fossiliferous, and their identity with those in the Beith quarries is evident from the presence of the same genera of shells and of *Petalodus*, *Psammodus*, *Cochliodus*. Trilobites are plentiful in the quarry north of Howrat house. As the upper beds only are wrought, no section of the lower beds is seen; but about half a mile to the south-west, on the estate of Swinlees, a good section is exposed in an old quarry; the two lower beds still preserve their identical character, the small crinoids in the main, and the *Lithodendron* in the two feet bed, being their chief component.

At Cunningham Bedland, on the Rye Water, another good section is exposed, the upper beds, which have been wrought, being identical with those of Hillhead both in fossils and lithological characters. The under beds in the Rye are slightly different in character from those of Beith, but the fossils are the same. The underlying bed of coal is absent, as it appears to be

all along this west side of the basin, Maich section excepted, and another one at Cartleburn, nine miles south of the Maich. In all the intermediate sections it is also absent, as well as the overlying argillaceous shale so fossiliferous at Beith.

No other good section of the limestone is exposed on the north side of the great break, but its outcrop can be traced along the hill side by Munnock to Ardrossan. A few openings occur, but of little use to the geologist, except in their connection with the breaks and denudation of the basin, which will be noticed under that head.

On the south side of the large dyke which has caused the break, and where the lower limestone has been brought to the surface from the depth of about 200 fathoms, good sections are exposed at Cartleburn, Auchenskeoch, Auchenmade, and in various places on the Dusk Water. In all these places the upper beds are present as at Hillhead. The section exposed at Auchenskeoch is 60 feet in thickness; the lower bed is of the same character as at Beith; the two feet post and blue stone have each lost their distinguishing character, and have become identical with the main bed; the divisional shales are present, reduced to 10 feet, and also the upper limestone, although in some places much denuded. At Auchenmade the whole series of coal, lower beds, divisional shales, and upper beds, are exposed as at Beith. In the Dusk, a stream which runs on the south of the great break and parallel to it, from where it debouches into the Garnock to Bankhead, Dalry, good sections are exposed in its banks near to Blair mill, Dalry, Nettlefirst, and Hazlehead, Beith. In Cleaves glen, below Blair mill, some fine natural caves occur in the upper beds, lying about twenty feet above the bottom of the burn. The entrances are not very large. The eastern one is $4\frac{1}{2}$ feet broad in the bottom, but narrows into a mere crevice at a height of 7 feet. At 29 feet from its entrance, another chamber turns off to the E.N.E. (the entrance is due south), and continues so for 49 feet, leading into a large chamber, 30 feet long, 10 feet broad, and 6 feet high. Others of smaller area exist, and the sides are covered with a stalactitic deposit, which has a very beautiful appearance when the caves are lighted up. The section is well worthy of a visit from the geologist, but the whole course of this stream, from Cleaves cove to Hazlehead, a distance of five miles, is of great geological interest, and is well adapted for instruction in physical

geology. I am sure even Col. Greenwood would acknowledge that other causes than air, rain, and river have been at work raising and sinking the strata, while, at the same time, he would rejoice to see that his favourite trio had been at work as finishers and polishers to the rough moulding of the more potent force. Above Blair-mill the limestone is thrown down, and the coal measures appear. This continues to near Pencott, when the limestone again comes to the surface, and continues so to Auchenmade, after which the coal measures again appear to near Nettlehirst, when the limestone again becomes the surface strata, spreading away to the south-east into Dunlop, and north-east into Neilston, and finally cropping out near Shelford. In this angle of the basin various sections are exposed. These mostly contain the lower beds, but at Old mill and Biggart, Beith, and at Waterland, Dunlop, the upper beds are present. From Old mill the out-crop of the limestone is traced, the strike running north-west back to the quarries at Broadstone.

We have now traced the outcrop of the lower beds of the basin, and in turning to the area, within the boundary described, we find in one place strata overlying the lower limestone to the extent of more than 200 fathoms. This thickness of strata lies in the south-west angle of the basin, above the Linn, Dalry, and consists as follows:—shales and sandstones resting upon the lower limestone, 30 fathoms; clay-band ironstone, 1 foot 4 inches; shales and sandstones, 30 fathoms; black-band ironstone, 1 foot 8 inches; volcanic ash, about 100 fathoms; Highfield limestone, 6 feet; shales and flaggy sandstone, 11 fathoms; limestone, 4 feet; flaggy sandstones and shales, 24 fathoms; lower Linn limestone, 36 feet; flaggy sandstones, 48 feet; upper Linn limestone, 42 feet; sandstone, 36 feet; shale 30 feet. These strata have not a very extended area in the basin, but, as above stated, cover only a small part of its south-west angle. The Linn limestones have a limited area, and the volcanic ash, which cuts out about 60 fathoms of carboniferous strata intervening between the Highfield limestone, and the black-band ironstone, thins out as it crosses, and extends up the valley until, at Drakemire, distant little over two miles, it is only 2 fathoms, and shortly disappears altogether. It is of a greenish colour, argillaceous, with layers of claystone, and is very similar to the ash which underlies the lower limestone. On the east side of the basin it is wanting, and the space between the Highfield

limestone and black-band ironstone is filled with sandstone, beds of coal, and shales.

Next to the lower limestone the clay-band ironstone has the greatest range, but owing to the irregular upheaval, or depression and upheaval combined, it is broken up into a series of small basins within the limestone area. The largest basin lies in the main valley at Dalry, up which it extends as far as the north end of Kilbirnie loch, if it does not continue farther, joining the Lochwinnoch basin, which I think very probable. After passing Beith station it continues on to the north-east end of Lochwinnoch loch, cropping out a little inside of the limestone outcrop, and continuing thus all along the west side of the valley. On the east side it extends along the north side of the great break, as far as Drumbowie, Beith, extending to the north as far as Brackenhills, Windyhouse, and Bogston, and is found in outliers at Bar, Balgray, Caldwell, and Lochlibo.

The blackband ironstone has a more limited range. It is developed in the main valley around the village of Dalry, extending up the valley as far as Mains, Beith. It is also well developed on the west-side of the valley, but on the east side it is not workable farther than Highfield, although it continues in a nodular state, and soon thins out. The clayband has a very uniform depth of 16 inches, but the black band is very irregular, varying from 6 inches to 3 feet, although 1 foot 8 inches is near the general average thickness.

In the centre and east side of the valley, about 40 fathoms above the blackband, there is a bed of coal of from three to six feet thick. This stratum is more broken up than the ironstones. The main basin lies in the centre of the valley, and along its west side as far north as Mains of Kilbirnie. On the east it extends along the north side of the great break as far as Whitespot, Beith. Its average breadth along the north side of the break is not more than a mile. But it is found in outliers at Meadowhead, Kersland, and Auchengree, Dalry; and at Coalburn, Lambar, Balgray Bar, Drumbuie, and Caldwell, Beith; Carse and Lochside, Lochwinnoch, and at Lochlibo, Neilston. For the most part these are small synclinal basins with their longest axes running north-east. Bar, Balgray, and Lochlibo are of this description, the strata in the two former being thrown almost upon edge along the southern side of the basin. This is caused by an outburst of

trap which runs parallel to their longest axes. The whole strata, including the lower limestone, is tilted up edgeways to the surface, and dips almost perpendicular for more than 150 fathoms. Coalburn and Meadowhead basins have their longest axis nearly east and west. As already mentioned, the main coal has a thickness of six feet, but varies, being sometimes reduced to three, and is found of every thickness between these two. In the pit section at Wheatyfauld, given at the end of this paper, it will be seen that a number of thin beds of coal lie both above and below the main coal. These are mostly too thin on the west side of the basin for working, although two of them are sometimes wrought, and like the main coal are of variable thickness. At Lambar three beds were wrought—the Smithy coal, two feet thick, 18 fathoms below the Highfield Limestone; the Main coal, $4\frac{1}{2}$ feet, four fathoms below the smithy coal; and the stony coal, $3\frac{1}{2}$ feet, ten fathoms below the main coal. On the west side of the basin at Mains, Kilbirnie, a gas coal, one foot thick, lies nine fathoms above the main coal. This latter is found at Bar and other places, and a thin bed of gas coal is found below the Main coal at Caldwell.

The sandstones, which lie both above and below the main coal, are wrought in various parts of the basin, as at Swinlees, Swindridge, Barkip, and other places. They make a durable building stone, but are all very much impregnated with the oxide of iron, due, no doubt, to the ironstone balls found mixed with them. The limestone overlying this sandstone has been wrought at Highfield and Swindridge, from which place it takes its name. The limestone and shale in connection form a stratum 12 feet in thickness. The main bed, five feet thick, is not very fossiliferous, but the shales yield *Bellerophon Urii* in abundance; a few *Producti*, and large numbers of *Nucula gibbosa*; corals are rare, crinoids stems common. This limestone has a limited range along the south side of the basin, but is found in the pits throughout the valley about Dalry, and along the west side of it, and in most of the detached basins. The four feet limestone which lies eleven fathoms above the latter, is, so far as I am aware, wrought only at Bankhead and Bourtrapping. It is very fossiliferous, and much resembles some beds of the lower limestone in the abundance of *Productus*, *Terebratula*, and *Athyris*. At Bourtrapping *Griffithides mesotuberculatus* is found in great numbers.

This limestone is easily recognised by a thin layer of calcareous sandstone, which underlies it, filled with crushed *Producti* and other shells, and it is the only shell-bearing sandstone in the basin with which I am acquainted. It is found in the valley around Dalry, but is chiefly confined to the south and south-west part of the basin; and although four feet is its general thickness, it is found at Bankhead eight, and at other places less than four feet. Twenty-four fathoms above this bed, and immediately below the lower Linn limestone, is a bed of coal of from two to ten feet in thickness. It is entirely confined to the south-west angle of the basin, and has a very limited range. Over this coal lie the Linn limestones, divided into upper and lower by 48 feet of flaggy sandstone and shale. These limestones have a respective thickness of 42 and 36 feet, but are not persistent, and of very limited range. The upper is confined to the Linn glen and a small area around it; the lower extends beyond this area, and becomes reduced, being found in one pit near to Linn Bridge 7 feet thick. Neither of the beds are very fossiliferous, but various species of *Producti* may be obtained along with *Streptorhynchus crenistria* and a species of *Pecten*. They are, however, rather rare, and generally not well preserved. These beds are very impure, and of little commercial value. Thirty-six feet of coarse thick-bedded sandstone, nearly amorphous, capped by 30 feet of argillaceous shale, complete the carboniferous strata found in the basin. These, like the under-lying limestone, are of limited extent, being only found in a small area in this angle of the basin.

Boulder Clay.—Throughout the basin this deposit is well represented, and from the several quarries wrought and pits sunk there are good opportunities for studying it. The striation on the rock-surfaces has a north-east and south-west bearing, and the boulders prove that the transporting force has come from the north-east. From observation, 20 per cent. of the boulders have been carried from distances exceeding five miles from the localities where they now are found, while the other 80 per cent. may safely be said not to have travelled a greater distance than from one to five miles. The former are old red sandstone, mica schist, clay slate, gneiss, quartz, and granite—the latter rare. These are generally of small size, of an oblong form, polished all around, and often striated. In the district there are two distinct and easily distinguished beds of this deposit. The undermost is a

very tough clay of a dark blue colour, full of stones, some of them large and generally striated, while the upper is more loose, has a reddish tinge, with boulders of a smaller size, and less striated. These beds are sometimes divided, as at Overtown, Beith, by a seam of fossiliferous clay; in other places the upper rests directly upon the lower, and in two different sections where this occurs I found in the line of division a species of moss. It would be out of place in a paper of this kind to theorise upon the origin of this deposit, still I may state that while the lower bed may be from *debris* accumulated by the flow of land ice, the upper bed bears strong evidence of being an aqueous deposit.

Change of Levels and Denudation.—Throughout the basin the evidences of a change of level are very striking. We find that the lower limestone is all but an unbroken bed within the area described, if we except the intersection of greenstone dykes; but, as already shown, the ironstones and coal, with the other upper strata, are broken up into a series of detached basins. That this state has been caused by alteration of level and the work of denudation carrying off the upheaved strata, will be best understood by selecting a bed and noticing its present position above or below sea levels in conjunction with the land surface. Thus, taking the lower limestone, and Dalry as the starting point, it being in the axis of greatest dip, we find that the bottom of this stratum is nearly 800 feet below sea level; while at Coldgreen, or Wardhill, on the Puduff burn, it lies about the same distance above it. Here, in a line less than five miles in length, we have a difference of 1600 feet in the position of this stratum—nearly the height of the Mistylaw. If we take a line across the valley from Maich to Broadstone, we find the limestone cropping out at both places about 300 feet above sea level; while at Carse, in the centre of the valley, the ground is 90 feet above sea level, and the bottom of the limestone 500 feet below it. Here, again, in a line not more than four miles, we have 800 feet of difference in the position of this under stratum. Again, if we take a line from Broadstone to Nettlehirst, passing through the Bar basin, and from Nettlehirst to Auchenmade, passing through the Drumbuie basin, we find the same result. Then, if we take the clayband ironstone, and draw a line across the valley, about two miles north of Dalry, from Swinlees to Wheatyfaulds, passing Hagsthorh and Crossroads, it will be found that at Swinlees the clayband crops out at an eleva-

tion of 300 feet above sea-level and close to the surface ; in a pit in the centre of the valley, and a little south of Hagsthorpe, it is 600 feet below the surface, and above 500 feet below sea-level. At Crossroads we find it only 78 feet below the surface and rather more than 200 feet above sea-level, and at Wheatyfaulds it is about 600 feet below the surface and 300 feet below sea-level. Examples could be given of a like kind throughout the entire basin, but enough has been given to show the great changes in levels within short distances, and the immense denudation of strata that has taken place. At Hagsthorpe and Wheatyfaulds the strata are about equal in thickness, while at Crossroads, between these two places, 500 feet of strata have been denuded. The general dip of the basin is south, and we find that the greatest denudation has taken place in its northern extremity, excepting always the depressed basins ; but as a rule we find that the higher that the bed lies above sea-level the greater has been the denudation, and *vice versa*. The lower that the bed is found below sea-level, the denudation has been the least. It would be hazardous to state the amount of strata that has been denuded in the valley. At Wheatyfaulds, close to the great break, the main coal lies at 45 fathoms below the surface ; and in the valley south of Kilbirnie station, the whole of this strata is absent, and the surface strata is the sandstone and shale, which lies immediately below the main coal. How far the strata that comprehends the Linn limestones and shales extended originally would now be a difficult matter to determine, but from the position which they now lie in, we may safely suppose them to have had a surface compared to which their present one is a mere fragment. Taking the beds at present above Linn, we have, as already noticed, 230 fathoms of strata from the surface to the bottom of the lower limestone. And from there to Broadstone, where the lower limestone crops out, all this strata is thrown off stratum by stratum, until we find the lower limestone at its outcrop thinned away to one foot where it is not preserved by depression. From Linn to Broadstone is little more than five miles, north by east. That this large amount of denudation has been caused in a great measure by change of level will be apparent to any one who observes the depth of the strata found at different points on the two lines we have given above.

Greenstone Dykes. — Various greenstone dykes intersect the strata throughout the basin. The first and greatest of these is the

large one which crosses the valley from Monkcastle to Bankhead. Its direction is nearly from south-west to north-east, as far as Pencott, when it branches in a south-east direction, and the other to Bankhead, where it terminates. In some places it has a breadth of 300 feet, although this may be due to an overflow at the time of outburst. Another dyke appears to branch off from this one near Monkcastle, and taking a north direction, intersects the strata to the west of Dalry, without causing any amount of displacement of the strata, in the southern part of the basin. Its real breadth is from ten to fifteen feet, but it is evidently an overflow, as it covers more breadth on the surface. Other dykes of lesser extent, one near Borestone, and the other close to Linn Bridge, traverse the strata about Dalry, but there are few which cause trouble to the mining engineer. In the northern part they are more various, and three of them large. The southernmost twenty-five feet broad,—crosses to the south of Roughwood, intersecting the Whitespot coal field, and apparently joins the large dyke at Bankhead. About a mile north of this one, another large dyke, sixty feet broad, crosses about the centre of Kilbirnie loch running south-east, through the Bar basin, and on towards Dunlop. Another, thirty feet broad, runs parallel to this latter one, at a distance of about two miles farther north. A great number of smaller dykes run between these, apparently crossing sometimes from the one to the other, and at other times starting from one of the larger ones, and making a course something like a half-bent bow, returning to it again; one four feet broad, which passes Langside, is of this kind; others appear to be mere fissures of no great length, filled with the greenstone. The coal along the sides of these dykes is changed into anthracite, in some places burned so as to be useless. These are the principal dykes which traverse the carboniferous strata. To enumerate the whole of them, which are traceable in the district, would be out of the scope of this paper.

Fossils.—From the cursory manner in which I have noticed the fossils found in the various beds, and from the table of fossils given at the end of the paper, it will be seen that the carboniferous strata in the district are quite unfossiliferous. The lower limestone has produced about thirty genera and above fifty species of shells, and about a dozen species of palate teeth. Shagreen and fragments of bone are also found in all parts of the basin, but as yet the Beith quarries have yielded the largest number. The

sandstones yield fragments of *Calamites cannaeformis*, *Lepidodendron elegans*, *Stigmaria*, *Sigillaria*, and others. In some beds, ferns are found, and a reed-like plant is very common, although not generally well preserved. The shales which divide the sandstone, ironstone, and coal are not very fossiliferous as far as they have been examined; but in the layers which overlie the ironstones and coal, palate teeth and spines are found, but not in great abundance considering the mining operations so long in progress, and yet if the miners would take the trouble to preserve them when found, many new and rare forms would be yielded of value to the palæontologist. *Rizodus Hibberti* has been found in the shale overlying both the ironstones and the main coal, proving its extent of range. In the great body of the shales which divide these beds, the opportunity of looking for ichthyolites is not great, as they are never opened to any extent except in sinking pits, and the sinkers do not trouble themselves much about them; but as coprolites have been detected in most of the beds, I have no doubt, with better opportunities, teeth and spines would also be found.

In the lower limestone, corals are both abundant and of large size, while in the Highfield and Linn beds they are rare and diminutive, and the almost total absence of encrinites in the latter is very remarkable. Remains of fossil wood exist in all the sandstones, but are most abundant at Swinlees, Swindridge, and Auchengree. A four-feet bed underlying the Linn coal is very full of plant remains, but badly preserved.

Conclusion.—The foregoing is a short vidimus of observations made in this important little district. To have given a minute detail of its geological structure would have occupied a much more extended paper; however, I trust that enough has been said to interest the geologist. And to those who wish to become thoroughly acquainted with all its geological phenomena, I can offer no better advice than recommend them to a study of this little volume of nature lying partially open in the hills, the quarries, and glens of the district.

No. 1.—Journal of strata passed through in sinking a pit at Wheatyfauld,
Dalry, referred to in the foregoing paper :—

	Fa.	Ft.	In.		Fa.	Ft.	In.
Surface, . . .	0	0	0	Arenaceous shale, . . .	0	0	10
Limestone, . . .	0	3	0	Sandstone, . . .	0	1	6
Argillaceous shale, . . .	1	0	0	Carbonaceous shale, . . .	0	4	6
Sandstone, . . .	1	2	0	Coal, . . .	0	0	8
Arenaceous shale, . . .	2	5	0	Brown stone, . . .	0	0	2
Sandstone, . . .	0	5	0	Coal, . . .	0	0	10
Arenaceous shale, . . .	0	1	6	Argillaceous shale, . . .	0	1	6
Sandstone, . . .	2	2	0	Sandstone, . . .	0	2	6
Arenaceous shale, . . .	0	3	0	Arenaceous shale, . . .	0	1	8
Sandstone, . . .	2	0	4	Coal, . . .	0	0	8
Argillaceous shale, . . .	2	1	6	Sandstone, . . .	1	5	3
Sandstone, . . .	2	4	0	Do., flaggy, . . .	0	2	6
Argillaceous shale, . . .	1	1	11	Carbonaceous shale, . . .	0	4	6
Sandstone, . . .	1	3	5	Fireclay, . . .	0	3	0
Limestone, . . .	0	0	9	Arenaceous shale, . . .	0	1	8
Sandstone, . . .	0	1	0	Main coal, . . .	0	5	6
Arenaceous shale, . . .	1	0	6	Fireclay, with ironstone			
Argillaceous do., . . .	1	2	6	balls, . . .	0	3	0
Arenaceous do., . . .	1	1	9	Argillaceous shale, . . .	2	0	0
Argillaceous do., . . .	2	2	6	Impure limestone, . . .	0	2	6
Arenaceous do., . . .	0	1	0	Argillaceous shale, . . .	0	0	8
Calcareous do., . . .	0	1	8	Coal, . . .	0	1	4
Highfield limestone, . . .	1	0	6	Sandstone, . . .	1	1	4
Arenaceous shale, . . .	0	0	8	Do., flaggy, . . .	0	2	6
Argillaceous do., . . .	1	0	6	Argillaceous shale, . . .	0	1	10
Sandstone, hard, . . .	0	2	6	Sandstone, . . .	1	5	6
Arenaceous shale, . . .	0	5	9	Do., flaggy, . . .	0	2	6
Argillaceous do., . . .	0	1	0	Argillaceous shale, . . .	2	0	6
Sandstone, . . .	0	3	0	Sandstone, . . .	2	4	6
Arenaceous shale, . . .	0	1	0	Do., flaggy, . . .	0	5	0
Sandstone, . . .	3	0	6	Argillaceous shale, with			
Do., flaggy, . . .	0	4	6	hard bands in it, . . .	3	5	4
Argillaceous shale, . . .	0	1	2	Conglomerate, . . .	1	0	2
Coal, . . .	0	1	0	Sandstone, . . .	0	5	2
Fireclay, . . .	0	2	6	Do., flaggy, . . .	0	2	8
Argillaceous shale, . . .	0	2	6	Coal, . . .	0	0	3
Coal, . . .	0	1	0	Sandstone, . . .	2	2	0
Arenaceous shale, . . .	0	0	4	Do., flaggy, . . .	0	1	6
Sandstone, . . .	0	4	0	Argillaceous shale, . . .	2	0	6
Do., flaggy, . . .	0	1	0	Ironstone, . . .	0	0	4
Coal, . . .	0	1	0	Argillaceous shale, . . .	0	3	4
Argillaceous shale, . . .	0	0	8	Black-band ironstone, . . .	0	0	2
Coal, . . .	0	0	6	Coal, . . .	0	0	8
Sandstone, . . .	0	3	6	Fireclay, . . .	0	0	6

288 TRANSACTIONS OF THE GEOL. SOC. OF GLASGOW.

	Fa. Ft. In.		Fa. Ft. In.
Argillaceous shale,	0 3 6	Sandstone,	1 5 0
Coal,	0 0 2	Do., flaggy,	1 1 6
Sandstone, flaggy,	0 3 0	Argillaceous shale,	4 5 1
Argillaceous shale,	1 0 0	Ironstone,	0 0 5
Ironstone,	0 0 6	Argillaceous shale,	0 4 1
Clay,	0 1 0	Ironstone,	0 0 5
Ironstone,	0 0 6	Argillaceous shale,	3 0 0
Argillaceous shale,	1 0 0	Ironstone,	0 0 8
Sandstone, flaggy,	0 2 0	Sandstone, hard,	0 1 8
Argillaceous shale,	1 3 0	Argillaceous shale,	0 3 1
Mussel-band,	0 0 6	Ironstone,	0 0 5
Sandstone, flaggy,	0 3 0	Argillaceous shale,	2 2 0
Argillaceous shale,	1 6 0	Ironstone (clay-band),	0 1 3
Dark sandstone,	0 2 0		
Coal,	0 1 0		94 5 7

NOTE.—The foregoing journal was taken during the sinking of the Main coal, and afterwards from a bore put down to the clay-band ironstone. It may be taken as correct, in noting the different strata that overlie the clay-band ironstone throughout the basin. In some places the shales are thicker, and the sandstones thinner, and *vice versa*, but the same alternation of shales, sandstones, &c., is found all throughout the main as well as the outlying basins.

No. 2.—Journal of strata taken during the sinking of a shaft and part of a bore, being nearly the same as in Langlands pit, Dalry.

	Fa. Ft. In.		Fa. Ft. In.
Boulder-clay,	3 2 0	Strata below black-band	
Argillaceous shale,	5 0 0	ironstone, — sandstones,	
Sandstone nearly amor-		and shales, with thin	
phous,	6 0 0	beds of coal & ironstone,	32 0 0
Linn limestone, upper bed,	7 0 0	Clayband ironstone,	0 1 3
Arenaceous shale and flaggy		Sandstones & shales, with	
sandstone,	8 0 0	thin beds of ironstone and	
Linn limestone, lower bed,	6 0 0	impure limestone,	30 0 0
Coal,	0 5 0	Lower limestone series,	17 1 0
Flaggy sandstone and Argil-			79 2 3
laceous shales,	24 0 0	Strata above the black-	
Limestone (Bowertrapping),	0 4 0	band,	169 0 8
Sandstone and shale,	11 3 0		
Limestone (Highfield),	0 6 0		
Volcanic ash with layers of			
claystone,	95 0 0		
Argillaceous shale,	0 3 0		
Ironstone (black-band),	0 1 8		
	169 0 8		248 2 11

NOTE.—It will be seen from the above, that the volcanic ash cuts out all the strata from the Highfield limestone to the black-band ironstone in this part of the basin, about forty fathoms, including the workable coal. A little south of this section the ash was still found at 115 fathoms below the Highfield limestone; but at this depth the boring was given up in despair of not finding the black-band ironstone, but it is strongly suspected that it will yet be found at even a greater depth.

LIST OF CARBONIFEROUS FOSSILS FROM THE DALRY DISTRICT.

PLANTÆ.

<i>Species.</i>	<i>Modes of Occurrence and Localities.</i>
<i>Calamites cannaëformis</i> , <i>Schlot.</i>	Ratherrare; in sandstone, Auchengree.
<i>Cauda-galli</i> , <i>sp.</i>	In sandstone above limestone, Bourtrapping.
<i>Dadoxylon</i> , <i>sp.</i>	Rare; trappean ash-bed above Dalry black-band ironstone.
<i>Lepidodendron elegans</i> , <i>Brongn.</i>	In sandstone, Barkip, Swindridge, and Auchengree.
————— <i>obovatum</i> , <i>Lindley.</i>	Pit Cone, Dalry; ironstone pits, Swindridge.
<i>Lepidostrobus</i> , <i>sp.</i>	Swindridge; Pit Cone.
<i>Sigillaria organum</i> , <i>Lindley.</i>	Common in all the preceding localities and in both of the ironstones.
<i>Sphenopteris affinis</i> , <i>Lindley.</i>	Rare; in shale at Auchengree.
<i>Stigmaria ficoides</i> , <i>Brongn.</i>	Common in the sandstones at Barkip, Swindridge, and Auchengree.
<i>Ulodendron majus</i> , <i>Lindley.</i>	In coal below lower limestone.
————— <i>minus</i> , <i>Lindley.</i>	Pit Cone; Riddence.

ZOOPHYTA.

<i>Alveolites septosa</i> , <i>M. Edw.</i>	Very rare; Linn limestone; Auchenskeoch.
<i>Amplexus coralloides</i> , <i>Sow.</i>	Rare; in shale, Langside, Broadstone, and Roughwood.
————— <i>Henslowi</i> , <i>M. Edw.</i>	Rare; Roughwood; Auchenskeoch.
————— <i>spinosus</i> , <i>De Kon.</i>	Rare; in shale, Langside, Broadstone, and Roughwood.
<i>Clisiophyllum prolapsum</i> , <i>M'Coy.</i>	Common; in limestone shale, in all the Beith quarries.
————— <i>turbinatum</i> , <i>M'Coy.</i>	Roughwood; Auchenskeoch.
————— <i>coniseptum</i> , <i>M. Edw.</i>	Common; Langside; Third part.
————— <i>Keyserlingi</i> , <i>M. Edw.</i>	Rare; Broadstone.
————— <i>bi-partitum</i> , <i>M'Coy.</i>	Common; Auchenskeoch.
<i>Campophyllum?</i> <i>Murchisoni</i> , <i>M. Edw.</i>	Rare; Broadstone.
<i>Cyathophyllum Wrighti</i> , <i>M. Edw.</i>	Common; in shale, in all the Beith quarries.
————— <i>paracida</i> , <i>M'Coy.</i>	Common; Gateside.

290 TRANSACTIONS OF THE GEOL. SOC. OF GLASGOW.

Cyclophyllum fungites, <i>D. and T.</i>	Common ; Langside ; Roughwood ; Broadstone. <i>C. prolapsum</i> , M'Coy.
———— Bowerbankii, <i>D. and T.</i>	Rare; Roughwood.
Favosites parasitica, <i>Phill.</i>	Rare; in shale, Howood.
Heterophyllia mirabilis, <i>Duncan.</i>	Broadstone; Auchenskeoch; Roughwood.
———— Sedgwickii, <i>Duncan.</i>	Broadstone.
Lithodendron fasciculatum, <i>Flem.</i>	Common; in all the lower limestone shales and two-feet limestone.
———— irregulare, <i>Phill.</i>	Do., do.
———— junceum, <i>Flem.</i>	Do., do.
Lithostrotion basaltiforme, <i>Phill.</i>	Rare; Broadstone and Puduff-burn, in calcareous shale.
———— Portlocki, <i>M. Edw.</i>	Rare; in limestone shale, Langside.
Michelinia tenuisepta, <i>Phill.</i>	Common; in limestone shale, Langside and Broadstone.
Syringopora ramulosa, <i>Goldf.</i>	Common ; Auchenskeoch.
Zaphrentis patula, <i>M. Edw.</i>	Rare; in shale, Langside.
———— Enniskillini, <i>M. Edw.</i>	Rare; Broadstone; Auchenskeoch.
———— Phillipsi, <i>M. Edw.</i>	Common; do., do.
———— Bowerbankii, <i>M. Edw.</i>	Rare; Broadstone; Roughwood.
———— cylindrica, <i>Scouler.</i>	Common ; Langside, Broadstone ; Auchenskeoch.

ECHINODERMATA.

Archæocidaris Urii, <i>Flem.</i>	Rare; Gateside.
Hydreionocrinus globularis, <i>De Kon.</i>	Common; in all the limestone shales of the Beith quarries.
Poteriocrinus MacCoyanus, <i>De Kon.</i>	Common; Beith quarries, Howood.
———— crassus, <i>Miller.</i>	Do., do., do.
Rhodocrinus, <i>sp.</i>	Rare; Gateside.

ANNELIDA.

Serpula parallela, <i>M'Coy.</i>	Common; Auchenskeoch, Howrat.
Serpulites carbonarius, <i>M'Coy.</i>	Rare; lower limestone, Langside.
———— membranaceous, <i>M'Coy.</i>	Rare; Langside, Broadstone, Howrat.
———— caperatus, <i>M'Coy.</i>	Lin limestone, Dalry.
Spirorbis, <i>sp.</i>	Common; attached to the valves of shells, corals, and crinoid stems, in the limestone shales, Beith quarries.

CRUSTACEA.

<i>Bairdia curta</i> , <i>M'Coy</i> .	Common; limestone shale, Swindridge.
<i>Cythere cuneola</i> , <i>Jones and Kirkby</i> .	Do. do.
<i>Entomoconchus Scouleri</i> , <i>M'Coy</i> .	Rather rare; main limestone, Beith.
<i>Griffithides meso-tuberculatus</i> , <i>M'C</i> .	Rare; in fragments, lower limestone at Langside and Howrat; abundant in four-feet limestone at Bourtrapping.
———— <i>Eichwaldi</i> , <i>Fischer</i> .	Rare; lower limestone, Howrat.
<i>Kirkbya Eichwaldi</i> , <i>Jones & Kirkby</i> .	Rare; limestone shale, Swindridge.
<i>Leperditia Armstrongiana</i> , <i>J. & K.</i>	Very rare; Howrat limestone.
———— <i>Youngiana</i> , <i>J. & K.</i>	Very rare; Den pits, Dalry.
———— <i>Okeni</i> , <i>Munster</i> .	Common; main limestone shale, Beith.

POLYZOA.

<i>Ceriodora interporosa</i> , <i>Phill</i> .	Limestone shale, Beith quarries.
———— <i>similis</i> , <i>Phill</i> .	Do., do.
<i>Diastopora megastoma</i> , <i>M'Coy</i> .	Encrusting corals, do. do.
<i>Fenestella plebeia</i> , <i>M'Coy</i> .	Limestone shale do. do.
———— <i>hemispherica</i> , <i>M'Coy</i> .	Rare; Broadstone.
———— <i>Morisii</i> , <i>M'Coy</i> .	Rare; Howrat.
———— <i>nodulosa</i> , <i>Phill</i> .	Limestone shale, Beith quarries.
———— <i>carinata</i> , <i>M'Coy</i> .	Do., do.
———— <i>flabellata</i> , <i>Phill</i> .	Do., do.
———— <i>frutex</i> , <i>M'Coy</i> .	Rare; Roughwood; Broadstone.
————	Several other species not determined.
<i>Glauconome bipinnata</i> , <i>Phill</i> .	Limestone shale, Beith quarries.
———— <i>grandis</i> , <i>M'Coy</i> .	Do., do.
———— <i>gracilis</i> , <i>M'Coy</i> .	Do., do.
———— <i>pulcherrima</i> , <i>M'Coy</i> .	Do., do.
<i>Gorgonia Lonsdaleiana</i> , <i>M'Coy</i> .	Rare; Auchenskeoch.
<i>Polypora dendroides</i> , <i>M'Coy</i> .	Limestone shale, Beith quarries.
———— <i>verrucosa</i> , <i>M'Coy</i> .	Rare; Broadstone.
<i>Sulcoretopora parallela</i> , <i>Phill</i> .	Limestone shale, Beith quarries.

BRACHIOPODA.

<i>Athyris ambigua</i> , Sow.	Common; lower limestone, Beith, Howrat, Bourtrapping.
—— <i>Royssii</i> , L'Eveillé.	Common; Bourtrapping, lower limestone, Langside, Broadstone, and Roughwood.
<i>Camarophoria globulina</i> , Phill.	Rare; Auchenskeoch.
<i>Chonetes Hardrensis</i> , Phill.	Not common; Langside, Swindridge, and Bourtrapping.
<i>Crania quadrata</i> , M'Coy.	Common; shale below main limestone, Langside.
<i>Discina nitida</i> , Phill.	Do., do.
<i>Lingula mytiloides</i> , Sow.	Do., do.
—— <i>squamiformis</i> , Phill.	Common; shale above blackband, Swinlees-burn, Dalry; one specimen in main limestone, Langside.
<i>Orthis Michelini</i> , L'Eveillé.	Very abundant; limestone shale, Gateside, rare; in shale, Broadstone.
—— <i>resupinata</i> , Martin.	Rare; in shale below main limestone, Langside, rare; Bourtrapping.
<i>Productus aculeatus</i> , Martin.	Rare; main limestone, Broadstone.
—— <i>costatus</i> , Sow.	Do., do., Gateside.
—— <i>var.</i> , <i>muricatus</i> , Sow.	Common; Broadstone.
—— <i>cora</i> , D'Orb.	Rare; shale, Broadstone; not common, Bourtrapping.
—— <i>fimbriatus</i> , Sow.	Rather rare; lower limestone, Langside and Broadstone.
—— <i>giganteus</i> , Mart.	Common; lower limestone, Beith; in shale, below main limestone, Puduff-burn; rare, Bourtrapping.
—— <i>punctatus</i> , Mart.	Common in all the Beith quarries.
—— <i>longispinus</i> , Sow.	Very common in all the Beith quarries, and in Highfield and Linn limestones.
—— <i>latissimus</i> , Sow.	Rare in Highfield and Linn limestones; very abundant in four-feet limestone, Bankhead; rare, Swindridge and Bourtrapping.
—— <i>mesolobus</i> , Phill.	Very rare; main limestone, Broadstone.
—— <i>scabriculus</i> , Mart.	Common in shale at Broadstone and all the Beith quarries; Bourtrapping.

<i>Productus semireticulatus, Mart.</i>	Common in all the Beith limestones, Howrat and Auchenmade; rare at Puduff-burn.
———— <i>sinuatus, De Kon.</i>	Common; Bowertrapping.
———— <i>spinulosus, Sow.</i>	Common in all the Beith quarries.
———— <i>Youngianus, Davidson.</i>	Common at Langside in the blue limestone.
<i>Retzia radialis, Phill.</i>	Rare; limestone shale, Roughwood.
<i>Rhynchonella pleurodon, Phill.</i>	Rare; blue limestone, Langside, Broadstone and Roughwood.
———— <i>pugnus, Mart.</i>	Rare; blue limestone, Langside; common, Bourtrapping.
<i>Strophomena analoga, Phill.</i>	Rare; Howood.
<i>Spirifera bisulcata, Sow.</i>	Common; Beith quarries, Howrat, Auchenmade and Bourtrapping.
———— <i>Carlukensis, Dav.</i>	Rare; Broadstone.
———— <i>duplicicosta, Phill.</i>	Rare; West Broadstone and Cunningham Bedland.
———— <i>glabra, Mart.</i>	Not common; main limestone, Langside and Broadstone.
———— <i>lineata, Mart.</i>	Common in all the Beith quarries in the main and two-feet limestone; Bourtrapping.
———— <i>ovalis, Phill.</i>	Rare; Auchenmade, in lower limestone, upper series.
———— <i>pinguis? Sow.</i>	Very rare; Trearne, upper series of lower limestone, rare; Puduff-burn, in shale below main limestone, lower series.
———— <i>Urii, Fleming.</i>	Common; Bourtrapping.
<i>Spiriferina octoplicata, Sow.</i>	Very rare; Bourtrapping.
———— <i>laminosa, M'Coy.</i>	Do.; Auchenskeoch; Broadstone.
<i>Streptorhynchus crenistria, Phill.</i>	Common; Broadstone, in shale; rare at Linn; common, Bourtrapping.
———— <i>var., radialis, Phill.</i>	Rare; Roughwood.
———— <i>var., senilis, Phill.</i>	Rare; Bourtrapping.
<i>Terebratula hastata, Sow.</i>	Common; blue limestone, Langside and Broadstone.
———— <i>var., sacculus, Mart.</i>	Common; Roughwood.
———— <i>var., vesicularis, De Kon,</i>	Langside; Bourtrapping.
———— <i>var., Gillingensis, Dav.</i>	Main limestone, Cunningham Bedland.

LAMELLIBRANCHIATA (MONOMYARIA).

<i>Anomia corrugata, Etheridge.</i>	Rare; Linn spout.
<i>Avicula sp.?</i>	A single example; Swindridge.
—— <i>sp.?</i>	Do.; Howrat.
<i>Aviculopecten fimbriatus, Phill.</i>	Rare; shale below the main limestone in all the Beith quarries.
———— <i>semicircularis, M'Coy.</i>	Rare; Roughwood.
———— <i>granosus, Sow.</i>	Rare; shale below the main limestone in all the Beith quarries.
———— <i>interstitialis, Phill.</i>	Rare; Bourtrapping.
———— <i>consimilis, M'Coy.</i>	Do.; do.
<i>Ostrea, sp.?</i>	A single example; main limestone shale, Broadstone.
<i>Pecten Sowerbii, M'Coy.</i>	Very rare; main limestone shale; Cunningham Bedland.
<i>Pinna flabelliformis, Mart.</i>	Good examples rare; blue limestone and shale above it, at Langside and Roughwood.

LAMELLIBRANCHIATA (DIMYARIA).

<i>Anthracosia robusta, Sow.</i>	Rare; in shale above blackband, Highfield.
<i>Axinus axiniformis, Phill.</i>	Not common; in shale below main limestone, Langside.
—— <i>carbonarius, Portl.</i>	Common; in shale below main limestone, Langside.
<i>Conocardium aliformis, Sow.</i>	Very rare; Roughwood.
<i>Cypriocardia acuticarinata, Armstrong.</i>	Do., do.
—— — <i>rhombea, Phill.</i>	Rare; below Linn limestone.
<i>Edmondia rudis, M'Coy.</i>	Common; Langside.
<i>Leda attenuatum, Flem.</i>	Very rare in shale below main limestone Langside; common at Swindridge.
<i>Solemya primæva, M'Coy.</i>	Rare; Roughwood.
<i>Leptodomus costellatus, M'Coy.</i>	Rare; in shale above Highfield limestone; Swindridge.
<i>Modiola elongata, Phill.</i>	Common; in shale below main limestone in all the Beith quarries.
<i>Myacites sulcatus, Flem.</i>	Do., do. do.

<i>Myalina crassus, Flem.</i>	Very abundant, but mostly crushed in shale, below main limestone, at Lyonsields and Roughwood.
<i>Nucula gibbosa, Flem.</i>	Very abundant at Swindridge, and in shale above Highfield limestone.
<i>Sanguinolites plicatus, Portl.</i>	Rare; shale above two-feet limestone, Langside; very rare, Bourtrapping.
———— <i>iridinoides M'Coy.</i>	Rare; shale above two-feet limestone, Langside.
———— <i>subcarinatus, M'Coy.</i>	Main Limestone shale.

GASTEROPODA.

<i>Dentalium priscum, Goldf.</i>	Common; Swindridge.
———— <i>inornatum, M'Coy.</i>	Very abundant; do.
<i>Eulima Phillipsiana, De Kon.</i>	Den pits, Dalry.
<i>Euomphalus acutus, Sow.</i>	Rare; Bourtrapping.
———— <i>carbonarius, M'Coy.</i>	Swindridge.
———— <i>Dionysii, Goldf.</i>	Very rare; Bourtrapping.
———— <i>pentangulatus, Sow.</i>	Rare; main limestone, Langside.
<i>Loxonema Lefebvrei, L'Eveill�.</i>	Rare; in shale below main limestone in all the Beith quarries.
———— <i>sulcatula? M'Coy.</i>	Rare; Bourtrapping.
<i>Macrocheilus acutus, Sow.</i>	Rare; in shale below main limestone in all the Beith quarries, and in shale above the coal at Barkip.
———— <i>fusiformis, Sow.</i>	Common; Swindridge.
———— <i>Michotianus, De Kon.</i>	Rare; in shale below main limestone, Langside.
<i>Murchisonia quadricarinata, M'Coy.</i>	Do. do.
———— <i>striatula, De Kon.</i>	Common; Swindridge.
<i>Naticopsis variata, Phill.</i>	Common; shale below main limestone, Langside; common, Bourtrapping.
———— <i>Omaliana, De Kon.</i>	Rare; Swindridge.
———— <i>lirata, Phill.</i>	Very rare; Swindridge.
<i>Pleurotomaria conica, Phill.</i>	Rare; shale below main limestone, Langside.
———— <i>altavitata, M'Coy.</i>	Very rare; Bourtrapping.
———— <i>expansa, Phill.</i>	Rare; shale below main limestone, Langside.
———— <i>monilifera, Phill.</i>	Do. do.

296 TRANSACTIONS OF THE GEOL. SOC. OF GLASGOW.

<i>Pleurotomaria Yvanni, L'Eveillé.</i>	Very rare; limestone, Cunningham Bedland; below Linn limestone, Dalry.
<i>Platyceras vetustus, Sow.</i>	Common; Bourtrapping.
<i>Trochus lepidus, De Kon.</i>	One specimen found in the shale below main limestone, Langside.
<i>Turbo biserialis, Phill.</i>	Very rare; Bourtrapping.

GASTEROPODA (NUCLEOBRANCHIATA).

<i>Bellerophon cornu-arietis, Scw.</i>	Rare; Langside.
———— <i>decussatus, Flem.</i>	Rare; lower limestone, Langside; common at Swindridge.
———— <i>Dumontii, D'Orb.</i>	Rare; Waterland; Howrat, very rare; Bourtrapping.
———— <i>Urii, Flem.</i>	Common in shale above Highfield limestone; Swindridge.
<i>Porcellia armata, Verneuil.</i>	Rare; Broadstone.

CEPHALOPODA.

<i>Goniatites vesica, Phill.</i>	Very rare; Bourtrapping.
———— <i>diadema, Goldf.</i>	Rare; Dalry ironstone; crushed specimens.
<i>Nautilus ingens, Sow.</i>	Rare; lower limestone, Langside, Broadstone and Howrat.
———— <i>Leveilleanus, De Kon.</i>	Rare; calcareous shale, Hazelhead-burn.
<i>Orthoceras attennatum, Flem.</i>	Rare; in shale at Langside; Broadstone and Howrat.
———— <i>sulcatulum, M'Coy.</i>	One fragment; shale, Bourtrapping.

PISCES.

<i>Amphicentrum granulosum, Young.</i>	Rare; scales and bones of the head in shale, Langside.
<i>Cladodus mirabilis, Ag.</i>	Single teeth, and part of a jaw have been found at Langside; teeth at Broadstone.
<i>Cochliodus magnus, Ag.</i>	Rather common in shale and limestone, Langside.
———— <i>contortus, Ag.</i>	Limestone, Langside.
———— <i>acutus, Ag.</i>	Rather rare; limestone, Langside.
<i>Ctenoptychius serratus, Ag.</i>	Rare; shale and limestone in all the Beith quarries, and Howrat.
<i>Glossodus marginatus, M'Coy.</i>	Very rare; shale and limestone in all the Beith quarries, and Howrat.

<i>Gyracanthus formosus</i> , <i>Ag.</i>	Rare; shale above ironstone, Barkip.
<i>Homocanthus</i> , <i>sp.?</i>	One spine found at Langside, in shale above two-feet limestone.
<i>Helodus planus</i> , <i>Ag.</i>	Rare; in shale and limestone, Langside.
<i>Megalichthys Hibberti</i> , <i>Ag.</i>	Rare; scales in shale, lower limestone, Langside and Broadstone.
<i>Petalodus Hastingsæ</i> , <i>Owen</i> .	Rather common; in all the lower limestone series found at Langside, Trearne, Broadstone, and Howrat.
———— <i>rectus</i> , <i>Ag.</i>	In all the lower limestone series found at Langside, Trearne, Broadstone, and Howrat; rarer than the preceding species in the proportion of one to twelve.
<i>Pœcilodus obliquus</i> , <i>Ag.</i>	Rare; shale, Langside.
———— <i>sp.?</i>	Do.; do., do.
<i>Psammodus rugosus</i> , <i>Ag.</i>	Rather rare; in all the lower limestone.
———— <i>porosus</i> , <i>Ag.</i>	Very rare; do., do.
<i>Rhizodus Hibberti</i> , <i>Ag.</i>	Rare; in shale above clayband ironstone, and main coal, Barkip; in shale above blackband ironstone, Highfield.
<i>Oracanthus minor</i> , <i>Ag.</i>	Rare; in blueish-grey limestone, Langside.
———— <i>Milleri</i> , <i>Ag.</i>	Very rare; Roughwood.

* * Several other fish-specimens, comprising one or two fin-spines, &c., have been found in the above localities, but their species have not yet been determined.

List of localities named in the foregoing paper, and distance from the nearest railway station.

Names.	Nearest Railway Station.	Distance and Direction.
Broadstones,	Beith,	2 miles, S.E.
Langside,	Do.,	Do.,
Roughwood,	Do.,	2 miles, South.
Roebank Glen,	Do.,	1 mile, N.E.
Maich Glen,	Do.,	$\frac{1}{2}$ mile, West.
Puduff Burn,	Kilbirnie,	$2\frac{1}{2}$ do., W. by S.
Auchengree,	Do.,	$\frac{1}{2}$ do., S. by E.
Howrat,	Do.,	3 do., S.W.
Swinlees Glen,	Dalry,	3 do., N.W.
Rye Water, Hyndog Glen, ...	Do.,	2 do., W. by N.
Highfield,	Do.,	1 do., N.E.
Bourtrapping,	Do.,	$2\frac{1}{2}$ do., N.E.
Auchenskeoch,	Do.,	$2\frac{1}{2}$ do., S. by E.
Auchenmade,	Do.,	$3\frac{1}{2}$ do., S.E.
Cleaves Coves,	Do.,	2 do., S. by E.
Linn Spout,	Do.,	1 do., S.W. by S.
Barkip,	Do.,	3 do., N. by E.
Waterland,	Lugton Inn, ¹	$\frac{1}{2}$ do. West.

¹ On the Crofthead and Kilmarnock Line, not opened November, 1869.