Anthracosia. The *Geological Magazine* for December, 1855, records *Anthracosia* (species not given) to have been found in the Staffordshire coal-field, along with marine shells.

In my late discovery of true marine forms at Drumpark in strata overlying all the upper coal seams (*Trans.* p. 52), I had anticipated that the further sinking of the pit would have revealed a deposit of similar fossils, but it has now reached one hundred and three fathoms, where the "main" coal has been found, while the upper or "soft" coal occurs at eighty-three fathoms, and the "Ell" coal at ninety-six, all these seams showing perfect regularity of position, without any slip to indicate an upthrow of the lower carboniferous beds, while the overlying shales enclose *Anthracosia* and *Anthracoptera* in perfect agreement with similar forms found in like positions at the workings in the vicinity.

LIII. *Notes on the Occurrence and Range of LINGULA in the Carboniferous Series of the West of Scotland.* By JOHN YOUNG.

(Read February 1st, 1866.)

UP till the present time, the carboniferous limestone series of the west of Scotland has yielded but four species of *Lingula*, the position and range of which I will indicate in the following brief notes:—

They have been named as follows:—*Lingula squamiformis*, *L. mytiloides*, *L. Scotica*, and *L. Thomsonii*. Figures and descriptions of the first three species are given by Thomas Davidson, Esq., F.R.S., F.G.S., in his Monograph of British Carboniferous Brachiopoda in the volumes of the Palæontographical Society, and also in his Monograph of the Carboniferous Brachiopoda of Scotland.* The last species, *L. Thomsonii*, is figured by Mr. Davidson, but not described, in this Society's Transactions, vol. II. pl. 2.

Lingula squamiformis is the most abundant species in many localities, and is found ranging from the horizon of our lower marine limestones and shales to the higher beds of our upper limestone series. Impressions of its thin and delicately sculptured valves are

* A Monograph of the Carboniferous Brachiopoda of Scotland. Six Plates, 8vo. London, 1860.

found in many of the ironstones and shales of the Lanarkshire coal-field, on many distinct geological horizons; but nowhere is it found in so great profusion, or of so large a size, as in the lower black-band ironstone wrought at Possil, to the north of Glasgow. It is there found in thousands; but, owing to the specimens being imbedded in a matrix of the gas coal and ironstone, the shells have been very badly preserved. It also occurs in great numbers in a shale connected with the black-band ironstone wrought at Govan and elsewhere. The finest *Lingula* of this species which I have yet seen from Scottish carboniferous strata were found at a pit sunk to the Possil upper black-band ironstone, at Robroystone, north-east of Glasgow. They occur in a stratum of soft blue shale, which immediately overlies the thick-bedded sandstones wrought a little farther to the north-east, at Bishopbriggs. The shale lies about five hundred feet from the surface, and the *Lingula* are associated with *Goniatites*, *Nucula*, *Cardiomorpha*, and several other genera of marine shells. One curious fact in the mode of occurrence of the *Lingula* in this bed, and which I have also observed in a somewhat similar shale at Dalry, in Ayrshire, is that most of the shells are found in their natural vertical position, instead of being compressed in the usual horizontal manner. This proves that the silt had accumulated round the *Lingula* during their lifetime, and that their delicate shells had never been tossed about after death by the rude currents of the ocean, so that their fine state of preservation in the strata of this locality may be easily accounted for from this circumstance.

L. mytiloides is not so abundant a species in the Glasgow coal-field as the former, but is found in considerable numbers in the ironstones and shales of other localities, as on the banks of the Avon near Strathaven, and in the shales at Dalry, and at Craigen-glen, Campsie. It is found along with the former in the shale at Robroystone, and it is also found above the limestone which was wrought at the quarries adjoining. Many of the specimens are of a fine bluish colour, and were, according to Mr. Davidson, probably of a bright green colour when alive, like some of the recent species. It seems to have had a greater life-range through the strata than *L. squamiformis*, being found from our lower limestones up to the horizon of the slaty band ironstone of the Lanarkshire coalfield, which is one hundred and sixty fathoms under the "ell" coal. The highest horizon in which *L. squamiformis* has been detected is

in strata about three hundred and seventeen fathoms below the "ell" coal. In the Permian formation of England, remains of a *Lingula* are found, so closely related to *L. mytiloides* of our carboniferous rocks, that it is doubted very much whether they are specifically distinct, and it is more than probable that it may have lived throughout all the coal period and continued into the Permian, now ascertained to be the case with several other species of carboniferous shells.

One of our recently discovered Scottish species, *L. Scotica*, is not common, so far as yet observed. It has only been found in Lanarkshire, where it occurs in two well defined horizons, viz., at two hundred and thirty-nine fathoms, and three hundred fathoms below the "ell" coal. It has also been found in strata at Boghead near Hamilton, the position of which has not yet been fully determined. *L. Scotica* had been long known to certain collectors in the Lanarkshire coalfield, but, from its peculiar shape, it was not until the last few years that it was identified as a true *Lingula*. Mr. Davidson having had his attention drawn to it by me, found it to be a species new to science. It was therefore figured, and described for the first time in his excellent "Monograph of Scottish Carboniferous Brachiopoda." Although this species has only been found in three or four localities in Lanarkshire up to the present time, further researches may prove its existence in other tracts of our Scottish coalfields. In the Glasgow district, it has been found at Robroystone, at two hundred and thirty-nine fathoms below the "ell" coal; and it also occurs on the same horizon at Gare, near Carluke, where it was first discovered by Dr. Rankin.

The other new species, *L. Thomsonii*, was found by Mr. James Thomson in a band of arenaceous limestone in Tirfergus glen, near Campbeltown. It is a rare species and has not yet been detected in any other locality. It is distinguished from *L. squamiformis*, to which it nearly approximates in form, by possessing, on well preserved specimens, traces of faint, longitudinal striæ, which is its principal specific character.

The following is a list of some of the principal localities and the nature of the strata in the immediate neighbourhood of Glasgow in which carboniferous *Lingula* are found:—

Possil and Keppoch-hill Pits, N.W. of Glasgow; in ironstone mixed with coal.

Inkerman, Paisley; Dalry, Ayrshire; Govan, Gartnavel, and Kelvinside Pits; in dark slaty shale above the Govan Blackband ironstone.

Orchard Quarry, south of Glasgow; in shale and ironstone nodules overlying limestone.

East-Kilbride and High Blantyre; in shale and ironstone nodules.

Boghead, near Hamilton; in nodules of ironstone.

Strathaven; in clayband ironstone and shale.

Bishopbriggs and Robroystone; in shales and ironstone nodules.

Craigenglen, Millburn, and Main limestone quarries, Campsie; in soft shales, calcareous shales, and clay ironstone nodules.

Corrieburn, east of Campsie; in sandy shale and clay ironstone.

The minute researches which have been made into all the fossiliferous strata of our Lanarkshire field during the last few years, by earnest and careful collectors, have revealed no new forms of *Lingula* which can be considered specifically distinct from any of the four species mentioned in this paper, so that the list of Scottish carboniferous species is not likely to be much farther extended. *Lingula* are found ranging through a series of beds in the Lanarkshire coalfield nearly two thousand feet in thickness; but their remains are seldom found in our purer limestones. They seem to have been a class of shells that loved an argillaceous deposit for their residence, rather than one entirely calcareous, so that they are more abundant in some of the clay ironstones and shales than in any other strata. There is one limestone in the Lanarkshire field known by the name of the "*Lingula*" limestone, but it is more of a calcareous shale than a pure limestone, so that what is here stated will be found to be generally correct, that carboniferous *Lingula* are often to be found in greatest abundance in strata where the principal base is clay. As formerly mentioned, the same species of *Lingula* is found in the Lanarkshire field, occurring in the same district on two or three distinct geological horizons; and it becomes an interesting question to consider what has led to its sudden extinction, and its reappearance in the same locality in a higher series of beds. And in our investigations we often find in certain strata, which must at one time have occupied a considerable area of an old sea-bottom, the remains of a whole colony of *Lingula* and other marine shells which have become suddenly extinct, overlaid by a series of beds in which few traces of shells or any other organisms are to be found. After ascending through a series

of unfossiliferous beds of greater or less thickness, we again find the same forms of organic life reappearing. Perhaps during the long period in which the intermediate strata were being deposited, some of the species found in the lower beds disappeared from these seas, and other new forms took their place; and these, after flourishing for a period over nearly the same tracts, again became suddenly extinct, left their remains in the strata, and were again overlaid by another series of unfossiliferous beds, and this reappearance and extinction of life over certain areas is found to be frequently repeated in that group of rocks which forms the middle division of our Scottish coalfield. These sudden extinctions of organic life may have arisen from several distinct causes, such as a change in the nature of the deposit, or from some deleterious sediment spread over the sea-bottom, killing suddenly the life of the period over that particular area; or they may have been destroyed by a depression of the earth's crust, causing the sea-bottom to sink to a lower level, and producing a change of temperature and pressure which became fatal to their existence. Of such changes, we have evidence in several of our coal-seams, formed of the remains of a terrestrial vegetation accumulated in swamps at, or near the sea level, and now found to be overlaid by a great thickness of fossiliferous marine strata. But wherever we find a sudden extinction of the organic life in any stratum, we are not to suppose that such extinction was universal. In most cases it must have been only comparatively local, for a total extinction would imply a new creation of the same forms in every succeeding stage of strata in which they are met with. The most probable supposition is, that during all the long geological ages in which our fossiliferous strata were being deposited, or from the first appearance of life on our globe, there never has been, at any one time, a total extinction of the Flora and Fauna, from that remote period till the present time; and when we find in our coal-measures the constant reappearance of certain well-known species, after each local extinction, in higher and higher stages of strata in the same locality, we are naturally led to conclude that, while they became extinct over these tracts, they must have continued flourishing in other parts of our carboniferous sea, and that they spread from these spots into their old localities, whenever the condition of the sea-bottom again became favourable to their growth and development.