

**No. XIX.—NOTES ON A SECTION OF CARBONIFEROUS STRATA, CONTAINING
ERECT STEMS OF FOSSIL TREES AND BEDS OF INTRUSIVE
DOLERITE, IN THE OLD WHINSTONE QUARRY, VICTORIA
PARK, LOWER BALSHAGRAY, NEAR WHITEINCH AND PARTICK.**

BY JOHN YOUNG, F.G.S., AND D. CORSE GLEN, F.G.S.

With an Illustration. [Plate IV.]

[Read 12th April, 1888.]

ON the north side of the Dumbarton Road, near Whiteinch and Partick, there is to be seen in the Lower Balshagray grounds a small ridge or knoll running east and west, crowned by a group of stately trees rising above the level tract of land, which here to the north bounds the river Clyde, its height above the present' sea-level varying from 20 to 25 feet. The ridge is composed in its upper part of beds of intrusive dolerite, which are here seen to be intercalated with Carboniferous sandstones and shales, the igneous rock being traceable westwards for nearly two miles, when it again disappears under the overlying strata of the district. The knoll now lies within the area of ground rented by the burghs of Partick and Whiteinch as a public park, and is at its south-western extremity. In former years, a quarry had been opened in the upper bed of dolerite, the rock being used for macadamizing purposes on the neighbouring roads. Since it came into the hands of the Partick and Whiteinch Commissioners, a great deal of work has been expended in dressing up and planting the rocky slopes of the old quarry; and while employed last winter in cutting a road along the hollow of the quarry, the workmen exposed the strata in which a number of fossil trees were found to be embedded. These strata underlie the upper bed of dolerite now largely quarried away, and consist of gray sandy shales, flaggy sandstones, and dark carbonaceous shales, in the bottom of which the erect stems of the fossil trees are seen to be rooted. When the workmen came upon the upper end of the stems, the excavation was carefully continued downwards until both trunks and roots of five large trees were laid bare. Four of these stand close to each other, the fifth and largest being some distance apart at the western end of the excavation. It is very probable that other tree stems exist in the immediate Proximity, as the sandstones and shales are found to be continuous on either side of the cutting for the roadway, those on the north



Chris. Meadows, Delt.

Robertson Brothers, Collotype.

FOSSIL TREES, VICTORIA PARK, WHITEINCH.

side being seen to extend under the overlying dolerite which has here not been quarried away. Other five trees have recently been exposed standing near the others, besides two prostrate stems, which are seen lying across the section in the cutting. The geological horizon of the group of strata in which these trees are found lies in the middle and lower divisions of the Possil coal and ironstone series, and which extends from this point eastward under the city boundaries, where it underlies the Millstone Grit and Upper Coal Measures, the beds in question being some 500 fathoms under the upper red sandstone which lies over the higher beds of the Lanarkshire coalfield.

The occurrence of erect stems of fossil trees, apparently on the "same geological horizon as those above mentioned in the old quarry at Victoria Park, has been formerly recorded from several localities to the north-west of Glasgow. The most recent was the discovery in the Gilmourhill quarry, where six erect stems, standing close together, were exposed in the year 1868, during the working of the sandstone for the new buildings of the University. The strata in which they were found were identical in character with those seen in Victoria Park quarry. As a notice of the strata of the Gilmourhill quarry, and of the erect fossil trees found there, and at other localities within this district, formed the subject of a paper read to this society by one of the authors twenty years ago (*Transactions*, vol. iii., 1869), it is unnecessary to repeat what is there stated regarding either this group of strata, its geological horizon, or its fossils, beyond the following short quotation where mention is made of the trees:—

" In the working of the upper bed of sandstone the quarrymen came upon the erect stumps of five or six large fossil trees. They appeared to be *Sigillaria*, and measured from 20 inches to 2 feet in diameter. They seem to have been broken, or to have decayed to within a few inches of the ground, and were composed of shaly sandstone, similar to the surrounding rock. The trees stood some three or four feet apart, and the roots of the one were seen in some cases interlacing with those of the others. While the remains of this old forest of the coal period were allowed to stand, they formed a very interesting object in the quarry, but they were ultimately removed in the working of the sandstone. Remains of large erect stumps of fossil trees from this neighbourhood are recorded in the

writings of Dr. Buckland, Mr. Smith of Jordanhill, and Mr. John Craig, mineral surveyor. Dr. Buckland states, in his "Anniversary Address to the Geological Society of London," 1840, "At Balgray, three miles north of Glasgow, I saw in the year 1824, as there still may be seen (1840) an unequivocal example of the stumps of several stems of large trees, standing close together in their native place in a quarry of sandstone of the Coal formation." These trees have now all been removed, but their position was, we believe, nearly on the same geological horizon as the trees found in the sandstone of the Gilmourhill quarry. It is therefore interesting to find them scattered over a considerable tract of country.

What we shall now endeavour to notice further regarding the new discovery at Victoria Park will be some of the more local conditions that the section presents and the proofs it affords of the great antiquity of the strata. There is nothing abnormal, however, in this section as to the conditions under which the trees originally existed. They evidently formed a portion of one of those widely extended coal forests, which over this district flourished on this horizon in Lower Carboniferous times. In the strata underlying and overlying the beds containing the fossil trees we have clear evidence that this region was then one of gradual and slow depression, which probably extended over the whole area of our coal-fields, and also over much of the country beyond. There is also further evidence that this general depression continued until more than 3,000 feet of strata were deposited above the particular horizon in which these trees now lie. The evidence for this assertion, as to the great accumulation of strata, and the downward movement of the beds, is revealed by the nature of the strata themselves.

It is now generally admitted by geologists that all our beds of free or cherry coal, whether thick or thin, were derived from growths of vegetation which flourished on the tracts of land where these coal-beds now exist. On the other hand, the strata of sandstone, limestone and shale, which alternate with these coal-beds, as clearly attest in their contained fossils what were the conditions, lacustrine or marine, under which their sediments were deposited. The coal-beds mark the periods of former land-surfaces, during which the underlying crust remained stationary, whilst the sedimentary strata mark the periods of depression when the land went down under water, either of lakes or of the sea.

of old land surfaces which exist, in the form of coal-beds, in the Possil group of strata lying between the horizon of the lower and upper marine limestones, near Glasgow. In the Gilmourhill quarry, already referred to, seven seams of coal were exposed in a thickness of 70 feet of strata, Mr. James Duncan of Twechar has sent us journals of bores put down through the same group of strata further to the east, in the Kelvin Valley, near Kilsyth, which show at least forty seams of coal, occupying horizons in the strata which lie under the upper, or Arden, limestone of the district; and over that, in descending series, of the Garibaldi ironstone, which is also worked in the Jordanhill and Knightswood pits, in the neighbourhood of Victoria Park, the distance, or thickness of strata, between the limestone and ironstone, being 207 fathoms, or 1,242 feet.

The seams of coal are generally thin, but several have been found of workable thickness within the district, such as the Shirva coal, which runs from 5 to 6 feet thick in the neighbourhood of Kirkintilloch and Kilsyth, and which is there worked, along with other of the thinner seams. The whole of these beds of coal indicate periods of repose, of longer or shorter duration, in which the land remained stationary, but they likewise mark as many periods of subsidence, when the land went down. When both are looked at and considered together they represent a very lengthened period of time, as the Possil group, which, it must be remembered, only forms the lower division of the 3,000 feet of coal measures formerly mentioned, once lay, we have every reason to believe, over the horizon of the trees now exposed in the quarry at Victoria Park. There is, however, a further period of time represented by the above section—the period required for the denudation of the whole of the coal measures which once lay over these beds in this district. Which of these periods was the longest, that represented by the slow growths of numerous coal seams and 3,000 feet or thereby of various intercalated sedimentary strata, or that during which the whole of this amount of strata has been removed by denudation, after the elevation of the region above the present sea-level? We are afraid that none of these points will ever be satisfactorily determined, as the period of deposition, and that of denudation, seem each so great as to lie almost beyond the grasp of the human mind,

Of the ten trees which have now been exposed at Victoria Park only the lower portion of the stems and the roots nearest to them have been preserved; One of the stems is, as already mentioned, much larger than any of the other nine, and stands apart in the western end of the excavation. It is of an oval form, and measures across the stem, which has decayed to near the level of the roots, about 4 feet by 3 feet in diameter. The other trees, which have their stems preserved to heights of from 2 to 3 feet above the roots, have diameters varying from 20 inches to nearly 3 feet, about the same size as the Gilmourhill trees. They are seen to have been buried near their roots in a dark carbonaceous shale containing numerous fragments and impressions of plant remains. A more arenaceous shale of lighter colour surrounds the upper portion of the stems. It may be here noted that the heights to which the stems have been preserved were in all probability determined by the depth of sediment which had accumulated around their bases ere the trees themselves had decayed downwards to their present level. Above this level the strata in the quarry were found to be quite continuous over the upper ends of the stems.

The erect stems of some twelve or fourteen fossil trees belonging to the lower Carboniferous Period, which were discovered by Mr. E. A. Wunsch, F.G.S., in a coast section in the Island of Arran, where they had grown on two or three distinct horizons, had the lower portion of their stems entombed in beds of volcanic ash, which determined the heights to which they were afterwards preserved. In a paper by Mr. Wunsch, with a diagrammatic sketch showing the trees in position (*Transactions*, vol. ii., p. 98), he says: "The height of the trunks is limited by the thickness—about three feet—of the enveloping bed of ash, in which they seem to have been buried suddenly. At the same time numerous branches must have been broken off, and covered up by the ash around the stems of the trees." We are inclined to believe that the preservation of erect stems of trees in any strata in which they may be found, is always due to the material having been accumulated around their bases ere the trees themselves had decayed down to the levels at which their stems are now found standing. These stems, it must be remembered, generally existed as hollow moulds which only represented the external form and the surface markings on the trees, but not

the wood itself; this having decayed in most instances ere their interiors became filled with the sandstone or shale, as the case may be, which now forms what are known as "casts" of the stems. The external markings which exist on the casts of the stems of the trees under notice are somewhat obscure. They have been examined by Mr. Robert Kidston, F.G.S., Stirling, an authority on fossil plants whose opinion we are glad to have, and whose remarks on the subject will be found following this paper. Mr. Kidston informs us that he is inclined to regard the trees as belonging to the *Lepidodendron* family, rather than to that of *Sigillaria*. In this view he seems to be strongly supported by the abundance of fragments and impressions of stems of *Lepidodendron* which exist in the shale above the roots of the trees, and which he believes all belong to one species, *L. Veltheimianum*, Sternb., which is also found on many other horizons in the Scottish coalfield. In the shale are also found remains of stems, and various impressions of plants which have not yet been fully determined. From the way in which the intrusive dolerite is seen to have been injected among the strata in this locality, hardening, crushing, and burning the shale beds, many of the plant remains have been rendered more obscure than otherwise they might have been.

The only other traces of organic life which have yet been met within the strata of the quarry, are the remains of Annelide burrows, which have been found in the surface layers of some of the flaggy sandstones. They belonged to a species of *Arenicola*, the tubes of which are very abundant in many of the sandstone beds lying within the Possil group of strata. For a notice of these and other organisms found in this group, we refer those interested to the list appended to the paper on the Gilmourhill quarry formerly mentioned.

The dolerite which is seen to be intrusive in the strata of the Victoria Park quarry presents the same mineralogical characters as that found intrusive in other horizons of the coal measures in the districts around Glasgow. It generally occurs in the form of extended sheets or bosses, and although seen to be intrusive in several distinct horizons of strata which range from the lower limestone series up into that of the higher coal measures, yet it is believed to have all been erupted about the same period of time, a period later, as has been clearly shown (at

pp. 39 and 44 of *Memoirs of the Geological Survey* for sheets xxiii. and xxxi.), than the deposition of the Scottish Carboniferous strata, although probably older than the upper red sandstone that overlies the coal, and in which the dolerite has apparently not yet been found to be intrusive.

In its several exposures over the country this dolerite is seen to vary more in its crystalline characters than it does in its mineral composition. It is a truly basic rock, of a dark greenish grey colour, which within the limits of the same quarry often varies from a coarsely crystalline into a fine grained and compact structure. Where thinner sheets and veins derived from the main mass are found to be intrusive in higher or lower levels of the strata in the same locality, as in the quarry at Victoria Park, the rock is generally seen to pass from its normal dark colour into different shades of light grey and greyish-white, the alteration being evidently due to its contact with the sedimentary rock, and to rapid cooling, especially along the lines of contact. In this quarry we have the interesting evidence that along these lines, especially in the thinner veins, the dolerite has cooled as a vitreous glassy lava, in which a thin layer showing micro-spherulitic structure has been developed during the process along the surface of both faces of the vein. These veins are now seen to have lost their glassy structure through devitrification, and are of a whitish colour, but their spherulitic structure, which still remains, clearly indicates that they once existed as veins of a glassy tachylite. This is the first instance in which we have found such a structure amongst the dolerites of the Glasgow coalfield.

The exposure of the dolerite here is evidently due to a fault which has brought it nearer to the surface, it having subsequently been laid bare by denudation of the overlying strata.

Near where the trees have been found it dips, at a low angle to the north-east, under the higher remaining strata of the district. About twenty years ago it was bored through at a considerable depth underground, on the farm of South Balgray, in this district, but to the north it does not again show itself at the surface until we come to the neighbourhood of Milngavie, where its intrusive sheets are once more seen, but on a much lower horizon, amongst the sandstone strata which underlie the Campsie main limestone. At the Linn of Baldernock, a little further to the east, the dolerite is seen to be intrusive amongst the same limestones, forming the

roof of one of the mines. Its subsequent intrusive character is often clearly displayed in many of the localities where it appears at the surface, as well as in those places where it has been met with in underground workings, the strata with which it comes in contact bearing evidence of having been strongly heated and otherwise altered, coal being converted into anthracite and coke, or sometimes burnt into a sooty condition, while sandstones are often much hardened and cracked, and shales are porcellanized into flinty conditions (see Geological Survey *Memoirs*). Such alterations in the strata, where these come in contact with the intrusive dolerite at Victoria Park old quarry, are clearly traceable at several places where the beds are exposed.

At one spot within the area of the excavation in which the erect stems of the trees are standing, one of the thinner horizontal veins of dolerite, in its extension through the shale, cuts right across one of the trees a little above the roots, and now forms a layer across the stem. Besides the geological interest attaching to this mode of occurrence of the dolerite, the fact also affords clear proof of its intrusion subsequent to the growth of the trees and the deposition of the shales and sandstones which afterwards surrounded them.

In the Geological Survey *Memoirs* explanatory of the several sheets which embrace the Western Scottish coal-field, and which, in the course of this paper, have been several times referred to, numerous interesting instances are given to show how these intrusive dolerites or basalts have altered and burned many of the coal strata with which they have come in contact, and also how the igneous rock itself has been altered from its normal conditions into that of the white decomposed varieties found in many districts.

In bringing our remarks on this interesting section and its fossil trees to a conclusion, we have only to add that we feel much more might be written upon the geological phenomena here displayed, as well as on the lessons which might be deduced. The nature of the strata in which the stems have been embedded forbids the idea of their being preserved for any great length of time, unless carefully protected from weather influences. Should their fate, however, be like that of the group of Gilmourhill trees, already mentioned, we shall at least have the satisfaction of recording, by the excellent and faithful drawing

made for us by our friend Mr. Chris. Meadows, their present appearance, as well as their position and relation to each other, when seen standing on the ground on which they lived and died countless ages ago.

The above paper was published in *Transactions of the Geological Society of Glasgow*, Vol. 8 (1888), pages 227-235.