

it always must have gathered its waters, ever since it was called into existence, unless some totally different action was at work, different not in *degree*, but in *kind* from what exists now. (c) And above and beyond that, I have shown how impossible it is, with the present physical character of the country then in existence, that the sands and gravels can in any way have owed their deposition or their excavation to any possible action of the river, with its present source and outfall with their existing relative levels.

The *assumption*, to which I have drawn attention, I think will be found to underly all theories respecting the history of these much disputed sands and gravels. And I trust, therefore, the Members of the Geologists' Association, will not think the time wasted in listening to or reading a somewhat argumentative, but at least an honest exposition of the grounds on which one of their associates conceives that the assumption can be shown to be untenable and consequently all theories based upon it, valueless.

EXCURSION TO CHARNWOOD FOREST, LEICESTERSHIRE.

WHIT MONDAY, MAY 17TH, 1875, AND TWO FOLLOWING DAYS.

Directors.—JAMES PLANT, Esq., F.G.S.; WILLIAM HARRISON, Esq. (Curator of Town Museum, Leicester); and WILLIAM MOLYNEUX, Esq., F.G.S.

(*Report by* WILFRID H. HUDLESTON, Esq., M.A., F.G.S.)

The party, under the guidance of Messrs. Plant and Harrison, met at Desford Station shortly after noon, on Whit-Monday, and proceeded in carriages to Lindridge Colliery. Mr. Mammatt, the engineer of the Company; Captain Marshall Hall, one of the directors; and Mr. Shore, the gentleman on whose property the sinking is made, were also present, and afforded every facility for the examination of the new works connected with the colliery. As this is a sinking through the Trias in a district not hitherto wrought for coal, the following section of the bore hole, fur-

nished by the kindness of the above-named gentlemen, is given:—

Began April 10, 1874. First coal found, May 14.

Ft. in.		Strata.	Keuper. Ft. in.
0	0	Red and Grey Marls	50 2
50	2	Smooth hard grey skerry	6 6
56	8	Red Marls (Gypsum) }	86 10
90	0	<i>Strong Spring</i> }	
143	6	Grey Sandstone	36 6
180	0	Red Marls (<i>Spring</i>)	78 0
258	0	Limestone	1 0
259	0	Red Marls	17 0
			Coal Measures.
278	0	Sandstone (plants)	9 0
287	0	CoAL	4 0
		Parting	2 0
291	0	CoAL	8 6
301	6	Grey Rock	27 10
329	4	CoAL	4 0
334	0	Grey Bind	35 0
333	4	Limestone	0 8
360	0	CoAL	3 0
372	0	Limestone, with fossils	1 0
		Grey Rock.	

The position of Lindridge is four miles south-west of the last continuous boss of the Charnwood ridge, at Groby. Two borings were made, about one mile apart. At the most easterly the "hard bind" of the Coal Measures was found dipping at a very high angle, and no further boring continued there. One mile to the westward, where the present sinking was being made, the beds are flatter, being further from the Charnwood axis, which is continued under the Trias, several miles south of Groby, as indicated by small bosses of fine-grained crystalline rock appearing on the surface.

The following remarks made by Mr. Plant serve to explain the physiography and general geology of the district:—"Where we now stand is about 18 miles from the river Trent, the north boundary of

the district, and about three miles from Charnwood Forest, which bounds it on the east side. On the west flank is the Hartshill range, a little less elevated than the Charnwood, the average height of the latter being about 600 feet, the former 400 feet, with an indefinite boundary towards the south, embracing an area of about 200 square miles, which comprises the Leicestershire coal-fields. To the north of us the Coal Measures come out at the surface. On the east the Charnwood Forest or Coleorton field extends, while the Moira stretches on the western side. The southern portion lies under the New Red formation, being covered by the uppermost beds of the New Red Sandstone. Forty years ago a practical miner and distinguished railway engineer predicted that there was no coal to be found south of this point in this direction. The Bagworth coal-fields are the answer to that erroneous opinion. There, coal is found at a depth of 320ft. below the Red-marl, where it must be noticed there is no Bunter or Permian strata. With reference to this Lindridge Colliery, I must confess I was afraid that the ridge of igneous rocks extending from Groby due south, and which might be reached near Lindridge, would be struck, and so coal would not be accessible. However, that fear has fortunately proved to be groundless, as the evidences around us testify. You must not suppose that this is the most southerly extension of the coal-field, as it is found six miles further south. Before concluding, I might just remark that you are now standing upon the Water-stones commonly called the Lower Keuper Sandstone, upon rippled-marked beds indicating old sea beaches of the formation. Here it is possible for you to find the footprints, jaws, and feet of the *Labyrinthodon*."

The party then adjourned to Lindridge Hall, where they were most hospitably entertained by Mr. Shore, who had prepared a really sumptuous luncheon, the discussion of which somewhat shortened the day's programme. This act of hospitality was duly acknowledged, on the part of the Association, by Mr. Hudleston and Mr. Plant, the latter taking the opportunity of showing the important advantages which Mr. Shore would confer on the town of Leicester with its 110,000 inhabitants by the discovery of workable coal within such a moderate distance.

An adjournment now took place to the grounds, where cores of rock, obtained in the boring, were exhibited. Here Mr. Molyneux, gave a brief account of the Coal Measures of the district.

It was already rather late in the afternoon before the party arrived at the syenite quarries of Groby, the southern termination of the Charnwood range. Immense quantities of paving stones are quarried from these rocks, which are true syenites, *i.e.*, binary compounds of orthoclase and hornblende. There is, of course, considerable variety in the different beds, as well as change in the system of jointing. Besides the ordinary syenite made up of good-sized crystals, a handsome rock, there are beds of a very fine-grained variety which seem to occur athwart the general system of bedding. In the second pit the jointing is more vertical, though the character of the rock is much the same. The Rev. T. G. Bonney writes—"I have examined microscopically the Garenden and Groby syenites—true syenites, though much altered—'messed,' I might say, subsequently." The rock generally appears to consist of a flesh-coloured felspar, with good cleavage, and of a certain amount of hornblende, which, where undecomposed, is nearly black. The hornblendic element seems, however, to have undergone a considerable amount of alteration—decomposition, one might rather say—the result being the production of a green-coloured mineral, which has largely stained the felspar. Pink and green, therefore, are the predominating colours, justifying to a certain extent the name of "syenitic greenstone," which has been applied to this rock. The joint faces are often lined with a green mineral matter, which sometimes resembles epidote, and sometimes is of a serpentinous character. All these may be looked upon as altered products from the original hornblende, produced in the 'wet way,' and have nothing to do with the original formation of the rock, which has all the character of an igneous one.

One very interesting feature here is the Upper Keuper Sandstone, which may be seen to rest upon the upturned edges of the old rock, in positions suggesting a sort of quaquaversal dip away from a rocky islet in the Triassic Sea. Between the syenite and the Triassic sandstones and marls there is a conglomerate of pebbles and boulders, chiefly made up from the neighbouring rock, in a pasty matrix, somewhat analogous to the Dolomitic-conglomerate of the Mendips.

A short drive brought the party to Newtown Linford, situated in the anticlinal valley of the Charnwood range, now wholly filled with beds of Keuper age, where all dismounted and entered Bradgate Park on foot. Here an immediate change in the cha-

racter of the landscape proclaimed the presence of that great body of syenite, which constitutes the southern termination of the eastern wing of the Charnwood range, just as the Groby syenites are the southern termination of the western wing. Ragged, splintery edges of rock start out of the steep hill-side, which is dotted with oaks short in stature and most picturesquely gnarled, a bit of Cambria or Caledonia in the midst of the rich Midland of England. The ruins of Bradgate Hall are close by. The place was set on fire, tradition says, by a former countess, who found the country dull, and wished to return to more animated scenes. Further on the slaty beds of the Charnwood series occupy the surface. Near "Old John Hill," which is the highest point of Bradgate Park, we find the cleavage planes dipping north, whilst the beds dip to the south, at an angle of 60° . In some places there is a remarkable ribboned appearance, due to variegated colouring in the bedding planes. Hereabouts the cleavage is often very imperfect and coarse. It was noticed by several members of the party that these slates have a very "ashy" appearance, not unlike those of the Volcanic rocks of Cumberland, now so well known through the labours of Mr. Clifton Ward, of the Geological Survey. The view from Old John Hill is magnificent; and Mr. Plant failed not to enlarge upon the physiography of the district, dwelling especially upon the configuration of the country as it had been left by Glacial erosion.

The party now proceeded to the great wood of Swithland, where there are several slate quarries. The one visited is a great excavation, 150ft. deep. The general dips here are about 45° in an easterly direction. It was already too dark, however, for much accurate observation. Two members of the party volunteered to descend the chasm, and were, unfortunately, left behind; a large portion of the remainder missed their way in the big wood, and, after wandering about for some time ultimately regained the carriages, and proceeded in the direction of Mount-sorrel, and so to Leicester.

TUESDAY, MAY 18TH.—The party proceeded by the Leicester and Burton Branch Railway to Bardon Hill Station. The first thing inspected was an old road-stone quarry in the slate, now converted into ornamental grounds. This is at the foot of Bardon Hill. The cleavage of the slates is very imperfect, but

the bedding is distinct, with a strong dip to the S.W., *i.e.*, away from the great boss of Bardon Hill. Amongst other objects of interest in this section is a band of old conglomerates, containing a number of rounded pebbles. A specimen of one of these pebbles consists almost entirely of pink orthoclase and vitreous quartz—no mica or hornblende. This was *in situ*, but amongst a group of stones forming a “rockery” were some specimens of the so-called slate from near the top of Bardon Hill, which was a typical volcanic breccia, or, rather, an “ash,” with large, included fragments precisely similar to examples from the Volcanic rocks of Cumberland. Unfortunately, no actual junction between these slates and the Bardon Hill Stone was observed. This stone is quarried exclusively for road-metal, since it cannot be broken into cubes, as are the syenites. On the Survey map it is indicated as a greenstone. The Rev. T. G. Bonney writes—“The greenstone of Bardon Hill is a felstone; it has orthoclase and much quartz in it. I rather think it is the stump of a plug or cone, for there is much agglomerate on one side of the hill.” It is less distinctly crystalline than the syenites of Groby, or the syenitic granite of Mount-sorrel. The prevailing green colour is probably due to the subsequent decomposition of small quantities of hornblende, or other magnesia-lime silicate, the resulting green hydrous silicate being more or less diffused throughout the whole rock. This description is not, however, applicable to the whole mass, as there are many varieties; some in the vicinity of quartz veins presenting mineralogical features of much interest. The green colour, in some instances, also may be due to the presence of a mineral of the epidote class. A system of planes, dividing the rock into large slabs, dips inwards in a direction of E.N.E.; and intercalated between these planes in one place, near the entrance of the quarry, is a parallel mass of rotten foliated rock associated with quartz. This has been called mica-schist. It is rather rich in magnesia, with a considerable amount of ferrous oxide, but is poor in lime, silica and alumina being, of course, the principal ingredients; and it may be viewed, perhaps, as a sort of talco-micaceous schist.

Not the least interesting part of the morning's work was an examination of the self-acting machine for breaking stones, invented by Mr. Everard's son. The working of this was most fully explained by Mr. Everard, jun., who had very kindly

(though the men were holiday-making) had the mill set at work for the benefit of his visitors. The stone is delivered from the face of the quarry into small waggons which run down the incline by the force of gravitation, and discharge themselves into the breakers; the empty waggons returning on another set of rails, forming one continual circle of operations for the delivery of the stone. The stone falling into the hoppers, is delivered into self-acting crackers, worked by a powerful steam-engine and by the aid of very ingeniously-contrived self-acting machinery, and the broken stone is sorted into three or four qualities into the railway trucks ready for delivery. The whole of the mill and machinery reflects the highest credit on the inventor; and we believe, as far as stone-breaking is concerned, it is unique.

The ascent of Bardon Hill, the highest point in the forest—854 feet above sea-level—had formed part of the programme. Mr. Herrick, of Beaumanoir, had been good enough to send his steward to act as guide to the party; but the weather was so unpropitious that the ascent had to be abandoned, together with the intended walk to see the “porphyrite” rocks of Greenhill. Of these Mr. Bonney writes—“The porphyrite rocks are not igneous, only extremely metamorphosed, and, so far as I know, are not conspicuous for plagioclase felspar; therefore, they should not be called porphyrites.”

It is somewhat remarkable that both the period of upheaval, and the period of formation, of these Charnwood rocks, should be still the subject of much dispute, notwithstanding the considerable amount of attention which they have received from geologists. Respecting the period of upheaval, it may be gathered, from the statements of Mr. Plant and Mr. Molyneux, that both these gentlemen believe it to have been *post*-Carboniferous; Mr. Molyneux especially expressing himself to the effect that it was the prolongation of the Penine axis which had “broken the back of the coal.” It had been Mr. Plant’s intention to have given a fuller exposition of his views on this point from the summit of Bardon Hill. The adjournment of this section of the excursion party from the quarry to Mr. Everard’s luncheon table, however, prevented him from fully developing his views on this and other points. Writing, subsequently, he says, “The age of the anticlinal has been a matter of dispute ever since geology was a science; my opinion, after nearly thirty years’ study of it, is that it is *post*-Carboniferous.

Professor Hull says it is *pre*-Carboniferous, and that the Mountain Limestone of Grace-dieu 'lies unconformably on the up-turned edges of these Cambrian rocks.' The question is one of immense significance, viz., the existence, or non-existence, of a coal-field to the east and south-east of Charnwood." On the faith of this more sanguine view of the question a boring through the Keuper marls is being executed close to the town of Leicester,* at a spot not far from the well-known Rhætic section, which has been worked with such success by Mr Harrison of the Leicester Museum. Should coal be found there, the views of Professor Hull would scarcely seem to be sustained in that quarter. That geologist was of opinion that an old land-surface† existed during the Carboniferous period extending quite across England, from Wales to the Wash, and that the Charnwood hills are portions of that old land-surface, in a hollow or bay of which what are now the Leicestershire Coal Measures were deposited.‡ It is quite possible that this may have been so, and yet that this old land-surface felt the effect of those elevatory forces, which, acting on N. and S. or Penine lines, have tilted the Coal Measures in post-Permian times. This would serve to explain why local geologists view the Charnwood anticlinal as post-Carboniferous; but that by no means takes away the possibility of its having been an old land-surface during Carboniferous times, and that the Leicestershire coal-field is an original basin of deposit, terminated at its eastern margin by pre-existing land-surfaces. The period and mode of formation of the Charnwood rocks, is equally a subject of dispute, though, as the issue has no economic importance, these are matters of purely geological interest. By the Survey, they are called Cambrian, because, as Professor Ramsay

* Mr. Harrison, writing Nov. 12th, 1875, says:—"The boring has, it is stated in last week's local papers, reached the New Red Sandstone; they are down nearly 700ft., through red marl and clay, and have now reached a bed of sandstone. If this is the Upper Keuper Sandstone, it is overlaid by a much greater thickness of marl than farther west, where some 200ft. only are found above it."

† "Coal fields of Great Britain," 3rd Ed., p. 464.

‡ "The known coal areas of England seem to have been deposited to the north and south of a tract of Carboniferous land surface, to which I have several times alluded under the term of the 'Barrier.' This tract of land appears to have extended from Wales, Shropshire, and Herefordshire, towards the east, along the southern margin of the South Staffordshire coal-field. The prolongation of this land surface may again be recognized in the Cambrian rocks of Charnwood Forest; and between this part of its range, and that of South Staffordshire and Worcestershire, there was probably a deep bay, stretching in a southerly direction, which was filled in by the prolongation of the Leicestershire coal field." "Memoirs of the Geological Survey, Triassic and Permian Rocks of the Midland Counties," by Ed. Hull, M.A., F.R.S., page 109.

told Mr. Plant, there were no sedimentary deposits of older date then known. Since then, Mr Plant has suggested in the "Geological Magazine," that, from Murchison's own data, they ought to be called Laurentian. Hence, it appears, there is a general idea of their being very old indeed; and, as they are only found in company with very much more recent rocks, we have nothing to prove the contrary. Lithologically, the resemblance of some of the slates and agglomerates to the volcanic rocks of Cumberland, has been already noted; thus they may ultimately turn out to be Silurians of the same age as these beds. The mode of formation, is also a subject of much dispute; and Professor Ansted has taken extremely metamorphic views. He appears to consider that one great deposit of marls, clays, and sand, was, in very early times, upon an axis of depression then existing over Western Europe, lowered within the scope of metamorphic action, and then brought up again, on an axis of elevation, itself one of the most ancient in Europe. It is very difficult to avoid believing that the syenites of Groby and other places, are true igneous rocks, although they may have undergone a considerable amount of alteration due to chemical changes, acting through long periods of time; but this is very different from what is usually understood by metamorphism.

After enjoying Mr Everard's hospitality, this section of the party had a rainy walk to Coalville, where they joined the rest, and all proceeded by rail to Gresley, a station on the Moira coal-field*

* The following notes on the Leicestershire Coal-field are obtained principally from "Hull's Coal-fields of Great Britain," page 225 *et seq.* Superficially, its western, northern, and southern edges are bordered by the Trias, and on the N.E., by the ancient rocks of Charnwood Forest. The Coal Measures underlie the Trias (here consisting chiefly of Keuper Marls) to a large and unknown distance towards the south and west. The coal-field is physically divisible into three districts—that of Moira, on the west; Ashby-de-la-Zouch in the centre; and Coleorton on the east. The first and last only contain workable coals. The coal series of these two districts cannot be identified with each other, though they are probably synchronous. The "main coal" of Moira is from 12ft. to 14ft. thick; that of Coleorton from 6ft. to 8ft. The new colliery at Lindridge, would, of course, belong to the Coleorton field in its southerly extension beneath the Keuper.

Coal Seams of the Leicestershire Coal Fields (page 227).

Moira district—(West).		Coleorton district—(East).	
	ft. in.		ft. in.
Ell Coal	3 8	Stone Smut	4 9
Dicky Gobbler	3 6	Swannington	3 7
Block Coal	3 6	Slate Coal	4 8
Little, or Four-feet	4 6	Coal	2 10
Cannel	3 6	Coal	3 7
Main { Over Seam	12 0	Main Coal	6 0
{ Nether Seam		Upper Lount	3 9
Toad	3 6	Second Lount	3 0
Little Woodfield	2 6	Middle Lount	4 6
Woodfield	5 6	Nether Lount	4 6
Stockings	9 0	Heath End Coal and Cannel	10 0
Eureka	4 6	Lower Coal measures.	

Strata below this unproved

some distance to the west of Ashby-de-la-Zouch. From Gresley, the party walked down the line about a mile towards the Coton Park and Linton Colliery—passing, on the way, a section of the lower portion of the Pebble-beds of the Bunter.

This is an instance of a shaft being sunk through beds of Triassic age, in order to reach the rich seams of the Carboniferous Series of Moira, which are here at a very moderate distance from the surface. The main seam is upwards of 14 feet thick, and is mostly good coal, with no gas. Whilst waiting the arrival of Mr. Molyneux, some of the party amused themselves by inspecting the “gobfires,” which had converted the rubbish heap of the pit into a little volcano. Shovel fulls of sulphur might have been taken away from here before the rain. Many “needles” and “flowers” of sulphur were still to be had. There was also a considerable quantity of ferrous sulphate, likewise the result of the oxidation of pyrites, which is plentiful in the smutty clod; crystals of salt are not uncommon.

After partaking of the hospitality of the Company, of which Mr. Molyneux is one of the directors, the party descended into the workings, which are remarkably clean and dry. As there is no gas, each Member was provided with a candle, and the effect of such an illumination on the shining walls and roofs of “black diamond” was most striking. These galleries—lofty, indeed, for a coal mine—are all hewn out of the coal, the workings having a face of 10 feet. The roof contains numerous compressed plant remains, mostly *Sigillaria*.

On returning to the surface, Mr. Molyneux addressed the party on the geology of the district; after which the train was taken for Leicester. In the evening many of the Members availed themselves of the opportunity of inspecting the Leicester Museum, under the direction of Mr. Harrison, the Curator.

The following is taken from a local newspaper :—

Wednesday.—To-day Barrow lime-beds were set down for a visit. The train from Leicester was taken, which soon brought the party to the Lias beds. Here the various operations of removing, lifting, burning, and grinding the limestone were witnessed. This was succeeded by a search for geological rarities. One or two of such were found. Ammonite casts and *Pectens* were very abundant. From Barrow, Mount-sorrel was soon reached,

where, under the guidance of Mr. Edmunds, a minute inspection of the Mount-sorrel Granite Company's extensive operations was carried out. Luncheon was here very generously provided. The company then made a tour of inspection of the hill, where the remarkable Glacial action, the most perfect of its kind in England, was pointed out. A brisk discussion took place as to the origin of the Drift found at the side of the hill. The fact of Liassic and Oolitic fossils being common in it, is conclusive against its being a true moraine, though it partakes more or less of a moraine character. A trap dyke on the flank of the hill, about six inches in width, and extending for several hundred yards, and composed of pure felsite, was next noticed. The Members carried off specimens of this intrusive igneous rock. Simpson's Quarry was then visited. This place has a historic interest, it being that visited by Professor Airy (Astronomer Royal), the late Professor Whewell, and Professor Sedgwick. These found a trap dyke of greenstone in 1834, but as the quarry has been worked, that has probably become obliterated, no trace of it being now visible. The gneissic rocks were next visited, after which the company returned to Sibley Station, whence most of them proceeded to London. Thanks are due both to Messrs. Ellis and Son and the Mount-sorrel Granite Company, for their kindness in permitting so thorough an inspection of their works. The arrangements for the various excursions were, on the whole, well carried out; and the Members doubtless returned to their various homes with the pleasant thought that they had derived both pleasure and profit from their visit to ancient Charnwood.

ORDINARY MEETING, JUNE 4TH, 1875.

WILLIAM CARRUTHERS, Esq., F.R.S., President, in the Chair.

The following Donations were announced:—

“Quarterly Journal of the Geological Society,” Vol xxxi., Part 2; from that Society.

“Abstract of Proceedings of the Geological Society;” from that Society.

“Journal of the Society of Arts,” May, 1875; from that Society.

“Journal of the Quekett Microscopical Club;” from that Club.