EXCURSION TO NOTTINGHAM.

JUNE 4TH—7TH, 1892.

Directors: THE PRESIDENT AND LIEUT. G. E. COKE, R.N.,
F.G.S.*(Report by THE PRESIDENT.)*

Saturday, June 4th. The party from London having arrived about midday, and taken up their quarters at the George Hotel, a start was made by the 1.25 p.m. train for Tonge, to visit the great mass of Mountain Limestone at Bredon Hill. This mass stands out from the low ground of Keuper Marls like a buttress, and, with the similar hill to the south called Bredon Cloud, forms a continuation of the Penine chain. Speaking in a strict geological sense it is an inlier, being surrounded by the newer Trias, but the President pointed out that it stood above the general level of the Keuper and had in all probability been worn into nearly its present form before Triassic times, so that originally it partook more of the nature of an outlier. The rock here has a fairly high dip towards the west, so that at Ticknall in that direction are found the higher shaly beds of the series, forming the commencement of the Yoredale Shales. The limestone here is very magnesian, as shown by the following analysis by H. Woods :

Ca CO ₃	.	.	.	57.2
Mg CO ₃	.	.	.	39.2
Fe ₂ O ₃	.	.	.	1.8
Si O ₂	.	.	.	0.3

98.5

The rock is not very soft or easily weathered, so that it is not a good hunting ground for fossils; but Mr. John Wright, of Melbourne, who was one of the party, gave the following list of the fossils which he had obtained here during some years' search :

<i>Orthoceras fusiforme</i>	<i>Spirifer striatus</i>
„ <i>giganteum</i>	„ <i>trigonalis</i>
<i>Bellerophon costatus</i>	„ <i>cuspidatus</i>
„ <i>apertus</i>	<i>Cyrtina septosa</i>
<i>Euomphalus Dionysii</i>	<i>Productus mesolobus</i>
„ <i>tabulatus</i>	„ <i>punctatus</i>
„ <i>pentangulatus</i>	„ <i>humerosus</i>
<i>Acroculia spirata</i>	„ <i>semireticulatus</i>
<i>Naticopsis spirata</i>	<i>Syringopora funiculata</i>
<i>Spirifer duplicatus</i>	<i>Zaphrentis cylindrica</i>
„ <i>papilionaceus</i>	

After examining the rocks in the quarry, and attempting to gather the wallflowers and greater snapdragons, which have a habitat here in almost inaccessible places, the party climbed the hill to obtain a general view of the surrounding geology. On the horizon to the south were seen the Charnwood hills, and on the

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right stood out the chimneys of the Leicestershire coalfield, indicating Coal Measures far below the ground. The spot on which the party was standing was intermediate in level between these two, and the rocks were intermediate in age; but it was pointed out that the order of level and age were here reversed, the oldest rocks being the highest and the youngest the lowest, while all the intervening ground was covered by a still younger formation. In Carboniferous times the Charnwood mass formed a promontory on the shores of which the earthy limestone of Grace Dieu was deposited, while in the more open sea, where no river entered, the purer limestone of Bredon was produced by the abundant forms of life. In Triassic times the outline of the land might be compared to that of Devonshire and Cornwall of to-day, the Carboniferous Limestone representing the Devonian, and the Charnwood mass the projecting headland of the Lizard.

Mr. Paul then pointed out that the country intervening between the Penine chain and the Charnwood mass had afforded passage for the water which drained off the western side of the axis, so that it crossed here to the other side, and fell into the sea on the east coast.

The party then returned from Tonge Station to Chellaston, and there examined the gypsum pits, under the conduct of the proprietor, Mr. Stableford. The gypsum here is in irregular lumps and of a massive kind; its formation after the deposition of the beds was very evident by the way in which strings of it ramified into the marls. This is the pit from which the Triassic foraminifera were said to have been obtained; but neither at the present time, nor ever before, have dark shales like the matrix of the foraminifera been here obtained *in situ* in the Keuper; and the President gave it as his opinion that they had been obtained from a Lias boulder in the Drift. The Drift at the other end of the pit was then examined, and though at present rather overgrown, abundant boulders of Lias, Chalk and flint were obtained, some of them beautifully scratched.

From this pit the party walked towards Derby, stopping at Sheldon's Wharf, where Mr. R. M. Deeley had kindly had some exposures of the Drift specially cleared for inspection. This is a very dark drift, with many coal-shale fragments. The boulders are beautifully scratched, and appeared to be all of Carboniferous age, whether limestone or sandstone, the contrast in this respect between these and those at the former pit being very marked. The relations in time of these drifts have been fully discussed by Mr. R. M. Deeley (*op. cit.*). The President had been content to distinguish them as the Eastern and Western Drifts respectively.

Monday, June 6th —The object of the day's excursion was the examination of the Permian and Triassic deposits of the Leen Valley. A commencement was made at Bulwell, whither the

party drove in brakes. Here the Magnesian Limestone is worked for lime and building stone, a thickness of about twelve feet being visible in the broad and shallow quarries. The limestone is brown in colour, very granular, and when examined with a lens is seen to be composed of a loose aggregation of octahedral crystals. So very much like a sandstone does it appear that some of the members while looking directly at it asked: "But where *is* the Magnesian Limestone?" The rock is probably as good a dolomite as any that can be found in the kingdom, as there is little else in it than crystals of one mineral which yield nearly half the weight of the stone of sulphate of magnesia. Along a certain band in the quarry, about three feet below a flaggy band near the top, were seen numerous hollow casts of fossils referable to *Schizodus*, but too imperfect for specific determination: with this exception, the Permian is here unfossiliferous.

The President here stated that we were at the southern termination of the Permian series, and hence that the development was small; in fact this Magnesian Limestone was here the lowest member and became conglomeratic a mile or two to the south. Nevertheless a little to the north and west lower beds came in, which would be seen later in the day. The Leen Valley is principally caused by the erosion of the overlying Trias to the level of the limestone, the river being kept up by the Permian Marl, and fed by the water rising out of the Bunter Sandstone. It is to be hoped that the inhabitants learnt something about their native valley, for they crowded round in such numbers that the members of the Association were lost amongst them.

From this quarry the succession upwards was traced through the Mottled Permian Marls into the Lower Bunter Sandstone, the junctions in both cases being perfectly visible in the Bulwell Brick Co.'s quarries. It is between these two beds that higher zones of limestone are reported further north, yet here it was seen that the whole is perfectly continuous. In spite therefore of the consensus of opinion that the Permian is Primary and Trias Secondary, Nottingham geologists were inclined to put them all in one group with the great break below, the only difficulty arising from the fact that the physical and palæontological breaks do not here coincide.

Having driven to Hucknall Torkard some of the members were conducted to the Long Hills to see what the President distinguished as the Volcanic Drift. It is a drift whose boulders are almost entirely of igneous rocks. Though the time was short, the locality was no sooner reached than boulders bearing a close resemblance to Buttermere Syenite and the Lodore Trap were immediately found; while the goal aimed at was a huge erratic of volcanic ash, like that of Borrowdale, lying across a ditch at Wyburn Farm.

The next halting place was Annesley Park, where, descending

from their carriages, the members mounted the hill and examined a sand and gravel pit. The Drift here, according to Mr. Deeley, is of earlier age than those examined on Saturday. It is remarkable for the abundance of pebbles of Permian rocks, particularly of the Marl Slate, and hence its ingredients are mainly derived from local rocks on the west. This same kind of drift is found capping all the hills which surround the head waters of the Leen, and it presents almost everywhere the peculiar feature of some parts being consolidated by calcareous matter and some being loose—the hardened parts standing up as pillars in the midst of the loose—or where the latter is worn away, outstanding on the surface as in the so-called “Druidical Remains” at Blidworth. The Director explained this phenomenon as occasioned by water passing down these spots as down pipes, discolouring and re-cementing the calcareous pebbles. Mr. Shipman, however, expounded a different view, namely, that the cemented parts were not Drift at all, but remains of a thick bed of conglomerate of Lower Keuper age that once capped the hill and had here and there escaped denudation. Thereupon the Director invited the members to find any difference, if they could, between the cemented and uncemented portions, beyond the presence of the cement. Another pit was then examined along the crest of the same hill, where the appearances were more in favour of Mr. Shipman’s views, inasmuch as a large mass of Trias sandstone is here surrounded by gravel. This mass was believed by the Director to be itself a boulder, which had not travelled far, but it was impossible to dig below it to see if it were *in situ* or not. On the road to Grives Wood the party alighted near Sherwood Place to examine the large boulder of andesitic lava which here lies by the roadside, as mentioned in the Geological Survey Memoir. On arriving at Grives Wood, the sides of which are all Magnesian Limestone, the party went along the Midland Railway cutting to examine the Marl Slate which crops out from beneath the Limestone. The cutting is all grassed over, but there are a few projecting masses and numerous fragments of a fissile grey calcareous rock, which is often coated with casts of *Schizodus* and *Axinus* indicating about thirty feet of Marl Slate. At the further end of the cutting the basal breccia is gradually reached, the Coal Measures being just beyond. Some of the members who, not being familiar with breccias in the field, had formed exaggerated notions of the size of the component fragments, were at first dissatisfied that this rock should be called a breccia, but further search brought to light pieces that the most sceptical could not deny.

Here ended the day’s geologising, though the drive home gave favourable opportunities for observing the physical aspect of a Bunter country.

Tuesday, June 7th.—In the morning the members visited the

Clifton Colliery, where they were received by the manager, Mr. Fisher. The nature of the seams here worked, their lie and position, the faults by which they are affected, and the amount of Triassic covering present were all explained by the Director (Lieut. G. E. Coke), who mentioned that this colliery was historically interesting as the first that was sunk through Trias rocks to reach Coal Measures, owing to the declaration of Sir R. I. Murchison that the latter would be found there. The party then descended the shaft and examined the workings, and the faults which cut the roadway.

On emerging to daylight the members returned to their hotel *via* the Castle rock, where the Pebble Beds of the Bunter are admirably exposed. Here particular attention was drawn to the manifestation of false-bedding and contemporaneous erosion shown in the roadside of Standard Hill.

In the afternoon a visit was paid to the Hemlock Stone. Driving along the Derby Road, the party alighted at the further corner of Wollaton Park, beneath the wall of which is an exposure of Keuper Waterstones. This gave the horizon at which the examination started. On the other side of the hedge, at a lower level in the field, is a quarry of very loose Pebble Beds, which is somewhat interesting from having a greater variety in its pebbles than is usual, one large one of grit with Caradoc fossils found some time ago by Mr. Shipman being the most remarkable. This pit must be at the very summit of the Bunter here, as the Waterstones are so close above. Here therefore, if anywhere, should be found the basement beds of the Keuper; and here on digging up the intervening ground, were accordingly found large masses of coarse calcareous conglomerate which forms a continuous band. The real nature of the base of the Keuper in this district was thus demonstrated.

While at this spot the President took occasion to mention the two rival theories of the origin of the Bunter, the marine and the fluvatile. He could not understand how a river could have made similar deposits on both sides of the Penine chain, which must have been even then in existence, nor how any river could form so widespread a formation. The pebbles also, certainly in some cases on this eastern side, came from the west, and he believed many of them were derived from the Cambrian, though the flakes of red clay might be washed out of the Permian below.

From this spot to the Hemlock Stone could be seen a continuous outcrop of rock bounded on the north by a fault bringing up the Coal Measures. The section across this band of rock was next examined in Moor Lane. The Director pointed out that though the base here was redder and had fewer pebbles than the upper part, yet no clear line could be drawn to mark off any Lower Red and Mottled Sandstone.

On arriving at the Hemlock Stone the question of its origin

SECTION FROM ROUGH HILL TO THE HEMLOCK STONE.—*J. F. Blake.*

- a.* Coal Measures. *c* Pebble Beds. *e.* Waterstones.
b. Lower Red and Mottled. *d.* Keuper Basement Beds. *f.* Keuper Marl.

SECTION ACROSS THE LEEN VALLEY AT HUCKNALL TORKARD.—*J. F. Blake.*

- a.* Coal Measures. *c.* Marl Slate. *e.* Permian Clay. *g.* Pebble Beds. *i.* Keuper Marls.
b. Permian Breccia. *d.* Magnesian Limestone. *f.* Lower Red and Mottled. *h.* Waterstones.

Horizontal Scale, 1 in. to the mile. Vertical Scale, 1 in. to 600 ft.

was discussed. It is marked on the more recent issue of the Survey Map as capped by Keuper conglomerate, as are also the summits of Bramcote and Stapleford Hills on either side. The members had just had an opportunity of seeing the undoubted Keuper conglomerate in the district, and the Director invited the members, if they could, to find any such rock here. The stone however is singularly free from pebbles, only one or two being here and there distributed as in the less pebbly portions of the Pebble Beds. The real reason of the isolation of this remarkable stone, as well as of the elevations of the neighbouring hills, was the infiltration of a cementing material, believed at one time to be calcareous, but now known to be barytic. The cement was more widely distributed where the hill summits were, but at the Hemlock Stone it was confined to a pipe, so that the lower part was softer. Still fewer pebbles were to be found at the base, which was redder and finer in texture, so that possibly it might be Lower Red and Mottled Sandstone, though more probably it was only a repetition of what had been seen in Moor Lane. It was also noted that the cementing material was sporadically distributed, so as to produce harder and softer parts; the former on weathering out gave the appearance of pebbles when large, and of a peculiar "coralloidal" structure when small. Mr. Shipman on the other hand held that the cap at least of the Hemlock Stone belonged to the Keuper Basement Beds, as it closely resembled specimens of that rock from Cheshire which he had brought for comparison.

Several of the members climbed on to the Stone by aid of a ladder at the base, and secured barytic specimens; after which the party crossed the road into Bramcote Park, by kind permission of Captain Holden. Here they went to the summit of the hill and found in numerous spots the development of white barytes, impregnating the loose sand and giving it a crystalline form, as in the case of the Fontainebleau Sandstone.

With this the geology of the day and of the excursion terminated. Yet not the pleasure, for the Association was cordially welcomed by Mr. Richard Enfield of Bramcote Grange, on whose hospitable lawn they learnt what picturesque surroundings the Trias can afford, and what genial sons of science the Midlands can produce.

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