EXCURSION TO BANBURY, BLOXHAM, EDGE HILL AND HOOK NORTON.

WHITSUNTIDE, 1895.

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(*Report by THE DIRECTOR.*)

THE Association met at Banbury for the second time in the Whitsuntide of 1895. A route was planned over ground which had not before been visited.

The most complete and the most fossiliferous sections of the Middle and Upper Lias are those at Bloxham, three and a half miles south-west of Banbury, and Constitution Hill, three-quarters of a mile west of the town. It was arranged for the Saturday afternoon to go to Bloxham by rail, and to return by road by way of the Constitution Hill to the town.

In the railway cutting of Bloxham the whole of the Marlstone rock bed of the Middle Lias (zone of *Ammonites spinatus*) is shown, together with a few feet of the Marls below. Above the twenty feet of the rock-bed, but passing into it without break, is the limestone of the Upper Lias. This is succeeded by other clays and limestones (see Fig. 1, p. 178). The two lower beds of limestone of the Upper Lias contain a profusion of Ammonites, and there is also a large general molluscan fauna.

At the top of the red rock a band filled with long, cylindrical tube casts occurs, at the point of junction with the Upper Lias. These lie for the most part parallel with the bedding. At some future time they will be described. There are two phases of transition from the Middle to the Upper Lias in the Banbury district, the one where the red ferruginous limestone of the rock-bed merges into the Upper Lias, and the other where the stratum I have called the Transition Bed (really a *spina communis* zone) intervenes. With the latter phase there is evidence of attrition of the rock before the deposition of the Transition Marl, but the latter is not present at Bloxham, neither is there evidence of the Fish-bed and Paper shales, which attain a thickness of forty feet in Gloucestershire. That series may be represented in time by the thin, white limestones of the Upper Lias with *Eucyclus capitaneus*, which are really welded with, though so distinct from, the "*spinatus*" rock.

At the Transition time died much of the fauna of the preceding deposits, and then also was developed the luxuriant life of the incoming Upper Lias.

Above the second limestone bed, deposited often in hollows in it, is a thin layer, barely a half inch in thickness, made up entirely of the joints of Pentacrinites. The segments make a pavement of tesserae which would be a good study for an Art

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School. Thin and inconspicuous as the crinoidal stone is, I have traced it over the country ten miles North of Banbury, where below it are seen the Fish bed and the Transition Bed, each stored with the distinct remains of its former life. It may seem that undue value is made of the recognition of these minute zones of life, but when their extension elsewhere is considered, the supposed "hemera" here means an æon elsewhere, and the student of *regional variation* knows such labour has not been in vain.

In the Banbury district the Ammonite zones of the Upper Lias are by no means well distinguished by their special forms. *Ammonites bifrons* ranges from the lowest beds to the uppermost (*Leda ovum*), nor can its abundance at any particular stage be depended upon as a guide. *Ammonites communis* is found in all the beds below the *Leda ovum* clays, and is replaced largely, if not wholly, by *Am. Holandrei* in the Transition Bed. *Ammonites serpentinus* may hold good as a name for the Fish-bed and Paper shales.

At Constitution Hill, the succession of the beds is shown as in Fig. 2. The marls below the rock-bed are nowhere seen in their full thickness, and vary from 20 to 30 feet. The brickyard in the Green Lane, south east of the town is the best exposure. The marl belt, however, plays an important part both in the physical geology of the countryside and in its agriculture. At its base is the chief water supply of the district. It is also marked by the terraced fields of its slopes. Bands of limestone in the lower part, near Byfield, yield Ammo-

FIG. 1.—BLOXHAM RAILWAY CUTTING NEAR THE STATION.

- 2a. Upper Lias Clays.
- 2b. " Limestones.
- 2c. Upper Lias Limestone.
- 3. Middle Lias Marlstone.
- 4. " " Marls.

FIG. 2.—VERTICAL SECTION:
MR. KIMBERLEY'S AND MR.
ATTWOOD'S BRICKYARDS, CON-
STITUTION HILL, BANBURY.

nites in form between *Am. spinatus* and *Am. margaritatus*, also *Am. amaltheus coronatus*, Quenst., *Trochus nitens*, Dumort., *Turbo latilabrus*, Stol., *Cardita multicostrata*, Phil., and many other small molluscs. In the marls themselves *Plicatula lævigata*, Dumort., occurs, but is rare.

The rock-bed above, into which there is gradual lithological and palæontological passage, is the Marlstone of the Geological Survey and the Hornton stone of the country folk. It is the same as that of Bloxham. It is a ferruginous cyprid limestone, of which I read an extended account before the Geological Society, but the paper has not been published. Though neither of the sections seen by the members of the Association showed more than 20 feet of rock it does attain 30 feet in thickness, and at Edge Hill, visited on the Whit Monday, its maximum thickness is between 25 and 30 feet. Throughout its extent, though rarely exposed, is the nodule bed at the base, always stored with the shells of molluscs and sometimes with corals.

The Marlstone by the oxydisation of its iron is often red brown throughout. The lower courses have cores varying from grey green to dark green in colour, and make a valuable building stone. The best building stone course is the bottom rag; the top rag yields the paving stone and stone well known for domestic work. Good alike for both architectural and general building purposes, the Hornton stone (Hornton is the best source of supply) has earned an excellent local name. Though in Acland

and Ruskin's good book, "*The Oxford Museum*," "columns of slate, and shafts of lias blue and white, marbles of Purbeck, Stamford, and Buckingham" are quoted, there is no mention of, nor apparently place in the beautiful Museum for, the sober grey green Hornton stone—the best of all.

As at Bloxham, the Marlstone and the Upper Lias limestone form one course, with, however, an intervening bed of crinoidal ossicles, which represents the Transition time.

The overlying clays and limestones correlate with those of Bloxham, but yield fossils indifferently preserved, *Ammonites communis*, *Am. bifrons*, etc.

In Mr. Attwood's brickyard the higher clays extend upwards for 40 feet, and are sparingly fossiliferous. *Ammonites fibulatus* is not uncommon, and the horizon, the *Leda ovum* bed, is characterised by it more than by the presence of *Leda*. A patch of Inferior Oolite caps the whole. We have seen, then, that an almost continuous section is there shown, from the Inferior Oolite through the various zones of the Upper Lias, and through the Marlstone, to the underlying marls. The Constitution Hill was, however, visited on a following day, in consequence of a rainstorm compelling an early return of the members to headquarters.

FENNY COMPTON, BURTON DASSETT, AND EDGE HILL. (Fig. 3.)

Lower beds of the Middle Lias than any shown at Banbury (the Lower Lias of the Geological Survey) are to be seen in the railway cuttings at Fenny Compton. On the Whit Monday morning the Association began the work of the day at nine o'clock, by studying the rock ledges and clay slopes, which are but partially obscured. The section exposes from 30 to 40 feet of clays, with two thin rock courses, and an upper line of nodules. The Ammonites of the beds are *Am. Valdani*, D'Orb., *Am. Maugenessi*, D'Orb., and, more rarely, *Am. Ibex*, Quenst., and *pettos*, Quenst. Mr. H. B. Woodward, in his memoir on the Lias of England and Wales, doubts the existence of the zone of *Am. Ibex* in England. At Fenny Compton, however, it seems that the zone would be better so named than as the *Am. Jamesoni* zone of Mr. T. Beesley. The latter Ammonite is of very problematical occurrence. Fragments of *Am. Henleyi* in the higher beds complete the sequence of the Middle Lias of the Banbury district; for it is at the zone of *Am. Henleyi* that the Banbury town series breaks off. The object of the day was not to study in detail the deposits or the fauna of the Fenny Compton Lias; hence the party was soon on the way to the Dasset Hills, travelling pretty much upon the line of the section shown in Fig. 3.

Upon nearly the same level, along the crest of the Fenny Compton and Dassett Hills, can be seen the sands of the Inferior Oolite, the clays of the Upper Lias, and the red rock of the Middle Lias. At the bottom of the hills, both on the northern and on the southern sides, the red rock may also be seen. There are faults everywhere. The hills are but the wreckage of the former line of escarpment. In the Upper Lias of the old brickyard on the Fenny Compton Hill the common fossils of the cephalopoda-beds were collected, and the phase of transition from the Middle to the Upper Lias was seen to be the same as at Bloxham. The difference between the clay-covered and the uncovered rock of the Middle Lias is contrasted in two contiguous quarries. In the one the stone is red-brown, with a tendency to cannon-ball structure, by weathering; in the other, the rock is dark green, with red bands. The clay cap has saved the rock from oxydisation, by preventing the passage of water so readily through it.

The interest of the Dassett Hills, however, centres in the sand and sandstone of the Inferior Oolite. Their resemblance to the sandy ironstones of Duston is evident, and when this is bracketed with the occurrence of casts of similar shells such as *Astarte elegans*, Sow., and *Trigonia*, there is no doubt of the continuance of conditions like those which made the Northampton sands of their commercial value. It is the farthest westward extension of the true Northampton

Sand, allowing that term to represent for a time the beds of sandy ironstone at the base of the Northamptonshire Inferior Oolite.

Ironstone "boxes," filled with fine white sand, as in the Northampton quarries, were found by Miss A. Parker and Mr. T. Leighton.

The connection of the Northamptonshire Inferior Oolite with the Hook Norton (Oxfordshire) type has not been clearly defined, though Professor J. W. Judd in his masterly essay on "The Geology of Rutland," and more recently Mr. H. B. Woodward in his "Lower Oolite Rocks of England" approach the mark. *Hudleston's** *Nerinae beds of the Yorkshire Dogger*, *Sharp's*† *series E of the Northamptonshire Oolites*, and my series A and B of the *Oxfordshire Inferior Oolite* are, I consider, practically of one age. The term Northampton Sand has been so generally used for both the upper sands and the sandy ironstone of Northamptonshire, that it has become misleading. In Oxfordshire the ten or twelve feet of limestone (A and B) represent the Northamptonshire ironstone (E); and at that part of the Dassett Hills, where the small quarry exposes the ferruginous sands, we have the representatives of Sharp's series E, with a few fossil casts to show their relationship to the lower beds of the limestone capping the hills on the borders of N.W. Oxfordshire. Whether we call the fossils which are found in Oxfordshire and Northamptonshire *Ammonites opalinus*, Rein., *Am. Murchisonæ*, Sow., *Am. insignis*, Schub., or by other names, will matter little; the forms are alike and occur on the same horizon. Study of the other fossils in my lists‡ and in Mr. S. Sharp's § lists will confirm the relationship of the strata, though it seems probable under his series E were included other beds than those characterised by the *Ammonites* named. I have been able to separate clearly by the fauna the superior beds of high horizon. Further consideration of the true palæontological horizon of the beds A and B of Oxfordshire must be deferred.

Descent of the North Hill, on foot, brought to view the beautiful terraced slopes of Gredenton Hill—a low spur of the main ridge. First were pointed out, on the top of the terraced hill, the Middle Lias Marls, lying alongside of, and on the same level as, the superior rock-bed of the zone of *Am. spinatus*. The fault by which the Marlstone appears to have been let down as in a trough, trends across the inner third of Gredenton Hill to the N.N.E. Several of the common fossils of the Marls were found, small as the exposure was, *Pholadomya ambigua*, Sow., *Greslya liasina*, Ag., and *Ammonite* forms between *Am. margaritatus* and *Am. spinatus*. The main points of terrace

* Hudleston, W. H., On the Yorkshire Oolites, *Geol. Mag.*, 1882.

† Sharp, S., On the Oolites of Northamptonshire, *Quart. Journ. Geol. Soc.*, 1870.

‡ Walford, E. A., On the so-called Northampton Sand, *Quart. Journ. Geol. Soc.*, 1883.

§ Sharp, S., On the Oolites of Northamptonshire, *Quart. Journ. Geol. Soc.*, 1870.

formation were explained again, as they had been before the Northampton Natural History Society and the Oxford meeting of the British Association (1894):—

The downward creep of the surface and sub-surface soil caused by percolation of water through the beds. The line of waterflow at the base of the hill aiding by both chemical and mechanical waste the cause of downslide. To these was added the nearly constant association of faults with the terraced lands. The fact that the terraces occur always upon the line of the marls, alone gave strong evidence of their geologic origin. There was, however, even among the geologists, considerable contention for their human origin as banks of cultivation, but the occurrence elsewhere of terraces, varying from the depth of step of a few inches to that of many feet, breaks down much of the cultivation theory.

Continuing the route over the Burton Hill, the road across the plain led to Knowle End, the foot of Edge Hill. There began historic ground, for near about the line of road was Rupert's charge in the first great fight between King and Commons in 1662. Though the details of the fight were tempting to linger over, the famous quarries of Edge Hill had to be visited. The level ground extending from the Edge Hill scarp to Hornton, and again with slight dip southward, has been extensively quarried in past years. There are now but five or six quarries in work. Reference to the section (p. 181) will show the "Marlstone" covers the whole of the high ground, and there is no trace nearer than Shenloe Hill, on the W. flank, of the beds of Upper Lias once thickly capping the stone. Coombe Hill gave the following section:

COOMBE HILL QUARRY, EDGE HILL.

Middle Lias—zone *Ammonites spinatus*.

	ft.	in.
1. Humus	2	0
2. Marlstone—a red brown ferruginous lime-stone in shivers atop	6	0
3. „ Top Rag, in thin beds with green core	6	0
4. „ ochreous band	0	8
5. „ red brown stone, with top and bottom courses, blue green cores	3	6
6. „ Lower Rag, dark green cores	3	0
(Bed 5 is the Pendle of other quarries)		

It is the lower course from which is won the good building stone used over the whole of the countryside. To the palæonto-

logist there is little of importance, excepting that Hornton is the home of Sowerby's type of *Terebratula punctata*.

Continuance of the drive past Upton brought the excursionists to the point where the Edge Hill escarpment breaks into isolated hills—Shenloe Hill, Mine Hill, Epwell Hill, etc. At Shennington other good examples of terraced fields were seen in the ground called Rattlecombe Slade and the adjoining field, and with these ended the work of the day.

HOOK NORTON.

During the making of the Banbury Railway fourteen years since, the Association visited Chipping Norton and made also an inspection of the Hook Norton cutting, under the guidance of Messrs. Wilfrid Hudleston and T. Beesley. Since then the ironstone of the Middle Lias has been brought into notice at Hook Norton, and has been for many years successfully worked by the Hook Norton Ironstone Company. The old workings expose a face of about fifteen feet of stone, compact and green-hearted in the lower beds. In the new workings the ironstone is rotten, soft and ochreous, and the fossils therein appear as blackened casts, the whole resembling the Ironstone of the Inferior Oolite of New Duston, Northamptonshire. The nodule beds, forming the base of the stone, provided good representative gatherings of fossils; amongst them were *Am. spinatus*, Brug., *Ostrea sportella*, Dumort, *Harpax lævigatus*, d'Orb., and great specimens of *Cardinia concinna*, Sow., and *Pecten æquivalvis*, Sow.

A cutting made for the tramway showed the basement beds of the stone better than had yet been seen.

	ft.	in.
1. "Marlstone," a sandy, ferruginous limestone, crowded with fossils, <i>Spirifer oxygonus</i> , <i>Pecten</i> , several sp., <i>Terebratula punctata</i> , <i>T. Edwardsii</i>	3	0
2. Hard, light brown Marl with iron concretions	1	1
3. Marlstone, a rotten stone, with flattened nodules, containing <i>Ditrupea</i> and <i>Ostrea sportella</i>	0	6
4. Hard marl, with ochreous parting at base	3	6
5. Grey, sandy Shales	4	0

In the great cutting one mile south of the railway station, the Upper Lias Clays and the various beds of the Oxfordshire series of the Inferior Oolite are cut through. Fragments of the Great Oolite rest here and there in rifts and pockets of the Inferior Oolite. Much obscured as the section is by the falling in of the rock masses, the sequence can yet be made out. Though no attempt was made in the short time left at disposal to study the

beds in detail, the number of fossils collected was sufficient to denote the high horizon from which they were derived. *Trigonia producta*, Lyc., *T. angulata*, Lyc., *Lima bellula*, Lyc., *Isastraea serialis*, E. and H., *Clausantrea Conybeari*, E. and H., *Thamnastraea DeFranciana*, E. and H., were some of the rarer species found.

At this point the party separated, some returning to town by way of Chipping Norton, and others to Banbury and more northern homes.

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THE MAKING OF THE DASSETT AND EDGE HILLS OF SOUTH WARWICKSHIRE.

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WHETHER we take in hand Sheet 45 N.W. of the map of the Geological Survey and scan the orange-coloured masses which project into the brown plain, or whether we stand on the hills which the orange colour represents on the map, we are brought face to face with the question of the former spread and continuity of the high land over the outspaces and interspaces now represented by vale and plain. There is no doubt that the
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