EXCURSION TO DUNBALL, BURLESCOMBE, ILMINSTER, CHARD, HAM HILL, AND BRADFORD ABBAS.

JUNE 2ND TO JUNE 7TH (WHITSUNTIDE), 1911.

Directors: L. RICHARDSON, F.R.S.E., F.G.S., W. A. E. USSHER, F.G.S., W. WHITAKER, F.R.S., F.G.S., AND THE REV. H. H. WINWOOD, M.A., F.G.S.

Excursion Secretary: W. P. D. STEBBING.

(*Report by* THE DIRECTORS.)

PART I.—By MR. USSHER.

June 2nd.

A PARTY of about twelve left Paddington by the one o'clock train. Changing at Bristol, where two or three members joined them, they arrived at Dunball shortly before five o'clock. Here they were met by Mr. Greenhill, who conducted them to his house, Puriton Manor, where an excellent tea was very kindly provided.

After tea Mr. Greenhill exhibited the relics of rock-salt cores from the boring sunk between January 10th and December, 1910, near Dunball. He then conducted the party to the cement-stone quarries in the Lower Lias, zone of *Psiloceras planorbis*, in which 20 to 30 ft. of even-bedded, dense bluish limestones, alternating with shales, are exposed. They dip with the slope, but at a rather higher angle, so that at the southernmost part of the quarries the top bed of the Rhætic, locally called "Dhus," is exposed, under calcareous shales, formerly ground up and used for cement, but now abandoned in favour of the dense limestone beds. The shales overlying the Sunstone or "Dhus" are included by Mr. L. Richardson in the Rhætic as the possible equivalent of the Watchet Beds. In the Dunball railway cutting he gives their thickness as 3 ft. 10 in. (*Quart. Journ. Geol. Soc.*, vol. lxvii, 1911, pp. 32, 33).

Proceeding to the top of the scarp made by the limestones, the party descended the steep, wooded outcrop-face of the Rhætic black shales and buff marls, and 50 ft. or more of upper beds of the Keuper Marls, to the site of the boring on the Alluvium, between the foot of the hill and King's Sedgemoor Drain, about a quarter of a mile from Dunball Station. Here nearly 2,000 ft. of cores, arranged in parallel lines, afforded an interesting section, in which both Triassic and Permian rocks are represented; the former being readily distinguishable by their purple or chocolate-red colours and greenish banding from the latter, which are characterised by a uniform bright-red tint. (See Fig. 20.)

FIG. 20.—PURITON BORING CORES.—*From photo lent by Mr. Greenhill.*
Foreground cores Keuper Marl, last rows (from shed) Permian.

The Director pointed out the great importance of this boring, as hitherto deep borings had afforded no evidence of a connection between the pre-Keuper New Red rocks of the Midland and those of the South-Western counties.

The abnormal thinning of the Keuper rocks over the Mendip area, and the fact that between Bristol, on the north, and the Bunter pebble-bed outcrop (from Budleigh Salterton to Williton), on the south, the oldest New Red rocks (brought up by faults) occurring on the margin of the older rocks of the Quantocks, belong to the Upper Sandstones, points to the thinning out of the infra-Keuper beds northward. Yet in this boring, where Palæozoic rocks might reasonably have been looked for at 1,000 ft., or less, from the surface, Permian sandstones were encountered at 1,491 ft. from the surface, and the boring was abandoned in them at 2,070 ft., as they afforded no signs of an approximate base.

The Director pointed out the great value of this boring in another respect, as it revealed the presence of rock-salt in the Keuper Marls, between 600 and 711 ft. from the surface, in sufficient quantity to indicate the presence of a saltfield, whereas south of the Mendips evidences of salt had hitherto been confined to the discovery of occasional pseudomorphs. The saliferous marls here occur on the southern lip of a synclinal curve of which the northern limb rises toward the Mendips, and the centre or deepest part is approximately marked by the nearly horizontal Upper and Middle Lias beds of Brent Knoll. This structure would be eminently conducive to the preservation of a great saltfield. The boring was put down in search of Coal Measures, and the syndicate had the benefit of the advice of Mr. J. McMurtrie, whose knowledge of the Somerset coalfields is unrivalled.

Having been called in at Mr. McMurtrie's suggestion to give an opinion on the rocks penetrated, when a depth of 1,700 ft. was reached, the Director had the advantage of inspecting the cores when in a less weathered state than at present.

Certain features, then rather obscure, have since been brought into prominence by weathering; such as the conglomeratic character of the Trias for about 14 ft. from its base, and the occasional presence of marl and shaly clay in the Permian sandstones. On the other hand, the Keuper Marl cores, which display for the most part the usual cuboidal structure, where finely divided, have crumbled away, and indeterminate gaps occur where the rock-salt cores had been removed from the saliferous marls. Mr. Greenhill supplies the following information:—The diameter of the hole at the top was 18 in. for 42 ft., $15\frac{1}{2}$ in. for some way down, then $14\frac{3}{8}$ in. down to 730 ft., then $12\frac{3}{8}$ in. down to 1,100 ft., from this to the bottom, $10\frac{3}{8}$ in.

An account of the boring by Mr. McMurtrie will appear in the Proceedings of the Somerset Archæological and Natural

History Society. In the following account, which deals especially with the determination of the New Red subdivisions, the Director calls special attention to the beds marked by an asterisk, as these correspond in character, if not in position, to conglomeratic beds, which may be taken as separating the upper, or Keuper, from the lower, or Bunter, part of the Upper Sandstones in the road-sections near Rockwell Green and at Nynehead, visited on Saturday, June 3rd. (See *post*, pp. 251, 253.)

In the photograph of the cores, Fig. 20, the position of the salt-beds is marked by the partial absence of materials.

BORING AT PURITON MANOR, NEAR DUNBALL.

		Thickness. ft. in.	Depth from surface. ft. in.	ft. in.
	Made ground and soil	2 3		
KEUPER MARLS, 1253 FT.	Alluvial clays	19 9		
	Dull purple brown marls, with green bands and spots	98 0	22 0 to	120 0
	As above, with gypsum in veins and impersistent masses	475 0	120 0 to	595 0
	Cores intersected by oblique even cracks . . . . at		317 0 &	326 0
	Small geodes, called by workmen "lough" . . . . at		591 0	
	Saliferous marls	116 0	595 0 to	711 0
	Dark grey and greenish marls, with a broken brecciated appearance, probably due to the dissolution of veins of rock salt . . at		595 0	604 0 and 610 0
	Nearly vertical mammillated sheet of selenite . . . . at		620 0	
	2 ft. of buff sandstone and greenish marl, North Curry type		628 0 to	630 0
	3 ft. of rock salt under pale, dull grey, red-banded loam		645 0 to	648 0
	8 ft. of buff sandstone, with inosculating greenish marl, North Curry type		648 0 to	656 0
	Marls, with veins and occasional crystals of rock salt; also two or three beds of rock salt, removed from cores before inspected. The salt occurred as cylinders encased in marl. Two of these were encountered between 667 and 675 ft. Mr. McMurtrie says . . .		656 0 to	711 0
KEUPER, 1455 FT.	Red-brown, finely-divided marls	185 0	711 0 to	896 0
	Tough marls, splitting into large cuboidal pieces	73 0	896 0 to	969 0
	Pale buff sandstone and bluish marl, North Curry type . . .	1 0	969 0 to	970 0
	Dense, red, clunchy marls, occasional veins of gypsum	250 0	970 0 to	1220 0
	Traces of barytes and strontian proved in vein at . . .		1188 0	
	Purplish red marls	36 0	1220 0 to	1256 0
	Buff sandstone and greenish marl, North Curry type . . .	1 0	1256 0 to	1257 0

		Thickness. ft. in.	Depth from surface ft. in.	ft. in.
Upper Sandstones, 202 ft.	Purplish red marls	18 0	1257 0 to	1275 0
Lower Keuper, 87 ft. 6 in.	Red sandstone, pale green at top and base	11 0	1275 0 to	1286 0
	Purple-red and green marl with patches (? gypsum)	4 0	1286 0 to	1290 0
	Pale buff sandstone	0 9	1290 0 to	1290 9
	Marl, as above, passing into red sandstone	7 3	1290 9 to	1298 0
	Pale buff sandstone, green at base	2 0	1298 0 to	1300 0
	Buff sandstone and marl, North Curry type.	0 6	1300 0 to	1300 6
	Marl, with green bands and pellets (? gypsum)	11 6	1300 6 to	1312 0
	Green, red, and pale buff sandstone, passing into marl above and below	2 6	1312 0 to	1314 6
	Marl, as above	5 6	1314 6 to	1320 0
	Red sandstones, greenish at top and base, and with greenish bands	11 0	1320 0 to	1331 0
	Band of marl	0 5	1331 0 to	1331 5
	Sandstone	3 7	1331 5 to	1335 0
	Band of Marl	1 0	1335 0 to	1336 0
	Sandstone	3 0	1336 0 to	1339 0
	Marl	2 0	1339 0 to	1341 0
	Sandstone, clayey or loamy in part, and with pellets (? gypsum)	9 0	1341 0 to	1350 0
	Red marly clay	12 6	1350 0 to	1362 6
Bunter Sandstones, 114 ft. 6 in.	Red and purplish, partly violet-grey, calcareous sandstones, with very small quartz pebbles in places	35 0	1362 6 to	1397 6
	Sandstone, with pellets (? of calcspar)	3 6	1397 6 to	1401 0
	Marly bed	1 8	1401 0 to	1402 8
	* Coarse sandstone, rounded grains	0 6	1402 8 to	1403 2
	* Red sandstone, brecciated with earthy pellets	0 6	1403 2 to	1403 8
	* Coarse, chocolate-red concretionary sandstone	0 5	1403 8 to	1404 1
	Purple-brown sandstone, with network of calcspar veins	3 0	1404 1 to	1407 1
	Sandstone	2 7	1407 1 to	1409 8
	Breccia, with pellets	0 4	1409 8 to	1410 0
	Sandstone	1 2	1410 0 to	1411 2
	Brecciated sandstone	1 0	1411 2 to	1412 2
	Red and purple-grey sandstone, finely brecciated and false-bedded (brecciated 1417 to 1423 ft., false-bedding 1423 to 1424 ft,)	19 5	1412 2 to	1431 7
	Sandy marl or marly sandstone	10 11	1431 7 to	1442 6
	Coarse, whitish sandstone	0 6	1442 6 to	1443 0
	Sandy marl, as above	2 0	1443 0 to	1445 0
	Sandstone	3 6	1445 0 to	1448 6
	Breccia	1 0	1448 6 to	1449 6
	Marly sandstone, hard and whitish at base for 9 in.	6 6	1449 6 to	1456 0
	Sandy marl and marly sandstone, giving place to marl for 16 ft. from base	21 0	1456 0 to	1477 0

		Thickness. ft. in.	Depth from surface. ft. in.	ft. in.
14 ft. 6 in. Probable representative of Budleigh pebble bed and conglomerate.	Pale-reddish calcareous sandstones, with pellets and lenticles of clay and fair-sized pebbles of carboniferous limestone . . .	13 0	1477 0 to	1489 6
	Whitish calcareous sandstone, with green band at base . . .	1 6	1489 6 to	1491 0
PERMIAN.	Brick-red, very fine-grained sandstones, giving place here and there to irregular courses of marly and shaly clay, mottled with small green spots and specks, and occasionally with irregular green splotches	579 0	1491 0 to	2070 0
		2070 6		

After inspecting the cores, the members returned to Dunball and took train for Taunton, where the headquarters were established at the Ashton Temperance Hotel.

June 3rd.

The members left Taunton Station at 9.6 a.m., by train for Wellington. A walk of about a mile and a half brought them to the first halting-place, where the high road to Exeter, near Rockwell Green, has been cut through Upper Sandstones, revealing a fine section in which hard concretionary calcareous conglomeratic beds are conspicuous beneath red sandstone with a tendency to false lamination, and little or no traces of calcareous matter. See the Map, Pl. XXXVI.

The Director pointed out the similarity of these conglomeratic beds to those at Ladram Bay, on the Sidmouth coast, which had been taken by Dr. Irving and Professor Hull as the divisional plane between the Keuper and Bunter Sandstones; but as beds of this character are found at lower horizons in the Upper Sandstone, for mapping purposes the Upper Sandstones cannot be split up with any degree of certainty. Similar beds are marked by an asterisk in the section of the boring (*ante*, page 250), and were seen later on at Nynehead. The party then proceeded to Westford, where a tongue of Keuper Marl, faulted against the Upper Sandstones on either side, terminates westward at a fault bringing up Permian Marls with outliers of Bunter Pebble Beds, more or less clearly defined by feature. From Westford to Harpford Farm the faulted junction of the Permian Marls and Upper Sandstones (exposed here and there in the road), though not visible, was demonstrated by the displacement of the Bunter Pebble Bed and Conglomerate feature on the north of the Tone Valley. To the north of Harpford Farm the fault follows the Tone for about half a mile, throwing the lower beds of the Upper Sandstones against Permian Marls and Permian Sandstones.

The lower beds of the Upper Sandstones, containing

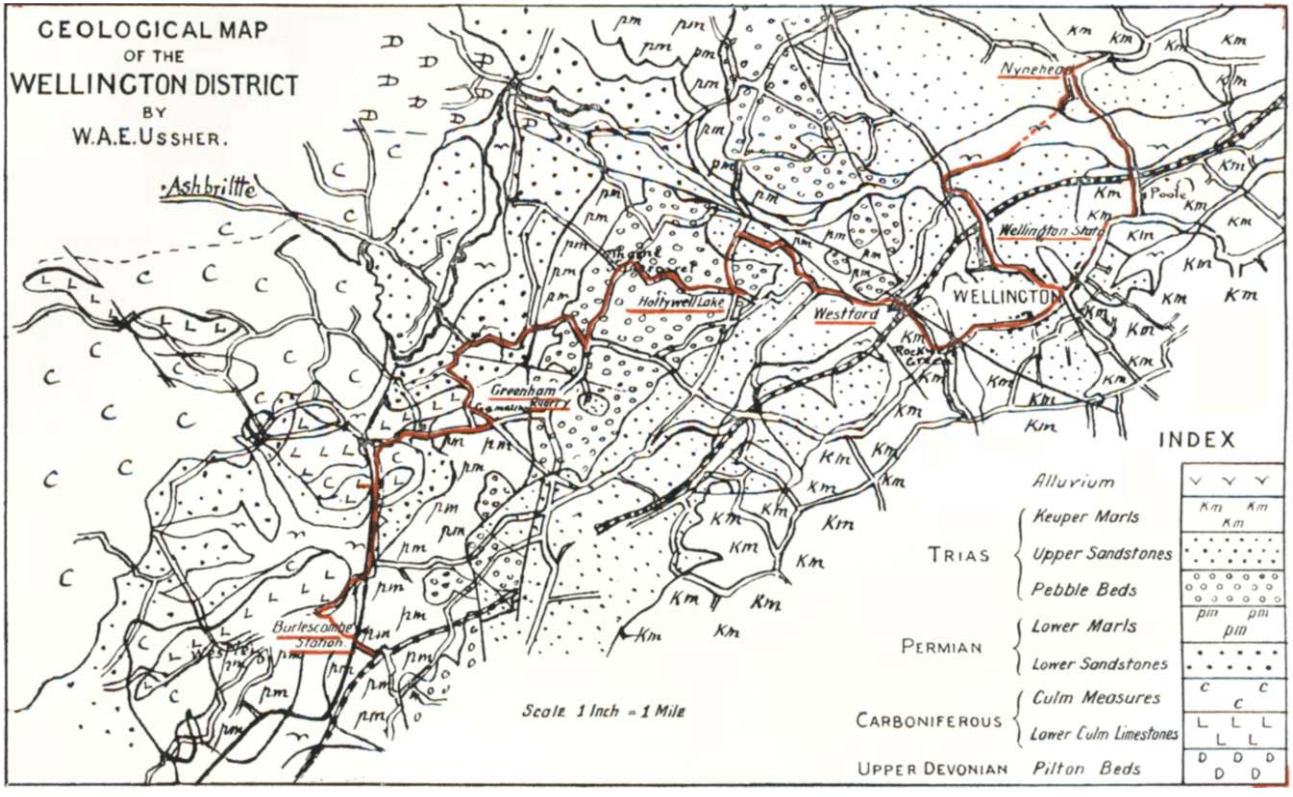
calcareous and more or less conglomeratic beds and occasional clayey seams, were observed in the road-cutting on the west of Harpford Farm. Proceeding southward the party soon crossed the feature marking the outcrop of the Pebble Beds near Holywell Lake Inn, and exposures of the red sands with pebbles and subangular stones were noticed. These unconsolidated materials pass into hard, massive, conglomerate-rock in their lower beds on the north of Thorne St. Margaret. Near Thorne St. Margaret, on the south-west, the outcrop of the Permian Marls marked by ponds was pointed out below the Pebble Bed feature.

The party then proceeded southward by Greenham Barton to the Culm Limestone Quarry (Greenham Quarry) near Gamlins Farm, traversing the outcrop of the Permian Marls, and noting exposures in the red Permian Sandstones near Greenham Barton. These sandstones differ from the Upper Sandstones in displaying more rounded grains throughout, and in the general absence of mica-flakes and of calcareous beds.

Greenham Quarry is the easternmost exposure in the series of hog-backed and dome-shaped hills, scarred by numerous Culm Limestone quarries, which form so conspicuous a feature in the vicinity of Westleigh and Holcombe Rogus, between Burlescombe and Ashbrittle. These hills mark complex anticlines in the Culm Limestones, every quarry revealing some special variety of contortion. There are chert-bands, lenticles, and segregations in most of the limestone quarries, but the Chert Beds proper are either absent, overlapped, or so feebly evidenced as to have escaped detection in this part of the district, although present at, and west of, Ashbrittle.

The party spent some time in Greenham Quarry, where the southern face exhibits dark grey and brown limestones, with calc-spar veins, partly massive and irregularly jointed, partly in thin evenly jointed beds with intercalated bands of chert and chert-segregations, repeated by numerous zigzag contortions which are difficult to follow, as the quarry face is more or less coincident with the strike. In the western face of the quarry the beds dip more or less evenly southward at a very high angle, and they appear to be faulted against the contorted beds. In the western face of the quarry the Director was so fortunate as to discover about 10 ft. of oolitic limestone, which, to the best of his belief, has not hitherto been recorded as present in the Culm Limestones.

Time only permitted of a brief visit to one more Culm Limestone quarry in the two-mile walk from Gamlins to Burlescombe Station. This is a large quarry on the west of the canal at Whipcoats, where the distinct bedding-planes enable the folding to be clearly distinguished as shown in the photograph (Pl. XXXVIII, Fig. 1).



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The party left Burlescombe by the 4.5 train, arriving at Wellington 4.16. After a much-needed tea in a cottage near the station, they proceeded across the fields to Nynehead. Here a good section of Upper Sandstones with brecciated calcareous beds in a by-lane was first inspected, and then the fine sections by the high road at the eastern end of the hamlet, where the sandstones are exposed nearly up to their junction with the overlying marls. The sandstones are mottled with yellowish bands and patches, the uppermost beds being devoid of calcareous material, as in the road-cutting near Rockwell Green, and, below this, calcareous concretionary sandstones and conglomeratic beds were seen. These sections have been given in some detail in the Geological Survey Memoir explanatory of Sheet 311, pp. 20, 21. Time did not permit of a visit to the Poole Brickpits in the lower beds of the Keuper Marls described in that Memoir on p. 23.

The party returned to Taunton by the 7.3 p.m. train due at 7.20 p.m.

June 4th.

The opportunity of spending a day on the Quantocks was taken by the majority of the party, accompanied by Mr. Ussher.

Proceeding northward through Kingston, where the Keuper rocks rest on Morte slates, over Buncombe Hill, where grits, slates, and calcareous beds of the Ilfracombe series come on they descended to the valley north of Hawkridge Common, where a quarry in tough, fine-grained slaty grits and slates in the Ilfracombe series was visited. Time did not permit of visiting exposures in the Asholt limestones. On approaching Plainsfield a quarry was noticed in red Keuper Sandstones, which here emerge from beneath the overlying marls and rest on the older rocks.

Leaving their conveyance at the avenue to Quantock Lodge, the party walked by the Kennels to Dibbles Quarry, where the igneous rock mentioned by Leonard Horner in 1816 is quarried. The rock is a grey-green schalstein, probably embracing lavas as well as tuffs, which predominate. Its relations to the bordering slates and grits are not visible. The type is a familiar one in the Middle Devonian schalsteins of South Devon and East Cornwall. The schalstein band may here exceed 60 ft. in thickness unless reduplicated by folding. It has been traced for some distance northward, but attenuates rapidly. The rock is locally used as a building stone and is susceptible of polish. Leaving Dibbles Quarry, a quarry in dark grey Ilfracombe limestone with marked slaty cleavage was visited on the northern side of the Adscombe Valley. Near Aley Farm a larger quarry in the limestones afforded numerous traces of *Cyathophyllum*, *Alveolites suborbicularis*, and other corals.

After rejoining the brake at Plainsfield the party proceeded

southward over Broomborough Hill to Volis Farm, where they alighted and walked across the fields to the Hestercombe quarries, now mostly overgrown. The rock quarried here was described by Leonard Horner as a syenite. Dr. Flett has lately pronounced it a diorite (see "Quantock Memoir," p. 29). The quarry now worked at the end of the wood is chiefly in pale green-grey Morte slates (Pl. XXXVII, Fig. 1), but at the northern end the diorite is partially exposed, and may be seen in contact with the slates, which are much indurated, and, Horner tells us, were formerly used for whetstones. The diorite face is in the darker background part of the photograph (Pl. XXXVII, Fig. 2).

From Hestercombe Lodge the party drove back to Taunton, where they arrived soon after 7 p.m.

PART II.—By MR. RICHARDSON, MR. WHITAKER, AND THE REV. H. H. WINWOOD.

June 5th.

In the morning Taunton Museum, in the old Castle, was visited. The curator, Mr. St. George Gray, was unfortunately absent, owing to an engagement on excavations in progress near Glastonbury. The Middle Devonian specimens collected by Baker and Prynne, specimens of the Dibbles Quarry schalstein in rough and polished states, and the duplicate specimens of Charles Moore's collection from the Upper Lias of Ilminster, presented by the Rev. H. H. Winwood, formed the chief attractions.

At 11.15 a.m. the members left Taunton by train for Ilminster, travelling over the undulating Red Marl country as far as Hatch Beauchamp. Here the ridge that marks the outcrop of the Rhætic Beds, and which is much steeper than many of the members had supposed, is penetrated by a tunnel: the Tea-green and Grey Marls, portions of the *Pteria-contorta* Black Shales and of the White Lias proper (Langport Beds) being indifferently seen in the cutting-side between the tunnel and the station. (See *Quart. Journ. Geol. Soc.*, vol. lxvii (1911), p. 52; *Proc. Somerset Arch. and Nat. Hist. Soc.*, vol. xiii, p. 134; *Ibid*, p. 137; *Quart. Journ. Geol. Soc.*, vol. lxvi (1910), p. 80.) From Hatch the route followed lay over the flat clay-ground of the Lower Lias, which, nearer Ilminster, is overlain by deposits of valley-gravel and alluvium.

The greater part of Ilminster is situated on the Marlstone. In times past this rock was extensively worked for road-metal and building purposes; but now unfortunately the quarry at Moolham (about half-a-mile to the south of Ilminster) is the only one in work. Few of the former workings did not show some of the basal Upper Lias deposits on top of the Marlstone, and as certain of the more nodular limestones were rich in fish-remains,

Photo by T. W. Reader.

FIG. 1.—MORTE SLATES IN QUARRY, HESTERCOMBE.

Photo by T. W. Reader.

FIG. 2.—QUARRY IN MORTE SLATES AND DIORITE, HESTERCOMBE.

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and, in the person of Charles Moore, the district had the advantage of an indefatigable collector, it soon acquired a national if not a world-wide fame.

The members walked from the station through Ilminster to the Moolham Quarry. Here the Marlstone is well exposed and rich in the ordinary fossils. According to Moore, the *Leptæna*- and Fish-Beds are absent from this section. Certainly the members found no fish-remains; but they obtained a large number of Ammonites of the genera *Hildoceras*, *Harpoceras*, *Dactylioceras*, etc., and a few examples of *Rhynchonella bouchardi*, from the overlying disturbed Upper-Lias deposits. [L. R.]

From Moolham the members returned to Ilminster station and proceeded by the 1.52 p.m. train to Chard.

From the station the party walked through the town westward (not without investigating the manufactured water-supply) to the large Snowdon Quarry on the outskirts. On the western side of the pit a good junction-section of Chalk and Upper Greensand was seen, the bottom of the former being marked by the usual glauconitic bed, with many fossils.

The top part of the Upper Greensand is a hard grey calcareous sandstone, some 7 or 8 feet thick. Beneath this come the Chert Beds, consisting of grey glauconitic sandstone with many layers of chert, well shown at the northern end of the pit, to the depth of nearly 30 feet.

At this end several small faults were visible, and the one fault large enough to be shown on the map was remarkably well seen at the north-eastern corner of the pit, much better than the writer had seen it before. On the western side there was hard Upper Greensand, ending off on the east against an irregular wall of more or less broken-up Chalk. This fault has been traced for a distance of several miles (Plate XXXVIII, Fig. 2).

Owing to the heat, some of the party decided to linger here rather than to continue the walk; but others were loyal to the official plan, and continued their walk over the hills north-westward, to the old chalk-pit "Coombe Wood Quarry," where the junction of the Middle and Lower Chalk had been made out by the President. They were successful in seeing the Belemnite Marl, and in finding two *Belemnites*.

The return was made along a different route, firstly towards Combe St. Nicholas and then south-eastward through Wadeford. On the way springs were noted, and other matters of a liquid character were experimented upon with considerable eagerness.

After tea at Chard the return to the station was made, most of the party going a little out of the way, so as to see the old church. The old grammar-school was passed by all. The members arrived back at Taunton about 8.30 p.m. [W. W.]

June 6th.

Brilliant sunshine ushered in the morning, when the members left Taunton by the 9.43 train for Montacute. Collecting together under the shade of the old Priory walls, Mr. Winwood led them through the field on the left of the Priory to the bottom of the lane leading up to the top of the hill. Deeply cut down in the Sands (query, the result of Roman traffic?), the Director said it was one of the best sections on the hillside, showing the entire thickness of the Sands from the base to the summit, where the workable limestone beds succeed.

Attention was called to the value of any fossils which might be found here, especially in the calcareous sand-beds locally called "sand-burrs"; hammers, however, were plied without result. Leaving the shady lane and following the road, with Bedmore barn on the right, a short rest was called at a spot opposite some fine old Scotch firs, at which the last "sand-burr" was seen, whilst the Director stated that they were now at the eastern entrance to an extensive camp which crowned the hill, and not far from the site of a Roman villa. A local antiquary, Mr. R. Hensleigh Walter, had lately made many discoveries here, the results of which the members had seen at the Taunton Museum on the previous day. Briefly, evidence had proved that the remains covered a long period, from the Neolithic or late Stone Age down through Roman to even Mediæval times. A regular scientific excavation of the camp should be made before the quarrymen obliterated all traces of its existence. (For an account by the Curator of the Taunton Museum of the "finds" see *Proc. Somerset Arch. and Nat. Hist. Soc.*, vol. lvi, pt. 2, p. 51.)

Crossing the hill towards the west, one of the foremen of the works appeared and pointed out the various uses to which the fine "grey beds" were applied, and the large blocks, several tons in weight, stacked alongside. The object of the visit, the great quarry, being reached, and the members arranging themselves along a ledge overlooking the section, seeking what shade was possible, the Director said that he had paid three visits to this quarry—namely, in 1886, 1910, and 1911. At the first (a quarter of a century ago) Mr. Charles Trask owned and worked it; now it was worked by the United Stone Firms, Ltd. The face of the hill has been so disturbed that it is difficult to recognise the old sections, but the general details and thickness of the beds remain the same in the new workings. Briefly alluding to the geology of the district, he said they had gone through the whole thickness of the Sands, until they stood near the top of the hard workable beds seen below, a section hardly anywhere to be surpassed in interest. The Ham Hill stone is celebrated for its durability and colour, and has been used for most of the

churches and for the fine manor-houses in the district, and especially from the fact that one of the churches, dating from the eleventh century, was built of it, we know that the stone was quarried in Norman times. Did the Romans work it? Report states that a Roman coffin has been found made of this material; therefore there is a high probability that they knew its value.

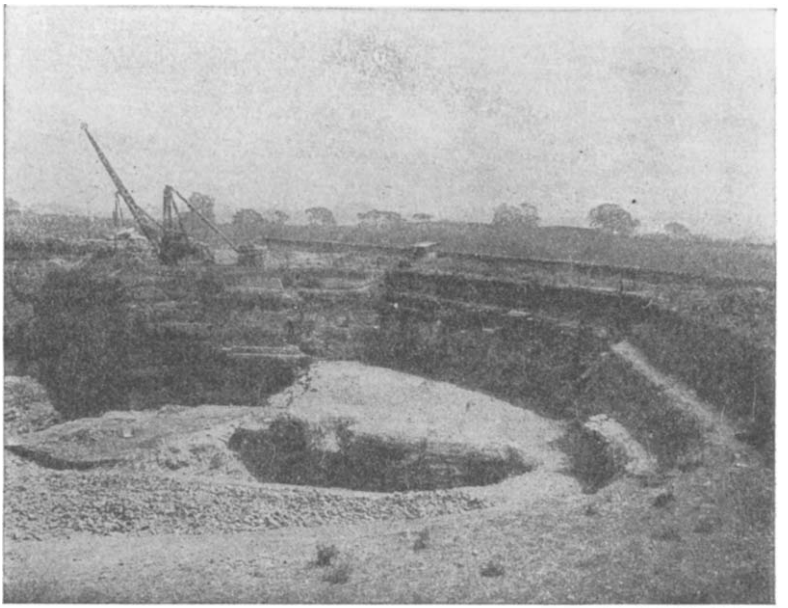

Photo by T. W. Reader.

FIG. 21.—HAM HILL QUARRY, UPPER BEDS.

The general section,* omitting the details of each bed, was given as the following :—

	ft.
"Ochre-Beds" (at the top)	40
Ham Hill Stone, false-bedded shelly Limestones of various shades of brown and yellow	50
Yellow Sands about	80

The view of this quarry, Fig. 21, shows the upper beds, the grey and coarser beds not being seen.

The workable beds, about 48 ft. thick, resting on the "Sands" are made up of a mass of broken shells, chiefly *Pecten*, *Ostrea*, etc., cemented together in a ferruginous matrix, which gives them that warm colour so much admired. Now, as to the "Sands" below, a long controversy has existed as to their position, whether

* See H. B. Woodward, "Jurassic Rocks," vol. iv, p. 72.

Oolitic or Liassic, and, in the writer's opinion, this still remains to be settled, notwithstanding certain dogmatic statements to the contrary. In support of his view he quoted the views of one whose knowledge of the district was second to none, and whose views have been supported by the Geological Survey. In 1866 Chas. Moore writes :—

"Until lately the yellow micaceous Sands above the Upper Lias were classified and mapped as the basement of the Oolitic series; but the discovery that several species of Ammonites have lived on from the former into the latter period has induced the removal of the Sands from their original position and their classification with the Lias. We have never been able to recognise the necessity for the change. Not only have we in the two horizons as distinct a fauna in its general facies as can be found with other formations, but we have, wherever the junction of the Sands with the Lias is observed, a most marked and permanent lithological distinction in argillaceous beds crowded with Ammonites, etc., capped by yellow Sands, with but few evidences in their lower beds of organic life. Under the former classification the line of separation could be drawn with the greatest nicety, but must now, in this district at least, be purely arbitrary."

After this quotation the Director said he was content to accept this view, strengthened as it has been by the Geological Survey, and to regard these Sands, at their base passing into the Lias and higher up into the Oolite, as passage-beds from the Lias to the Inferior Oolite above.

Specimens of *Rhynchonella cynocephala*, with one, two, and three plaits on the mesial fold, from the Ham Hill hard beds, were shown, and claimed as characteristic of the basement-beds of the Inferior Oolite, and an Ammonite, *Dumortieria moorei*. In conclusion it was suggested that these passage-beds should be called "Ham Hill Sands," without correlating them with either the Midford, Yeovil, or Bridport Sands.

Mr. Richardson, having been asked to make a few remarks, naturally adopted the newer and more heretical view, and said that the Brachiopods were not *R. cynocephala*, but *R. cynica*; that they were not characteristic of the basement-beds of the Inferior Oolite, and claimed not only the Sands as Liassic, but all the workable Ham Hill beds above as Liassic also! —[H. H. W.]

Mr. Richardson's account of the day's proceedings is now given.

Montacute Station, where the members detrained, is on the Middle Lias. The bottom-beds of the Upper Lias, limestones and clays, vary—according to Moore—"but little from those at Petherton and Stoke." *

* *Proc. Somerset Arch. and Nat. Hist. Soc.*, vol. xiii, p. 137.

Photo by T. W. Reader.

FIG. 1.—CONTORTIONS IN LOWER CULM LIMESTONES, QUARRY NEAR WHIPCOATS.

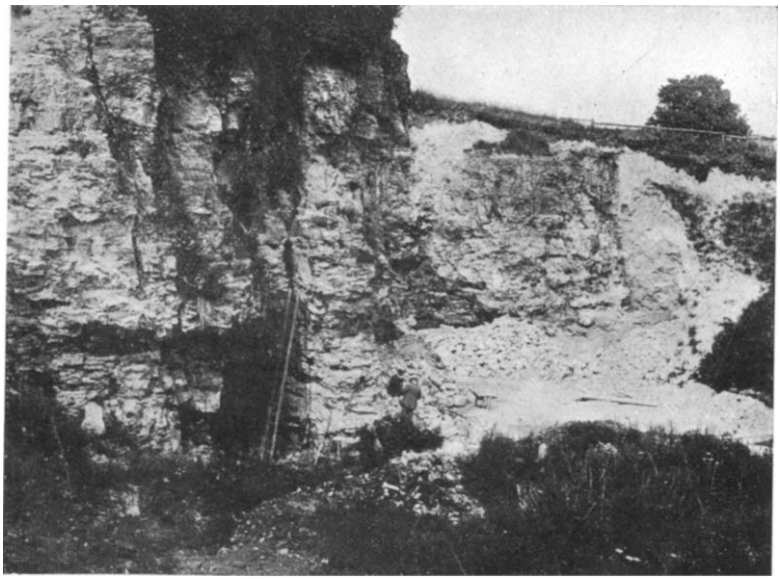

Photo by T. W. Reader.

FIG. 2.—VIEW OF SNOWDON HILL QUARRY, NEAR CHARD, SHOWING FAULT *f f*.

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Mr. S. S. Buckman states that "in the neighbourhood of Ilminster, Barrington, and Shepton Beauchamp, the Yeovil Sands rest upon clay of *dispansi* date," and that "in these places the strata of *variabilis* date are a thin development of clayey limestone very well charged with Ammonites." But, around Yeovil, he thinks that that portion of the Yeovil Sands which becomes "bluish and clayey in their lower part" may be of *dispansi* date. The main mass of the Yeovil Sands, however, is certainly of *Dumortieriæ-moorei* date.

The Yeovil Sands are yellow, fine-grained micaceous sands with prominent burrs, and are well-exposed in many a deeply-cut shady "hollow way" in the district between Ham Hill and Bradford Abbas.

The members saw these Sands in the deeply-cut lane that leads from Montacute in the direction of the summit of Ham Hill, but did not obtain any fossils therefrom.

On the right side of the road at the rampart of the old camp, about half a mile to the east of the great Ham Hill Stone Quarry, is one called the Rocks Quarry, where stone is got for metalling the local roads.

At the top of the section is seen about 5 ft. of fine yellow sands (correlative with bed 1 of the main Ham Hill Quarry), below which are exposed about 20 ft. of massive limestone (bed 2 of the Ham Hill Quarry), which is almost wholly made up of shell-débris. *Rhynchonella cynica*, S. Buckman, is not uncommon, nor are specimens of *Syncyclonema demissum* (Phil.). There are several sandy layers between the beds of shell-limestone in which examples of *Rhyn. cynica*, although generally crushed, are very abundant.

Where undisturbed by quarrying operations, the summit of Ham Hill is noticeably flat; but that portion between Stoke-sub-Hamdon and Little Norton is very irregular, owing to the extensive workings of past and present times. Ham Hill has furnished the material for the stonework of most of the renowned towers and churches in the West Country; also of many mansions and important buildings in the South and West of England.

The large quarry visited by the members was until comparatively recently worked by the Ham Hill and Doulting Stone Co., but on the expiry of the leases was taken over by the United Stone Firms Co., Ltd., and considerably developed. The section here is as follows:

Ham Hill Stone Series	1.	Sand: seen about		10 ft.
	2.	"Riddings"		30 ,,
	3.	Ham Hill Stone	Yellow Beds	33 ,,
			Grey Beds	15 ,,
	4.	"Bottom Bed."	Hard Sandstone	1½ ,,

The Riddings have yielded some very excellent stone-tiles, and if more could be obtained now they would fetch a very good price.

The Ham Hill Stone comprises "Yellow Beds" and "Grey Beds." The term "Grey Beds," however, is misleading; the "Grey Beds" are really only of a somewhat deeper brown than the "Yellow Beds," and a little coarser.

The stone, seen in a building, has a very pleasing appearance —a warm rich colour that harmonises readily with almost any surroundings. The Prospectus of the United Stone Firms says:

"To Architects requiring a reliable Stone (superior to Bath Stone in weathering qualities, and of equal cost and durability to Doulting and less costly than Portland), then Ham Hill Stone supplies this want. The Crushing Strain of Ham Hill Stone is 207 Tons to the square foot, which is considerably more than Ancaster, and other softer stones, yet it compares favourably in cost. It is impervious to atmospheric influences.

"Adjoining the Quarries are Works fitted with Saws, Planing and Moulding Machines, and a complete Plant for sawing and working the Stone."

On Chiselborough Hill, about a mile and a quarter to the south of the Rocks Quarry, is a large working in beds equivalent to bed 2 at Ham Hill, that is, to the Riddings.*

Time did not permit of a visit to a Marlstone quarry, so after tea at the Fleur-de-Lis in Stoke-sub-Hamdon the members returned to Montacute in time to catch the 6.1 p.m. train for Taunton.—[L. R.]

June 7th.

Taunton was left at 9.43 a.m., and Pen Mill Station, Yeovil, reached at 11.12 a.m. At the bridge over the Yeo the members left the brakes and walked up Bradford Hollow Way—a lane very deeply cut in the Yeovil Sands.

Before going into the quarry alongside Baggerbush Lane (three-fifths of a mile north by 12° west of Bradford Abbas Church), Mr. Richardson gave an outline of the geology of the district.

He said that in their walk from Pen Mill to where they now stood they had passed over the local representatives of those beds that they had been studying in greater detail on portions of the previous two days. The most noticeable difference they would have observed had been in the matter of the Ham Hill Stone. The hardened upper portion of the Sands in Bradford Hollow Way looked very different to the Ham Hill Stone, and yet there was little doubt that it was on the same horizon. Formerly, this indurated top portion of the Sands had been worked, and worked extensively, at Babylon Hill, which was under a mile to the east of Pen Mill. They now stood upon the Inferior Oolite, but for the moment he wished to direct their attention to the position of Bradford Mill, on the banks of the Yeo, and Lillington Hill. Bradford Mill was on the Top-Beds of the Inferior Oolite; Lillington Hill was capped with Forest Marble

* *Vide* "Jurassic Rocks of Britain," vol. iv (1894), "Lower Oolitic Rocks of England," p. 71.

and outliers of Cornbrash. In the country between the mill and the hill-top cropped out the Lower Fuller's Earth, Fuller's Earth Rock and Upper Fuller's Earth; there was no limestone present comparable with the Bath Oolite between the Fuller's Earth and the Forest Marble. The slight intervening ridge they saw was originated by the Fuller's Earth Rock. There are excellent sections of the Fuller's Earth Rock near Goathill, east of Haydon, and in the railway-cutting at Laycock near Milborne Port Station.

The members then went into the quarry locally known as "Baggerbush Lane" Quarry. Mr. Richardson stated that those members who had been in the Cotteswold country would at once see how very different, lithically, were these Inferior Oolite beds from any there. Ammonites, chiefly from the *Concavus*-Beds, were found in great abundance—some lying loose, others packed like plates in the rocks.

After spending some time collecting here the drive was continued to Halfway House. Here there are three quarries: the Limekiln Quarry on the southern side of the road; Chapel Quarry on the north, and the third in the field near Rock House.

All three sections are very similar; the main difference being that the "Top-Limestones" are thickest in the quarry on the south side of the road; about half as thick in that on the north; while they are absent from that near Rock House.

In all three quarries the bottom-bed has a very level, oyster-covered and bored top-surface. In the Rock House Quarry, which the Members visited first, at five feet four inches above the top of this bed is the *Astarte-obliqua*-Bed—a very easily found horizon. The intervening beds, with the exception of a very thin layer at the top, are called the "Blue Beds" by the quarry-men, and are of *discitæ*, *concavi*, *bradfordensis* and *murchisonæ* hemeræ.

A portion of the Chapel Quarry is depicted in Pl. XXXIX, Fig. 1. The positions of the *Astarte-obliqua* and Blue Beds are shown in this view, while the figures indicate the positions of the similarly numbered beds in Mr. S. S. Buckman's record of the succession in this quarry (*Quart. Journ. Geol. Soc.*, vol. xlix, 1893, p. 487).

From Halfway House the Members drove to Bradford Abbas, and had a bread-and-cheese meal at the village inn. Afterwards they visited King's Pit, where the "Top Limestones" have been and are still extensively worked for burning for lime. This is "Section iii" of Buckman (*op. cit.* p. 486), but the present vicarage is another house. In this quarry the sequence is as follows:

SECTION AT KING'S PIT, BRADFORD ABBAS.

		Thickness in	Ft.	Ins.
FULLER'S EARTH.	1.	Marly clay with thin beds of limestone; *Belemnopsis, Collyrites ovalis*: seen	2	3
	2.	Irony nodules in marly clay	0	6
TOP LIMESTONES OF THE INF. OOL.	3.	Limestones, white, harder than those of bed 4; *Ammonites (Parkinsonia) depressa* (Qw.) . .	2	3
	4.	Softer, yellower and more marly limestones than those composing bed 3. Numerous bodies resembling the hardened infillings of cavities made by the decomposition of fucoids . .	1	6
	5.	Limestones, blue-hearted: seen	3	0

The ammonite indicates a deposit of *zigzag* hemera.

The next halt was at a quarry in the Fuller's Earth Rock at Troll. A number of specimens of *Teloceras*? *subcontractum* (M. and L.) and of *Pholadomya* were obtained, but otherwise the beds proved rather barren.

Mr. Richardson said that the Fuller's Earth Rock had been used to a considerable extent for building purposes and road-metal. Most of the houses along the undulating ridge to which the Rock gives rise between Troll and Sherborne Park are built of it; while the principal roofing material is thatch. Owing partly to faulting, the Fuller's Earth Rock forms a very prominent ridge between Laycock, to the north of Milborne Port, and Haydon to the south.

From Troll the Members drove to Stoford, near Yeovil Station. Leaving the brakes at the railway bridge, they walked up the hill to the Stoford Quarry. The Yeovil Sands, with their prominent burrs, were seen in an old quarry-face at the back of the cottages and in the banks alongside the track near the gate at the entrance to the field.

It was pointed out that at the gate the members were standing upon the Yeovil Sands; beyond, in the field, was the quarry with Fuller's Earth Clay at the top. So the Inferior Oolite was very thin here—probably not more than 5 ft. thick.

The view of a portion of the quarry, Pl. XXXIX, Fig. 2, now (Sept. 1911) partly obscured, will give an idea of what the basal Fuller's Earth Beds, which contain *Ostrea knorri*, and the Inferior Oolite look like here. The numbers alongside the picture correspond to those given by Mr. S. S. Buckman in his record of the beds exposed here. Until a careful investigation has been made it is difficult to believe that the rock below the bed numbered 6 includes deposits of many hemeræ—according to Mr. Buckman of *truellei*? *garantianæ*, *sauzei*, *discitæ*?, *concavi*, and *murchisonæ*.

In conclusion, Mr. Richardson stated that he had worked over the whole of the district between Doulting and Crewkerne;

Photo by T. W. Reader.

FIG. 1.—VIEW OF PORTION OF THE CHAPEL QUARRY, HALFWAY HOUSE, NEAR SHERBORNE, DORSET.

Photo by T. W. Reader

FIG. 2.—VIEW OF A PORTION OF THE STOFORD QUARRY, NEAR YEOVIL.

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but that there were still several problems to solve before he could publish the results of his work.—[L. R.]

During the excursion votes of thanks were accorded to the Directors, and to Mr. Stebbing for acting as Excursion Secretary.

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