

a necessary warning in the case of the Bokkeveld Beds with their diverse lithological development, and in view of the absence of minute zonal work or zonal collecting from the beds included in this stratigraphical series.

4. In the case of the Mollusca Professor Schwarz is able to record several new species. Perhaps with regard to the specimen identified as *Cypricardella Pohli*, Clarke, the figured leaves something to be desired, as, comparing it with the one given by Clarke of this species, there does not seem to be much resemblance. However, without seeing the specimen a fair criticism cannot be passed.

5. With regard to the trilobites and the points of difference between Professor Schwarz and Mr. Lake in their identification, it is not for me to pass any opinion. A small collection recently presented by the South African Museum to Cambridge includes a good example of the new species *Homalonotus hippocampus*, Schwarz, which, as the author states, is sharply separable from *H. Herscheli*. I notice the subgeneric name *Cryphteus* still used by Prof. Schwarz in connection with *Phacops*, though it has been shown to be preoccupied (GEOL. MAG., Dec. V, Vol. II, 1905, p. 173), and it is doubtful if any of the South African forms referred to this subgeneric group, *Asteropyge*, can be rightly retained in it without undue extension of its meaning.

In a subsequent article a review of the whole fauna will be given.

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## NOTICES OF MEMOIRS.

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### I.—A CONTRIBUTION TO OUR KNOWLEDGE OF THE LIMESTONE KNOLLS OF CRAVEN. By A. WILMORE, F.G.S.<sup>1</sup>

THE Craven Lowlands district, between the great faults on the north-east and the grit hills of the Pendle Range on the south, is characterised by a well-known series of limestone knolls which have been the subject of much discussion.<sup>2</sup> Having worked in the district for some years I venture to make the following suggestions.

I. The words 'knoll' and 'reef-knoll' seem to be differently understood by different workers. It seems to me desirable to drop the term 'reef-knoll.' This term was applied by Mr. Tiddeman to certain extreme members of a series: there is every possible gradation between these and ordinary rounded knolls to which the term would never be applied. Further, the hills so named by Mr. Tiddeman have not all originated in the same way.

<sup>1</sup> Paper read in Section C (Geology) at British Association Meeting, York, 1906.

<sup>2</sup> Tiddeman: Brit. Assoc. Rep., 1899; Brit. Assoc. Handbook for Leeds and Airedale, 1890; Brit. Assoc. Rep., 1900; GEOL. MAG., January, 1901. Marr: Q.J.G.S., vol. lv, pt. 3 (August, 1899); also Dakyns in same number. W. Hind & Howe, "On the Pendleside Group at Pendle Hill, etc.": Q.J.G.S., vol. lvii, pt. 3 (August, 1901). Sir A. Geikie: "Text Book," vol. ii (1903), p. 1041.

II. The following types of knolls may be recognised :—

- (A) Those in the grey or bluish-white limestone. Some of these are well-bedded and very fossiliferous; some are obscurely bedded; some are not *apparently* very fossiliferous.
- (B) Those in the dark limestones with numerous shales: these knolls are lower and more rounded.
- (C) Scar-knolls; truncated folds weathered into semi-rounded and more or less detached masses. These vary from small crags through large peninsular masses to long scar-like ridges. These may be in the white or dark limestones. Sometimes a scar-knoll has been detached from the main mass of a limestone by weathering.

There are gradations of every degree connecting these types.

III. Examples of all these types of knolls occur on one well-defined horizon. They may all be seen striking parallel with the Pendleside shales containing *Posidonomya Becheri*, *Posidoniella levis*, *Aviculopecten papyraceus*, and immediately succeeded by these shales. The succession may be seen at Cracoe and Thorpe, Stockdale, Newsholme, Broughton and Thornton, Downham, Slaidburn.

IV. The knolls are most conspicuous on the margins of the district. They are seen close to the faults at Threshfield, Malham, Attermire, Stockdale, and Bell Busk. Against the grit ridges on the southern side they are well developed at Thorpe and Cracoe, Broughton and Thornton, and near Downham.

It is noteworthy that knoll-like masses are seen *north* of the Grassington branch of the Craven faults, at Craven Moor, and near Dibble's Bridge. Here the massive white limestones come up with a much greater dip than is usual north of the faults.

The whole district is much folded. There are well-defined folds with N.E.-S.W. axes intersected by less conspicuous folds parallel to the main Pennine axis. The interference of these fold-systems seems to have directly produced some of the knolls. Folding is seen everywhere, in both the dark and the white limestones; though the well-bedded dark limestones naturally show it best. Minor faults are common, and some of the knolls appear to be due in part to faulting.

V. The more massive knolls of white limestone appear to be due to irregular aggregations of submarine débris. Folding has ridged up these massive limestones, and weathering has intensified the difference between these and the commoner knolls of the district. The smaller knolls are due to folding (as in IV) and subsequent weathering.

II. — INVESTIGATION OF THE FOSSILIFEROUS DRIFT DEPOSITS AT KIRMINGTON, LINCOLNSHIRE, AND AT VARIOUS LOCALITIES IN THE EAST RIDING OF YORKSHIRE.<sup>1</sup> By J. W. STATHER, F.G.S.<sup>2</sup>

*The Speeton Shell-bed.*—As mentioned in last year's report, this fossiliferous estuarine sand was first described by Professor Phillips

<sup>1</sup> Report of the Committee, consisting of Mr. G. W. Lamplugh (Chairman), Mr. J. W. Stather (Secretary), Dr. Tempest Anderson, Professor J. W. Carr, Rev. W. Lower Carter, Mr. A. R. Derryhouse, Mr. F. W. Harmer, Mr. J. H. Howarth, Rev. W. Johnson, Professor P. F. Kendall, Mr. H. B. Muff, Mr. E. T. Newton, Mr. Clement Reid, and Mr. Thomas Sheppard.

<sup>2</sup> Paper read in Section C (Geology) at British Association Meeting, York, 1906.

in his "Geology of Yorkshire" (pt. i, p. 100), and later by Mr. G. W. Lamplugh in the *GEOLOGICAL MAGAZINE* for 1881 (p. 176). As the bed is almost always obscured by slips, so that its relations to the drift are open to question, it was decided to examine its position by excavations.

Since the presentation of the last report several excavations have been made in the neighbourhood of the exposures seen by Professor Phillips and Mr. Lamplugh, and your Committee reports that, though the results obtained are corroborative of the accounts given by the observers above named, they also include certain new points of interest.

The largest excavation was made in the ridge between Middle Cliff and New Closes Cliff at Speeton, and at this place beds were exposed as follows:—

		ft.	in.	
	(A) Boulder-clay (lower part only excavated) ... ..	45	0	
	(B) Fine chalky gravel ... ..	1	6	
	(C) Yellowish sandy silt with shells ... ..	6	2	
ESTUARINE SHELL-BED.	{	(D) Black silt ... ..	4	0
		(E) Black silt with sandy streaks and a little gravel ...	2	0
		(F) Fine gravel, chiefly of chalk ... ..	4	0
		(G) Speeton Clay (base of <i>Bel. jaculum</i> zone 1½ feet, and "compound nodular band" 6 inches, forming the upper portion of the sloping cliff of secondary clays 84 feet above beach-level).		

It will be seen from the above section that the shell-bed is here 17 feet 8 inches thick, and its base is about 86 feet above the present beach.

The gravel (F) rests on the *Bel. jaculum* clays, but contains some material washed from the lower beds of the Speeton Clay, such as fragments of *Bel. lateralis*, etc.

The excavation showed that the beds do not rest on a flat surface of Speeton Clay, but that their surface dips into the cliff at an angle of 25 degrees, and that the bedding of the shelly deposit itself also dips into the cliff at about the same angle.

Shells occur throughout the silty beds, but are most plentiful in bed C. When excavating, the shells seen were *Cardium edule*, *Tellina balthica*, *Scrobicularia piperata*, and *Hydrobia*. A quantity of the shelly material was collected for washing, on which the Committee will report later.

Search was made for the shell-bed at the same level both north and south of the main excavation. Southwards no trace was observable, but northwards the beds were traced fifty yards along the slopes of New Closes Cliff.

At the foot of the cliff, about 500 yards northward of the site of the excavations, similar shelly silts were laid bare during favourable conditions of the foreshore early this year. In this exposure the beds attained a thickness of 4 to 5 feet, and were traceable for at least 100 yards. The silts rested on Kimeridge Clay, and were overlain by glacial drifts, which at this locality are extremely thick.

At the north end of this section the following particulars were noted:—

	ft.	in.
Boulder-clay with intercalated stratified sand and gravel, not less than ... ..	120	0
Fine chalky gravel ... ..	2	0
Silt with shells ... ..	3	0
Kimberidge Clay ... ..	4	0

The thanks of the Committee are due to the Right Hon. the Earl of Londesborough for permission to investigate the shell-bed at Speeton, and to Mr. C. G. Danford, of Reighton, for help in many ways.

## REVIEWS.

I.—MEMOIRS OF THE GEOLOGICAL SURVEY, ENGLAND AND WALES.  
EXPLANATION OF SHEET 110: THE GEOLOGY OF THE COUNTRY  
AROUND MACCLESFIELD, CONGLETON, CREWE, AND MIDDLEWICH.  
By T. I. POCOCK, M.A. With Contributions by G. BARROW,  
F.G.S., W. GIBSON, B.Sc., F.G.S., C. B. WEDD, B.A., F.G.S.,  
and J. A. HOWE, B.Sc., F.G.S.; and Notes on Fossils by  
E. T. NEWTON, F.R.S.<sup>1</sup> pp. 138. 1906. Price 2s. 6d.

MAP. SHEET 110. 1 inch to the mile. An edition showing drift and solid. Printed in colours. Price 1s. 6d.

IN this new issue of Sheet 110 we have an excellent map at a low cost. The new method, adopted in the map of Stoke-on-Trent, immediately contiguous, supersedes the old hand-coloured maps, with their inaccuracies due to the personal vagaries of the colourist, the difficulty of getting the same tint of colour on different copies, and the want of permanence in the colour, due to fading, and to the fact that the colours run, if the map gets damp. The production of the map is one for hearty congratulations to all concerned, but we would fain have seen two editions, a drift and a solid.

The present edition attempts to show both, consequently the solid geology of the area is not as distinct as it might be. The sheet introduces more country to the west and less of the east than in the old edition, and on the whole takes in a much larger area. We are glad to see the term Pendleside Series adopted for the beds between the Carboniferous Limestone and the Millstone Grits, and a distinctive colour adopted for them. We hope that the Survey will continue the use of the term for similar beds on the eastern side of the Pennine uplift and thus avoid further ambiguity.

The map, we understand, is printed and coloured at the Ordnance Office, published by the Board of Agriculture, and distributed, as agent apparently, by Fisher Unwin.

The Memoir contains detailed descriptions of the various divisions of sedimentary rocks which occupy the area of the map. They include

<sup>1</sup> A brief note of this Memoir appeared under "Notices of Memoirs" in the December Number of the GEOLOGICAL MAGAZINE, 1906, p. 558.