

II.—THE PERCHED BLOCKS OF NORBER BROW AND THEIR LEVELS RELATIVE TO THEIR PLACE OF ORIGIN.

By T. MELLARD READE, C.E., F.G.S., F.R.I.B.A.

IN a recent excursion the Liverpool Geological Society visited Norber Brow, near Austwick, to inspect the celebrated perched blocks of Silurian rock lying upon the Carboniferous limestone plateau. The visit was made in very appropriate weather during a storm of hail which added a weird element to the scene and heightened by contrast the blackness of the Silurian blocks. Since returning home I have re-read Prof. McKenny Hughes' interesting paper on the subject,¹ and find that generally speaking my notes and measurements are in accord with his. The angularity of the perched blocks, so different to the rounded and striated erratics of the Boulder Clay Plains of Lancashire and Cheshire, and the absence of Boulder Clay, is very striking, and inevitably suggests their transportal by glacier ice probably at the last phase of the glacial period.

It has, I believe, been generally taken for granted that these blocks are higher than their origin, and have been, as stated by Prof. Hughes, pushed up hill from the north.² Being specially interested in this question, which was raised on the spot by our excellent guide Dr. Ricketts, four of our party, after descending into the valley, climbed up the western side and traversed it northwards towards Crummaek. The first object that attracted attention was a magnificent glaciated surface or *roche moutonnée* of Silurian rock on our left ascending the slope to the west transversely to the direction of the valley. On the right at about the level of the perched block on Norber Brow figured in Prof. Hughes's paper (p. 530), which I shall refer to as Perched Block No. 1, and which we took for our datum level, was what may be fitly described as a mason's yard of black angular Silurian blocks, as large or larger than those on Norber Brow. The bed rock was Silurian also and further northward up the valley appeared to be much glaciated. Continuing our ascent we reached the junction of the Silurian with the Carboniferous Limestone, and following the contour northward came upon a jutting crag of Silurian from which several huge blocks had separated at the joint planes a distance of a foot or two. These blocks had a slight cant down hill, and were just in a condition and position for transportal had the valley been filled with glacier ice. The upper surface of the crag appeared to be rounded. The rock evidently breaks up naturally into cuboidal masses. Here then was probably the origin of the blocks of Norber Brow, as according to the aneroid observations made by me and checked by Mr. Ashton Hill, C.E., this Crag is 265 feet above Perched Block No. 1 on Norber Brow. The highest point of the Silurians we tried by aneroid was 295 feet above the same datum. It is evident that the movement of the blocks towards Norber Brow was in accordance

¹ On some Perched Blocks and Associated Phenomena, Q.J.G.S. vol. xlii. pp. 527–538 (1886).

² Q.J.G.S. vol. xlii. pp. 531 and 538.

with the laws of gravity and downhill. A glacier filling the Crum-mack Valley would move southward and the blocks in question clinging to the west side of the valley might be stranded where they are found on Norber Brow. There is no doubt that the pedestals and platforms on which most of them stand, and which vary from one to two feet in height, are due to the wasting away of the surrounding limestone rock as pointed out by Prof. Hughes and Mr. Mackintosh, but I quite agree with Prof. Hughes that more data than are at present available would be required before any reliable estimate of the time that has elapsed since the close of the Glacial Period could be worked out.

These remarks are not intended to apply to the Silurian blocks above Settle, which Phillips states are 200 feet above any similar rocks in the district *in situ*.¹ As we did not see them or test their levels, any remarks of mine would be superfluous.

III.—THE LOWER CRETACEOUS SERIES OF THE VALE OF WARDOUR.

By A. J. JUKES-BROWNE, F.G.S., and Rev. W. R. ANDREWS, F.G.S.

IT has long been known that certain deposits of Lower Cretaceous age lay between the Gault and the Purbeck group in the Vale of Wardour, but the absence of any good open sections, along the tracts where they reach the surface, has hitherto prevented geologists from ascertaining the exact nature and succession of the beds.

Dr. Fitton, whose account of the Vale of Wardour is wonderfully good and accurate, distinctly recognized the existence both of Wealden and Vectian (Lower Greensand), stating that certain sands, containing traces of marine shells, occurred beneath the Gault and above the clays which he regarded as Wealden.

Mr. Bristow, however, when surveying the district in 1851 to 1853, does not seem to have obtained any evidence for the separation of the sands, and considered it safer to colour all the sands and clays below the Gault as Wealden until clear evidence of their marine origin could be obtained. Hence no Lower Greensand is indicated on the Geological Survey Map.

During last year we jointly resurveyed a portion of the ground on the six inch maps, and were able to obtain evidence that proved Fitton's view to be correct, and goes far towards completing our knowledge of the succession in this district.

This preliminary notice is printed by permission of the Director-General of the Geological Survey. Early in 1890 a well was sunk at Dinton, which gave us important information regarding the beds immediately beneath the Gault. The following is an abstract account of the section thus obtained.

		Fet.
GAULT	Yellow, brown, and blue clay (with fossils)	21½
	Sandy rock with a layer of small pebbles at the base (fossils) ...	14½
VECTIAN	Brown, grey, and yellow sands, with lumps and layers of ferruginous sandstone	26½
	Light grey sandy clay, becoming darker and passing down into stiff black clay	7
		69½

¹ Rivers and Mountains of Yorkshire, 1855, p. 111.