

rock." Since that time I have been confirmed in my opinion by local geologists, so that I have now no doubt upon the matter. The same reasoning which proves that the Magnesian Limestone, forming the base of the Permian system, reposes directly on unproductive Millstone-grit from Barnard Castle to Harrogate, shows exactly a like sequence of rocks through Knaresborough, Plumpton, and Bramham Park, the only difference being that the coarse millstone at Plumpton is coloured red by peroxide of iron, certainly no sufficient reason in my judgment for claiming it as Permian. I should not have troubled you with this letter had not I deemed it right to lose no time in warning people from searching for coal in the Millstone-grit of Plumpton, which is not a locality where there is any fair probability of finding a profitable seam of coal, but a place where no productive coal-beds can reasonably be looked for.

I remain, yours truly,

E. W. BINNEY.

RAVENSLIFFE, DOUGLAS, ISLE OF MAN,  
Sept. 10th, 1866.

#### RIVER-DENUDATION OF VALLEYS.

To the Editor of the GEOLOGICAL MAGAZINE.

SIR,—Those who are acquainted with the region of the Lower Carboniferous Rocks on the borders of Lancashire and Yorkshire—forming the great anticlinal ridge between the coal-fields of these two counties—cannot fail to have been struck with the characteristic features of its valleys. They consist for the most part of narrow winding channels—bounded by steep sides, or cliffs of grit or shale—intersecting flat-topped or gently sloping moorlands of Millstone grit. These valleys generally contain rapid brooks and torrents—which are often swollen by heavy rains—and in their course carry away large quantities of material from the bottom and sides of their channels. It is, in fact, one of those districts where it might be supposed the theory of the sub-ærial or river-denuotation of valleys could be most satisfactorily illustrated. This is certainly true in the great majority of instances. When the valleys contain brooks—*having some relationship to the size of these valleys themselves*—the process of scooping the ravines is palpable to every observer; but that the theory is not capable of universal application seems to me equally clear from the fact that some parts of the deepest and most sharply sculptured valleys contain no streams whatever, owing to their crossing watersheds. I shall briefly notice a few examples, illustrated by cross-sections, of which the outlines have been drawn to natural scale for the contour lines on the Ordnance Maps. They are therefore true to nature, and are consequently less striking than when actually seen on the spot and *fore-shortened*. But their real proportions would be more evident did space admit of the lateral extension of their sides.

1. Vale of Todmorden (Fig. 1). This is one of the most remarkable valleys in this part of England. It is entered from the south at the village of Littleborough, near Rochdale, and extends northwards in a slightly winding course to Todmorden, a distance of

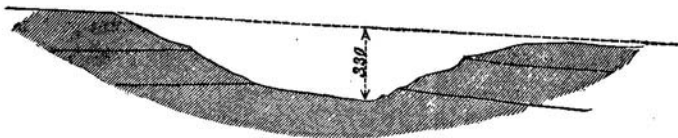


FIG. 1.—VALE OF TODMORDEN, NEAR DEAN HEAD.

five miles—when it divides into two arms: one stretching to the north-east in the direction of Burnley—the other, eastward into Yorkshire. Throughout its course to Todmorden it is bounded by lofty banks, maintaining a nearly uniform distance from each other; but in many places cut through by branching ravines. If restored (to use a favourite term) it would present the appearance of a huge canal trough, as the bottom is smooth and slopes almost imperceptibly. To the eye it presents the appearance emphatically of a “river valley.” Yet, at a point distant one-third of the way between Littleborough and Todmorden, it is crossed by the watershed, and consequently contains no stream whatever. It might be supposed that, at this point, the valley becomes narrower and shallower than further down on both sides where the rivers are flowing; but, in reality, there is scarcely any appreciable difference between this and the other parts of the valley; and for some distance on either side of the watershed the brooks are so insignificant that they cannot be considered as having modified the form of—much less of having been the agents in hollowing out—this deep furrow in the Pennine Hills. At the point where the watershed crosses—as shown in the woodcut—the valley is 330 feet in depth.

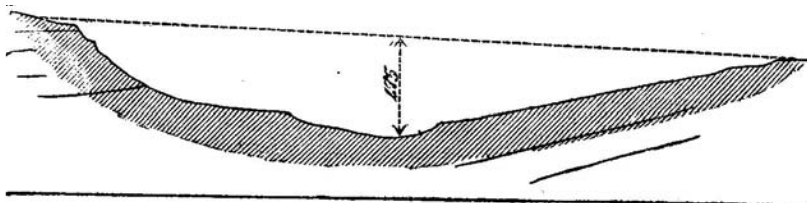


FIG. 2.—VALLEY OF CLIVIGER, AT CALDER HEAD.

2. The Valley of Cliviger (or Portsmouth) is another illustration. This valley is the one alluded to above as branching in a north-westerly direction from that of Todmorden. It is also a very marked and deep valley, opening in the opposite direction into the wide basin of Burnley. At Calder Head—a distance of nearly four miles from Todmorden—it crosses the watershed; and the streams which issue forth from springs, at this point, flow in opposite

directions. At this point the valley is 475 feet in depth, measuring from its steepest portions, but is much deeper if measured from a line joining the tops of the moorlands on opposite sides. It should also be remarked that the relative steepness of the sides have an evident connection with their geological constitution. The valley is in the line of a large fault, along which the Millstone-grit is upheaved on the south-west side, and forms, in some places, a wall of precipitous rock.

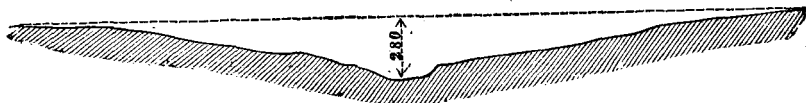


FIG. 3.—WHITWORTH VALLEY, SOUTH OF BACUP.

3. The third instance (Fig. 3) is that of Whitworth Valley, between Rochdale and Bacup. Almost two miles south of the latter town it crosses the watershed. It is less striking than the other two cases just cited, but is worthy of notice from the fact that, at the point where there is no brook, the sides of the valley are very sharply cut. The hills on either side rise much higher than is shown in the figure.

4. The last example to which I shall especially refer is the Valley of Sabden—at the eastern base of Pendle Hill. This is a truly remarkable channel from its evident connection with the strike (or direction) of the beds of Millstone-grit. It commences at the valley of the Calder, near Whalley, and thence ranges in a nearly straight line for a distance of seven miles in a north-easterly direction. The ridge which bounds it on the south-east side is composed of hard grit, and is sharply defined—that on the opposite side is more broken, but is in some parts very steep. Not having the six-inch Ordnance Maps at hand, I cannot give the exact depth of this valley where the brooks rise; but, judging by the eye, it seems not less than 400 feet, and is probably more. The watershed crosses near the village of Newchurch, in Pendle, about two-thirds of the distance from the south-western entrance to the valley; and it is a curious fact that a branch of the river Calder crosses the opposite entrance on the north-east.

There are, doubtless, many other illustrations of the same kind throughout the Northern uplands; but the cases I have cited are sufficient for my purpose, which is to show that there are valleys—with all the appearances of “river valleys”—which have no connection whatever with, at least, the present streams. It may be replied that these were once river-valleys, but that in consequence of the changes in the relative levels of the different parts of the country, the streams have been diverted. This may be so, but I should like to have some evidence of it in the presence, for example,

of some old river-terraces, of which, however, there are no examples as far as I have observed. On the other hand—from the elevation attained by the Drift, and erratic blocks on these hills—it is beyond question that at the Post-pliocene period nearly the whole country was submerged; and it is less incredible (to say the least of it) to assume the agency of the sea in the formation of these valleys (or parts of them), which we know *was* there, than that of a stream of which there is no trace.

The more I consider this subject the more I am satisfied that, in the great majority of instances in this region, the extent and limits of river action are capable of the clearest demonstration. Most of the valleys are really double valleys, or valleys within valleys, the smaller being alone due to river denudation. This is a subject, however, on which I have more fully stated my views in the pages of a contemporary,<sup>1</sup> and shall not further allude to at present; but before the enthusiastic advocates of sub-aërial denudation *for all valleys* can expect their views to meet with general acceptance, they must explain the origin of valleys without rivers such as those of the uplands of Yorkshire and Lancashire.

I remain, your obedient servant,

EDWARD HULL.

GEOLOGICAL SURVEY OF GREAT BRITAIN,  
Manchester, 11th Sept., 1866.

*To the Editor of the GEOLOGICAL MAGAZINE.*

SIR.—Permit me through the medium of your Magazine to direct attention to some remarks made by Mr. J. W. Salter in the Appendix to the Memoirs of the Geological Survey of Great Britain, Volume III., lately published.

In reviewing the group of *Cystideans* (page 284), which had been so ably and philosophically handled in the preceding volume of the Memoirs, by the late Professor Edward Forbes, then Palæontologist to the Survey, Mr. Salter takes upon himself the responsibility of expunging the identification Professor Forbes believed he had correctly made, of specimens collected by the Survey from Rhiwlas, and Sholes Hook, in Wales, with *Echinospherites* (*Sphæronites aurantium*), describing them as a new species under the name of *Sphæronites stelluliferus*; the figures to illustrate this and the other fossils on Plate 20 being transferred from the very fine engraving by Mr. Lowry, originally made for Professor Forbes' article in vol. ii. part 2.

As to the correctness of Mr. Salter's views with regard to the structure of this singular group of Silurian Echinoderms, wherein he differs from Professor Forbes, I do not at present intend to enter; I cannot, however, allow the remarks on some of these species to remain unrefuted as I consider them unjust to the memory of one so universally admired for the strict probity and correct scientific observation, so characteristic of our late highly esteemed friend.

The following are the passages I especially allude to (the italics

<sup>1</sup> The forthcoming number of the Popular Science Review.