

directly on marmorized Carboniferous Limestone in part of the quarry; elsewhere it is separated from it by vesicular 'toadstone' or by a bed of clay which is indurated and rendered columnar for a considerable depth. Above the dolerite comes another vesicular 'toadstone.' Thus the dolerite does not always rest on rocks of the same horizon; while the amount of alteration effected by it is far greater than is usually associated with lava-flows. Taking one bed in the limestone as a datum, the author establishes the following conclusions:—The dolerite does not cut across the beds of limestone; the clay varies in thickness, and is sometimes absent; the clay is rendered columnar and the limestone marmorized to a considerable depth, unless vesicular 'toadstone' of sufficient thickness intervenes, when the 'toadstone' itself is indurated; the base of the compact dolerite is approximately parallel to that of the metamorphosed rock. The dolerite itself is ophitic at its centre, granular above and below, and fine-grained at its margin; it is different in microscopic aspect from the vesicular 'toadstone.' Descriptions of the limestone and marble, the lavas, tuffs, and clay, are also given, and the positions of the faults bounding the inlier are defined.

#### CORRESPONDENCE.

##### THE AGE OF THE VALE OF CLWYD.

SIR,—In the article on this subject in your March issue, Mr. Strahan refers to a recent paper of mine on "The Carboniferous Limestone of the Vale of Clwyd,"<sup>1</sup> and to a difference of opinion between us as to the period during which the faulting of the strata occurred. He states that "We differ only on the theoretical question whether the faulting is in part pre-Triassic"; but it seems to me that we also differ as to whether the Trias anywhere overlaps the older rocks. In my paper it is stated that "I failed to find a satisfactory section showing the Trias overlapping any portion of the Carboniferous Limestone or the Purple Sandstone in the Vale of Clwyd," and I might have added, "or the Wenlock Shale."

Mr. Strahan gives several instances where he supposes the Trias to overlap the Limestone, but particularly along the east of the ridge on the west of Llanfair, Dyffryn Clwyd, and refers to "the Trias creeping across the edges of zone after zone of the limestone, until near Ruthin half that formation has been overlapped." In that locality I could not find any evidence of overlap, but that it was the gradually increasing denudation of the Limestone from south to north that caused it to become several hundred feet thinner. Of other examples he gives Bodfari, about which he remarks that "The evidence, however, is more suggestive than conclusive," and he qualifies his references in like manner as to other places. I have searched in vain for some evidence of an overlap by the Trias, but could not find any.

Mr. Strahan, in support of the pre-Triassic faulting, seems to rely on the N.N.W. faults so general along the west of the British Isles,

<sup>1</sup> Proc. Liverpool Geol. Soc., vol. viii (1897-8), p. 32.

and refers to the Vale of Eden, South Wales, and other distant areas in connection with the Vale of Clwyd. In my paper, however, I relied on the same system of faulting in South-West Lancashire and West Cheshire—about Liverpool and Birkenhead—where there are many such north-and-south faults, dislocating the Trias, and varying from a throw of a few up to 1,000 and even 2,000 feet,<sup>1</sup> equal to any in the Vale of Clwyd and all indisputably of post-Triassic age. This area is only 25 miles from the Vale, so that the conclusion is irresistible that the faults in both areas were produced at the same time. The post-Triassic faults in South-West Lancashire and West Cheshire are as great dislocations as those which traverse the Coal-measures in the country to the east, the only difference being that the Trias has been denuded from off the older strata, after the faulting had been completed.

With the exception of the Carboniferous Limestone, there are few really important exposures in the Vale of Clwyd, and most of them afford considerable scope for the use of the imagination, and it is surprising when anyone has a theory to uphold how facts crop up to support it. I have my theory, and appear to see faults where Mr. Strahan does not, while he thinks he can see evidences of the Trias overlapping the Carboniferous Limestone and perhaps the Wenlock Shale where I do not. It seems to me that it is the absence of good sections that is the cause of the difficulty.

I have been indebted to Mr. Strahan for much information, and for the position of exposures which, however, I always examined for myself, while on the other hand I constantly informed him of the progress of my work in many areas in North Wales. No geologist is a more careful observer than Mr. Strahan, and I much regret that he left the Vale of Clwyd before I began to examine it about seven years ago. Still, he has only completed a portion of it, so that when he has finished there may be little difference of opinion between us.

G. H. MORTON.

LIVERPOOL, *March 20, 1899.*

#### THE EASTERN MARGIN OF THE NORTH ATLANTIC BASIN.

SIR,—Will you allow me briefly to reply to the communications from Admiral Sir William Wharton and Mr. Hudleston which appear in the April number of the *GEOLOGICAL MAGAZINE*, so far as they concern myself.

Presuming from the context that the question to which Admiral Wharton was invited to reply refers to some supposed statement of mine, I have to say that I am not aware of ever having asserted that there are “submarine vertical precipices 7,000 feet or so in height,” and, therefore, as far as regards anything I have written I might leave the matter to others. But I can scarcely conceal from myself that the words have been put into my mouth, and I have reason to complain that no reference is given to which I can refer. I have, it is true, called the sub-oceanic ‘slope,’ along which the Continental

<sup>1</sup> The boundary fault (2,000 feet) has the Trias only on the downthrow side, but before the country was denuded the Triassic strata were on both sides.