

## THE FOLIATION OF THE LIZARD GABBRO.

SIR,—Students of petrology will, I am sure, feel indebted to my friend Mr. Teall, no less for his valuable paper on the Lizard Gabbro than for the admirable Plate with which it is illustrated. He has stated very clearly the reasons in favour of ascribing the peculiar rock-structure, there described and depicted, directly or indirectly to mechanical influences. In this it is quite possible he may be right. But, inasmuch as there seems to me some danger at the present time of overestimating the part played by mechanical agencies in producing the crystalline schists—a part which hitherto undoubtedly has been much underestimated—a danger in short of supposing that a truth is “*the truth, the whole truth, and nothing but the truth,*” I venture to put a few words on record, not so much by way of protest or criticism, as for the purpose of showing that in Mr. Teall’s proposed solution of this puzzle there are difficulties on which he does not dwell, so that it ought at present to be regarded as an hypothesis on its probation, and should not be quoted (as I feel sure it would otherwise be) as an undoubted fact. My remarks, be it understood, must be regarded as directed, not against the general principle, of which this Lizard gabbro would be a particular case, but against the application of the principle to this case.

The difficulties which I feel may be thus stated. If the foliation of the Lizard gabbro is the result of earth-movements acting on the rock after it became solid, these movements, having resulted in effects of an exceptional character, should have been of exceptional importance—that is to say, the whole district should bear the impress of the same earth-movement that has foliated the gabbro. Mr. Teall states indeed: “that the Lizard district has been profoundly affected by earth movements is apparent on every hand.” Speaking for myself, I should prefer to read ‘considerably’ for ‘profoundly,’ so far as regards the earth-movements to which we could ascribe the foliation of the gabbro. I am well acquainted with three large separate areas of country which have been ‘profoundly affected by earth-movements’ since their rocks became solid, and I do not find a parallel to them in the Lizard, except perhaps at the extreme south and near the great boundary fault on the north. There are undoubtedly numerous dislocations (as I have pointed out in one of my papers on the district); there are endless wrenches, slips and nips; but there are few signs of a great compression such as may often be traced through whole regions of crystalline rock almost as surely (when the key to it is once found) as a slaty cleavage in one of sedimentary rock. This foliation of the Lizard Gabbro, as Mr. Teall truly says, comes in and disappears, even in the thin veins, in apparently the most arbitrary manner. This of course is perplexing in any theory of its origin. I only quote it to show that our difficulties are so far not diminished by the new one. Again, the foliation often occurs where the neighbouring rocks show little or no signs of material disturbance. I do not say that the contrary is not sometimes the case, but near the Balk (or Pen Voose), and to the north

of Karaklews, and at Coverack this is the case. Serpentine is a decidedly brittle rock. Any one who knows the Alps is familiar with its pressure-modifications. Yet the serpentine at all these three places, as a rule, is singularly perfect in its structure, free from all indications of serious mechanical disturbance. There are, I am well aware, serpentines at the Lizard which might be quoted as evidencing 'pressure-structure,' but, as it happens, these do not occur at any one of the three localities where the foliated gabbros exist. At all three the serpentines are perfectly normal in their characters. But it might be asserted that, at the epoch of the pressure, the serpentine existed as a peridotite, and this very possibly would be true; still I think I know what is the effect of pressure on a peridotite, and could conjecture what the results would be when it was converted into a serpentine, and of these also I find no signs at the above-named places.

But it may be argued that this foliation in the gabbro is the result not so much of a general compression of the district, as of local strains, thrusting, and shearing in the gabbro-mass itself, due to local disturbances; that it is a structure resulting from *faulting* rather than from *folding*—from dislocation-strains rather than compression-thrusts. So far as the minor cases at the Balk and Coverack are concerned, this explanation would seem feasible, but it is difficult to apply it to such an enormous mass as that of Karaklews, where the differentiation and parallel ordering of the minerals have an extraordinary development. Moreover, as Mr. Teall justly says, this mass sends out veins into the neighbouring serpentine, and that rock to the north has been repeatedly pierced by small gabbro veins, so that we cannot suppose the main mass to have been thrust far away from its original position.

There are then, as it seems to me, some serious difficulties in applying the theory of pressure-foliation to the Lizard gabbros, if it be assumed that the structure was produced in a solid rock. Mr. Teall's solution of the difficulty *may* be the right one, but it is always well to look at all sides of a question. A new answer to one of Nature's greater riddles is often rather a first approximation to the truth, than the actual truth, and stands in need of subsequent modification. As at present advised, I am disposed to think this the case in regard to the Lizard gabbro, though further study may remove my difficulties. Still I think we shall do well to proceed cautiously in regard to this new hypothesis of pressure-metamorphism. It has come to many, like myself, almost as a revelation, pouring a flood of light upon a number of dark enigmas; but for all that we must not allow it to dazzle our eyes. In this, as in so many other things, reason should go hand in hand with faith. T. G. BONNEY.

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NECROLOGY.—We have to record with deep regret the recent losses by death of Dr. H. Abich, F.M.G.S. (Vienna); Mr. George Busk, F.R.S., F.G.S.; Rev. W. Downes, B.A., F.G.S.; the Earl of Enniskillen, D.C.L., F.R.S., F.G.S.; Mr. Caleb Evans, F.G.S.; and Prof. F. Guthrie, F.R.S., F.G.S.

ERRATUM.—GEOL. MAG. November Number, p. 492, line 10, delete "difficult."