

respect genuine. I have often thought of publishing these facts, and I think I shall do so ere long."

What became of Dr. Bowerbank's collections?

I am quite aware that, as a rule, a geologist will not trust any one to observe correctly except himself. But on questions of this kind, where the evidence is destroyed in the process of being obtained, autopsy is impossible. We are therefore obliged to rely upon cumulative evidence, the weight of which depends upon the circumstance, that it is highly improbable that *every* observation should be erroneous, while at the same time a *single* correct one is sufficient to prove the point at issue.

O. FISHER.

HARLTON, CAMBRIDGE, 4th April.

#### FELSPAR IN THE LIZARD SERPENTINE.

SIR,—May I be permitted to state, as briefly as possible, the reasons why the characters described by my friend Mr. Teall in his letter on "The Lizard Serpentine," fail to convince me that the mineral in question, which occurs in the Rill rock, is really felspar? As he rightly says, the identification of a mineral under the microscope is often more or less a matter of inference. Hence it is occasionally quite possible for two observers, both of some experience, to take different views. I do not then attribute a mistake to him in the ordinary sense of the word, nor wish in any degree to detract from the value of his work. The point is one of considerable interest, where there is ample room for two opinions.

To prevent any misunderstanding, let me say that I do not in the least deny that felspar may occur as an accidental constituent in a peridotite, and, if it occurred anywhere in the Lizard Serpentine, I should expect it, as will be seen from my remarks on that of Gue Graze, in the serpentine of the Kynance-Mullion district.<sup>1</sup> The difficulty of determining this particular mineral is not a new one to me, as I had to consider it nine years ago when preparing the above-named paper.

The following are my reasons, so far as they can be expressed on paper:—

1. The texture and aspect of the mineral in question, seen under the microscope, do not appear to me exactly identical with those of a felspar, but remind me rather of a pyroxenic mineral.

2. The brown earthy decomposition of the mineral seems to differ slightly from that of a felspar, and I find a similar decomposition in some grains of decomposing hornblende (mineral identified by cleavage and extinction) in the serpentine of Lower Pradanac, also in that of Mullion and Helston Road. I have also seen a similar decomposition in bastite or enstatite.

3. As to the tints seen between crossed Nicols. Low neutral tints are not rare in enstatites. I have noted them in augites, when somewhat decomposed, and in certain hornblendes. In my slides from Lower Pradanac the hornblende generally shows chromatic polarization, but some grains exhibit these low neutral tints. I believe it indicates incipient decomposition. As we have lately heard much

<sup>1</sup> Quart. Journ. Geol. Soc. vol. xxxiii. p. 918.

about the life of minerals, we may say that the flush of health is being replaced by the pallor of approaching death.

4. As regards the twinning, which is no doubt a very strong argument, I find a rather similar lamellar twinning (as it appears) in hornblende (serpentine of Mullion and Lower Pradanac). These seem to be produced by the formation of a mineral (doubly refracting but with different extinction) along the cleavage planes parallel to  $\infty p$ , but I am by no means sure that this is the explanation of every case. In my slide (of 1878) from the Rill it occurs in a mineral which much more resembles a variety of enstatite than felspar. In the slide cut from Mr. Teall's specimen the twinning both lamellar and in two directions at high angles occurs in minerals which I cannot distinguish from the low-tinted pyroxenes (I use the name generically) in the other slides. Further, the twinning is produced by narrow bands such as one obtains in the almost microlithic felspars of lavas, not in those of holocrystalline rocks such as picrites, gabbro, etc., and the outline of the grains is not that usual in felspars, but curiously irregular. Moreover, I find in a slide cut from the Carn Sparnack serpentine, both lamellar twinning and cross twinning in the less highly altered part of the pyroxenic constituent. I have measured the extinction angles of some of these compound grains, but to discuss the result would unduly extend this letter, so that I must content myself with affirming that these bear as much resemblance to the twinning of a plagioclase felspar as those noted by Mr. Teall, while they occur to such an extent that, if the mineral were felspar, the rock could not fail to give macroscopic indications of its presence. So, though I have endeavoured to approach the subject with the 'open mind' of some modern statesmen, I remain after repeated examination of the question of 'the same opinion still' that the mineral is not felspar. My suggestion as to its name was 'vague' designedly, for two reasons: (a) that it is very often easier to say what a mineral is not than what it is; (b) that I am by no means sure that these characteristics are exhibited by one mineral only; I believe it, however, to be always a member of the pyroxenic group, viz. some variety of augite, hornblende, or enstatite.

In conclusion, may I add that Mr. Teall appears to have slightly misunderstood the drift of my remark quoted by Colonel McMahon. Whether or not there is evidence of mechanical action on the serpentine at Porthalla is hardly germane to the question. Of course I should say that to assign the banded structure in this rock to pressure is at present just as much an hypothesis as it is in regard to the banded gabbro. But, apart from this, the difficulty, which I had felt and to which Colonel McMahon referred, was this—that, when the gabbro is so remarkably banded, then the serpentine shows little or no sign of mechanical disturbance. Porthalla is some miles from both Karakelews and the Landewednack district, and, so far as I know, gabbro does not occur in association with serpentine either there or near Mullion Cove.

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