*Note on a Picrite from the Liskeard District.*

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SPECIMENS of this rock were presented a short time since to the British Museum by the Earl of St. Germans, and Mr. T. Davies, knowing my interest in picrites and peridotites, kindly requested me to examine them and communicate the results to the Mineralogical Society. The rock occurs, as I am informed, in boulders between Menheniot and St. Germans. The picrite of the Clicker Tor, near the former place, is well known and has been more than once described, but, as all specimens which I have seen from that locality are very different, macroscopically and microscopically, from those now sent to me, it may be well to put on record a description of the latter, which, after the excellent summary of the mineral character of picrites given in Mr. Teall's *British Petrography*, need not be lengthy. I may add that, from my recollection of a conversation with Prof. Rosenbusch some years since, I have little doubt that the rock before me is that mentioned in his *Mikroskopische Physiographie der massigen Gesteine* (p. 263, ed. 1887), as "Ein sehr typischer Pikrit findet sich bei Liskeard in Cornwall von wohl auch devonischem Alter."

The rock has a moderately coarse holocrystalline matrix of a very dark green, almost black colour, slightly spotted with a lighter tint, which occasionally approaches white; in this are rather thickly scattered crystals of brownish-black hornblende, roughly about a quarter of an inch or a little less in diameter, the lustre of their cleavage planes being interrupted by small dark inclusions. The weathered surface of the rock is brown. The rock has a general resemblance to some of the picrites from Wales which I have elsewhere described.[1] Its specific gravity is 2·97.[2]

Microscopic sections show the following minerals and structure:—

(1.) Olivine; in small grains (about ·02″ in greater diameter), included in crystals of pyroxenic minerals, and in larger grains (about ·09″ in greater diameter), sometimes showing pinacoidal and corresponding dome faces imperfectly developed. In the larger grains insulated portions of the

[1] *Quart. Journ. Geol. Soc.* Vol. XLI. p. 511.

[2] Determined for me, by Prof. Ramsay's kindness, in the Laboratory (Chemical) of University College.

mineral yet remain unaltered, but the smaller grains and the exterior parts of the others are converted into serpentine of a pale greenish or yellowish tint; the iron of the olivine being deposited as granular or dusty magnetite. Slight varietal differences in the colour and the structure, and in the amount of opacite are exhibited among these secondary products, which may indicate slight differences in the composition of the original olivine.

(2.) Hornblende of a brown colour, and very dichroic, for vibrations parallel with a pale brown, b deep rich brown, c light brown,[1] enclosing the serpentinous grains, passing occasionally at the edges into a green hornblende,[2] also occurring in the usual green needles of secondary origin, and (rarely) in needles of a rather strong brown colour. For what is probably another variety of hornblende see below.

(3.) Augite of a pale puce-brown tint, with a slightly turbid aspect, in close association with the hornblende. The relations of these minerals will be considered presently.

(4.) Biotite, not very rare, but only seldom in flakes longer than about ·02″; sometimes partially altered into a greenish chloritic mineral.

(5.) A few crystals of magnetite, which are probably original constituents. Also clustered granules of the same, in some instances at least of secondary origin.

All these minerals appear to be embedded in a kind of residual groundmass, which here and there fills up the spaces between the above-mentioned grains. Generally it has a granular or a fibrous structure; sometimes forming in the latter case an aggregate of greenish and, more rarely, of brownish flakes or needles, giving varied aggregate polarisation in low tints; but occasionally it is an earthy-looking granular mass. It is very difficult to ascertain what was the original mineral (if only one) which has been thus replaced. The earthy part would suggest a felspar, but I have more than once seen a similar substance replacing portions of a bastite crystal, so this alone is not conclusive, and I cannot find a sharp division between this and the green and "serpentinous" looking part. If the latter be an aggregate of tremolite, chlorite, and (occasionally) biotite, we might regard the whole as replacing a felspar, such as anorthite—the first-named mineral being formed by taking a little magnesia from the neighbouring olivine, and its lime from the felspar; the chlorite taking alumina from the felspar and iron from the olivine, and the (rare) biotite uniting some residual alumina with a little potash which might occur in a variety

[1] For description see Teall, pp. 90-95.

[2] *Ibid.* pp. 90-94.

of the anorthite[1] (see Teall, p. 112, &c.). I have a strong suspicion that the rock has contained a little enstatite, which is now almost wholly replaced by secondary products.

There are also a fair number of colourless crystals (see above), generally about five times—but sometimes not more than twice or thrice—as long as wide. They are more frequent in the ground-mass, but occasionally they pierce into or are included in the larger pyroxenic crystals. About ·015″ is a common length, but one attains nearly ·045″. The extinction angles in longitudinal sections agree with those of hornblende, and in transverse sections the external angles and the indications of cleavage correspond fairly well with that mineral. A colourless hornblende occurs in some of the Lizard serpentines, in the Rauenthal serpentine, and probably in the Menheniot rock (Teall, p. 125), and in the first and second cases it appears to be an original constituent. A colourless augite, it will be remembered, occurs in the larger hornblende crystals of the St. Davids picrite.[2]

Although, as the above description indicates, this rock differs much from that of Menheniot, I think it not impossible, knowing the variable nature of picrite, that it might be found *in situ* in some parts of the Clicker Tor *massif*, and would recommend local geologists to make a careful search, unless, by following the track of the boulders, they are led in another direction.

We come next to the question of the relations of the brown hornblende to the augite mentioned above. That the former mineral is sometimes altered into a green variety is, I think, clear, but there is more difficulty in deciding whether it is itself the result of mineral change or is paragenetic with the augite. Sometimes the evidence would accord well with the latter view, to which Mr. Teall inclines, but, as I have already said,[3] there are cases where the other conclusion appears more probable. I have carefully studied the slides of this rock, with the following results (I speak only of the brown hornblende) :—

(*a*) The amount of hornblende is much greater than that of augite.

(*b*) The augite is rather unusually brown in colour, and has a slightly turbid aspect as if not in a very fresh condition.

(*c*) The two minerals commonly appear to form part of a single grain,

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[1] It is a curious fact, to which I have already called attention (*Geol. Mag.* Dec. iii. Vol. IV. p. 380), that the percentage of alumina in picrites is often higher than we should expect; microscopic examination indicating that felspar is very rare, and neither suggesting its former presence nor disclosing minerals in any quantity that are likely to be rich in alumina.

[2] *Quart. Jour. Geol. Soc.* Vol. XLI. p. 519.

[3] *Quart. Jour. Geol. Soc.* Vol. XLI. p. 120.

however peculiar its outline may be ; that is to say, if an uncoloured outline drawing were made of the slide, there would be nothing whatever to suggest where the one mineral began and the other ended, but we should naturally suppose the sketch represented large crystals of some one pyroxenic mineral including and associated with grains of olivine.

(*d*) While now and then the boundary between the hornblende and augite is fairly definite and rectilinear, cases are common where it is as irregular as possible ; the augite occurring like a gulf or inland sea in the hornblende, and flattened promontories of the latter sometimes projecting from the outer edge of the former mineral. Moreover, at the junction, brown films of hornblende are seen to occur in the augite, so that over a narrow space the two minerals appear to be actually mixed together.

Hence the evidence in this specimen, as in some already described,[1] appears to me in favour of the following mineral succession :—(1) Augite, (2) brown hornblende, (3) green hornblende, (4) colourless hornblende, while the external form of the grain or crystal remains unchanged. The name uralite was originally given to a mineral which, while retaining the outward form of augite, had assumed the cleavage, &c. of hornblende, so that the process described above may properly be called uralitisation. Hence this term need not be restricted as suggested by Mr. Teall, and so that which he proposes as a substitute is hardly necessary.[2] Apparently the change from the first to the second mineral indicates a modification of the iron-constituent analogous to that which takes place, as described by Prof. Judd, in the process of "Schillerization," when the colour and dichroism of the mineral are strengthened by some kind of minute separation of constituents. The change from the second to the third indicates another alteration of the same constituents.[3] Very commonly the change seems to take place directly from the first to the third, without passing through the second stage, as might be expected if this explanation be correct.

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[1] *Quart. Jour. Geol. Soc.* Vol. XLI. p. 520.

[2] *British Petrography*, p. 95. It is quite true that some uralite shows a fibrous structure, and this may be so with Rose's original type; but as the structure has been disclosed by the microscope and was not dominant in the original definition, I see no advantage in restricting the term.

[3] Can it be a slight hydration, for glauconite, chlorites and alteration products after sundry ferro-magnesian silicates are green?