VIII. *Notes on a Picrite (Palæopicrite) and other Rocks from Gipps Land, and a Serpentine from Tasmania.*

By Professor T. G. Bonney, D.Sc., F.R.S., F.G.S., &c., President.

[Read February 12th, 1884.]

THE rocks whose microscopic structure is described in this paper were collected by my friend, M. G. Stuart, Esq., during a tour in Australia, under the kind auspices of A. W. Howitt, Esq., F.G.S., the well-known geologist, who has so largely added to our knowledge of one of the most interesting districts of that continent.* Some of them have been already noticed by that gentleman, but as the volumes in which his descriptions are published are not very accessible to English readers, and as two of them are rocks to which I have devoted special attention, I have ventured to bring them to the notice of our Society.

Swift's Creek, Gipps' Land.—Picrite.—A moderately coarsely crystalline dark green rock, containing crystals, up to about ¼ inch diameter, of a blackish mineral, with two easy cleavages meeting at angles of about 120°. Their surfaces have a bright lustre, and are interrupted by enclosures of a non-reflecting mineral. In this respect they much resemble bastite, but the peculiar 'brassy' appearance of that mineral is wanting. The rock weathers brown, and is extremely like the picrite of Schriesheim in the Odenwald. The predominant mineral in the slide is a pale green hornblende, which is clearly the mineral of the larger crystals, and occasionally occurs in aggregated smaller crystals. It is not very strongly dichroic, but gives characteristic extinction angles and cleavages. Associated irregularly with this, and seemingly having solidified rather prior to it, is a slightly brownish, almost colourless, and sometimes rather 'dirty looking' mineral, which from its cleavage and extinction angles (not very easy to observe owing to the granular habit of the mineral) appears to be an augite, with a rather diallagic habit. From its relation to the hornblende I cannot help suspecting that much of the latter is of secondary origin—a kind of uralite—as I have already observed in other picrites. Irregularly interspersed

* *Quar. Jour. Geo. Soc.* Vol. XXXV. p. 1. See also the volumes of the *Victoria Geol. Survey*.

about the slide and forming the interruptions to the larger hornblende crystals are grains of olivine, fairly well preserved, except that the cracks are outlined by a black staining. Here and there incipient serpentinisation may be noted, and from the brown colour of the result, as well as from the above staining, I should infer that the olivine was rather rich in iron. Scattered very irregularly about the slide, but often roughly grouped, are several small grains of a rather resinous looking, clear, but darkish sap-green colour. They exhibit indications of a cleavage probably octahedral, and do not depolarise light, so that I think I may venture to identify them with picotite (pleonaste). It much resembles that described in my paper on the Lherzolite of the Ariège (*Geol. Mag.* Dec. II. Vol. IV. p. 59), but is yet more distinctly green, having no tinge at all of brown.* In one or two cases the grains have almost a filmy aspect, and are enclosures in a hornblende crystal. A few grains of a black iron peroxide are scattered about, and in one part of the slide there is a little of a plagioclastic felspar. I note a flake or two of brown mica in the rock, but it happens not to occur in the slide. The rock is therefore a very typical picrite (or 'palæopicrite' of many authors), and in chemical composition probably differs little from the Schriesheim rock, except that we may expect a small amount of chromium to be present.

Diorite (*typical*), *Gipps Land.*—A moderately coarse crystalline white and dull green rock, of slightly foliated aspect. Under the microscope it is seen to consist of felspar (plagioclastic), quartz, and about equal quantities of green hornblende and brown mica. The felspar is in fair sized, generally well-defined crystals, with characteristic twinning. It is not very well preserved, and is probably either oligoclase or albite. The quartz is remarkable, it occurs in rather irregular streaks formed of aggregated granules of varied size and rather irregular outline, 'clotted' together in a way that is common in mica schists. I never saw this structure in a rock that had indubitably consolidated from a state of fusion; yet the felspars, by their form and general aspect, suggest an igneous origin. They give, however, indications of fracture, so that I am disposed to the opinion that the rock is a true diorite, but that the abnormal character of this specimen is due to local crushing, and subsequent cementation by infiltrated quartz.

Balgobach Hill. Dyke.—A dark felstone with light coloured felspar crystals of rather rounded form, and a crystal of black hornblende, the part remaining being about ¼ inch in diameter. Ground-mass crypto-

* Rosenbusch, *Mikros. Physiogr.* Vol. II. p. 538, mentions the occurrence of Picotite in Picrite.

crystalline, pretty thickly studded with crystallites of felspar, hornblende (frequently belonititic) and filmy green minerals, sometimes rather ferrite-stained. Most of these appear to be hornblende, but some may be slightly altered magnesia mica or a chlorite. In the ground-mass are (1.) Crystals of felspar, often rather rounded externally. One or two may be orthoclase: most of them are certainly plagioclase, exhibiting zonal banding or polysynthetic twinning. With some hesitation I refer these to oligoclase; their worn and rounded aspect favours the idea that they were formed considerably anterior to the last consolidation of the rock. (2.) Hornblende. Most of this occurs in crystals from about ·01 to ·02 inch diameter, sometimes showing the characteristic external form and prismatic cleavage, sometimes rather fibrous in structure. The larger crystal of hornblende mentioned above is included in the slide, and proves to be a group of four. These contain as interpositions, magnetite, apatite, biotite, and several rounded grains of plagioclase felspar. The last occur similarly to the olivine grains in the larger augite or hornblende crystals of a picrite. So far as my experience goes, these felspar interpositions are not very common. There is some apatite and several grains of iron peroxide, probably magnetite (one exhibiting a skeletal structure) in the slide. There is no appreciable amount of free quartz in the slide, so that the rock must be named a porphyrite.

From a Lava Stream, Gipps Land.—A compact dark rock, with very faint indications of a fluidal structure and some small whitish felspar crystals not exceeding $\frac{1}{4}$th inch in diameter. The slide under the microscope shows a distinct fluidal structure, and when examined with a $\frac{1}{8}$th objective exhibits a clear glassy base crowded in part with minute granules and trichites of opacite and ferrite, and with other microliths too small to be determined. In this matrix are embedded fragments of lava, presenting various slight structural or mineral differences, together with several small felspar crystals, often rather rounded in outline, which contain glass inclusions; generally the mineral is rather decomposed. The majority are orthoclase, but one or two show plagioclastic twinning. In parts of the slide small grains of clear quartz are rather frequent. The rock then is a rhyolite, probably with a considerable percentage of iron and a not very high one of silica.

Omeo, Victoria Plains, running in Dykes through the Country.—A buff-coloured felstone, consisting of a somewhat granular intimate mixture of quartz and rather decomposed felspar, with crystals of quartz (bipyramidal) and decomposed felspar (small). Under the microscope the ground-mass exhibits a cryptocrystalline structure approximating to micrographic or

spherulitic, fairly perfect spherulites appearing in parts of the slide; these, however, have no definite boundaries, but are confusedly intergrown (see Daubrée, Geol. Exper. Vol. I. p. 170, fig. 45). A few small scales of a colourless mica are scattered about. Some of the quartzes contain a fair number of cavities (exhibiting in one or two a linear arrangement). These are often empty and stained, but some contain fluid with rather small bubbles, others are very clear. There are enclosures of ground-mass. The felspars are rather decomposed, but plagioclase as well as orthoclase is present. There are some scales of a dirty brown mica, probably lepidomelane, with opacite and ferrite. The rock accordingly is a typical quartz-felsite (quartz-porphyry of many authors).

From the same Locality and from a parallel Dyke.—A somewhat similar rock to the last described, but rather more compact and without quartz or felspar readily visible to the eye. A little yellower in colour. The microscopic structure presents a general similarity, but is rather more definitely spherulitic. There are numerous small irregularly shaped grains of pretty clear quartz, often clustered, but none of conspicuous size, and no isolated felspar crystals. The same mica as in the other slide. Also a quartz felsite.

Mount Pleasant. Part of the Sisters, Omeo.—A very pretty fairly compact felstone of pinkish grey colour, containing darkish bipyramidal quartz and light reddish felspar crystals up to about ·2″ diameter. Under the microscope the ground-mass exhibits a minute microcrystalline structure, and evidently is largely composed of felspar, which is decomposed and ferrite-stained. The larger felspar crystals also are much decomposed; so far as I can ascertain they are orthoclase. Microlithic enclosures and cavities are rather abundant in the quartzes; the latter usually containing bubbles which vary from about $\frac{1}{3}$th to $\frac{1}{4}$th of the total volume. The rock, like the last, is a quartz-felsite.

Tasmania.—Small fragments of a blackish serpentine containing very typical bastite. I have given so many descriptions of the structure of serpentine that it is only needful to say this is a good example of an altered olivine rock, of which mineral indeed a few small 'kernels' still remain in one corner of the slide; the black 'strings' are stronger in one direction than in that transverse to it, and are very rudely parallel, from which I infer a slight tendency to a banding in the original rock. Next to the strings comes a zone of nearly colourless serpentine, with a clearly marked fibrous structure at right angles to the strings, and within this is a greener serpentine, of less definite structure. There is a fair amount of enstatite, more or less converted into a serpentinous mineral, but still retaining indications of its

cleavage structures, and generally free from iron stains; but in one place what may have been an enstatite crystal is almost wholly replaced by iron peroxide, and with it two or three grains (which apparently consolidated after the olivine and enstatite) of a closely cleaved rather dirty looking mineral, which from its extinction angle is clearly diallage. As usual, a few large grains of magnetite are scattered about. The rock then has been an enstatite-diallage-peridotite.