3.

NOTES ON A "FAYALITE BASALT" FROM ONE TREE POINT.

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The rock on which these notes have been written occurs as a basaltic flow in a small promontory, on the far side from Hobart, of Sandy Bay.

The geological age of basaltic flows and tuffs is given by Mr. R. M. Johnston (Systematic Account of the Geology of Tasmania, p. 249 *et seq.*) as being younger than the tertiary leaf-beds, and from the occurrence of this rock and its associates, sections of which can clearly be seen on the Brown's River Road, there seems to be no reason for doubting that the age ascribed is approximately correct. The average thickness of the flow is on the exposed section about nine feet, and the extent of the sheet, as far as it can be traced, is not great. (*Ibid.*, p. 281.)

This paper has been written rather to give an account of the peculiar Petrographical character of this rock than to attempt a description of its geological occurrence, and further, such an attempt would only be a trespass on ground already well worked.

In the title the name "Fayalite Basalt" has been used as descriptive of this rock. This term may be open to some criticism when we consider the definitions given by the leading authorities of the term "Basalt." For example, Rosenbusch defines basalt as a rock consisting essentially of olivine, augite, and plagioclase, and regards such rocks as the tertiary and recent equivalents of olivine, diabase, and melaphyre. This rock will answer the requirements as to geological age, but not those relating to mineralogical constituents, for in some seven sections examined not a trace of augite was discovered. Olivine exists as the red variety Fayalite (FeO, SiO_2), and plagioclase felspar, probably as labradorite. This peculiar mineralogical composition involves almost a total absence of magnesia, and this absence is confirmed by chemical analysis, the result of which is given below. From a structural point of view the term "Fayalite Basalt," seems

to be justifiable. The terms "Dolerite," "Anamesite," and "Basalt" are here applied respectively to the coarsely textured, finely textured, but still visible to the naked eye, and the very finely textured or microscopic varieties. This rock, then, would preferably be classed as a basalt as regards texture, though the fayalites are just visible to the naked eye. Briefly, therefore, this rock is a basalt in which fayalite has replaced augite and olivine. Macroscopically, the rock is of a dark, compact appearance; fracture, conchoidal. The fayalite crystals are just visible as small dark red spots, which stand out clearly under an ordinary hand lens. The specific gravity obtained by weighing in air and water, of two specimens is 2·81. According to Von Lasaulx the specific gravity of basalt varies from 2·80 to 3·00.

The following is a chemical analysis of an average specimen of fragments taken from the upper, middle, and lower zones of the flow, care being taken to avoid weathered fragments :—

SiO_2	47·21
Al_2O_3	16·06
Fe_2O_3	11·87
FeO	4·43
CaO	7·34
MgO	·12
K_2O	2·40
Na_2O	7·51
Ignition Loss	2·55
Total...	99·49

From the nature of the case, that is on account of the gradual merging of different varieties of rocks, it is difficult to state definitely a typical average analysis of Basalt, but most analyses show MgO in considerable quantity, say, from two or three to seven or eight per cent., and in several analyses of this rock only traces of MgO were obtained. This would point to the olivine mineral being true Fayalite, that is, FeO, SiO_2. Not having material for Specific Gravity solutions, we were unable to separate any of the fayalite crystals and confirm this point, but trust, at some future time, to investigate this matter, and bring the results of our investigations before the Society.

The following is a brief account of the microscopic characters displayed in thin section by this rock :—The most striking mineral under the microscope is Fayalite, which appears in crystals and grains of a beautiful orange-yellow colour in ordinary transmitted light. In thicker

sections the tint deepens to a fine red. In the majority of cases the Fayalites exhibit crystalline outlines, the prismatic form predominating, and giving excellent longitudinal and cross sections. Here and there occur patches of Fayalite exhibiting no discernable crystalline outline. In length the crystals vary from 0·5 m.m. downwards. The inclusions visible under a high power (one-sixth inch) appear to be apatite and needles of felspar, and perhaps glass, though, on account of their minute dimensions, it is difficult to obtain good extinctions under crossed nicols.

Under crossed nicols the Fayalites exhibit the ordinary interference colours and the normal extinction of rhombic crystals. Pleochroism is not noticeable.

We have noticed neither augite nor olivine in any of the sections examined, and most probably these are entirely absent in this rock. Apatite was mentioned above as occurring in the Fayalites. It is also found here and there in the base as long needles of a faint violet-brown tint, and exhibiting pleochroism from a very faint brown tint to a deeper violet-brown (E > O). On treating a section with hydrochloric acid the apatites slowly dissolved out, leaving the glass slip visible underneath. The Fayalites were also attacked, though less rapidly.

The base consists of a ground-work of glass, penetrated with needles and fine laths of felspar running in all directions, the whole being thickly dusted with grains of magnetite. The felspars exhibit extinction angles, varying from 40° to 48°, which, according to Michel Levy's table for microlites, indicates a basic felspar, probably labradorite or anorthite. The percentage of lime (7·34% CaO) in the analysis, and also that of the alkalies, some 9%, point to the felspar being labradorite (in which the proportion of alkalies to lime is approximately one to three) mixed with a little andesine or some more acid felspar. This supposition is based on the assumption that the base is of the same composition as the microlites of felspar,—a somewhat doubtful hypothesis.

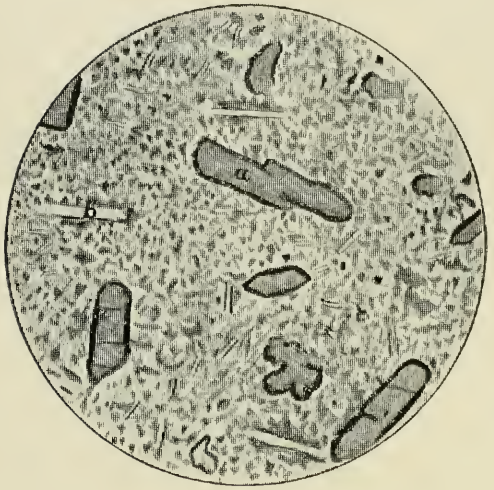
This rock appears to have followed the normal order of consolidation,—the apatite and magnetite consolidating first, then the Fayalite and felspars. It is difficult to determine exactly the relation of the Fayalite to the felspar microlite, for, included in the Fayalite crystals, appear thin rods, which in some cases are glass, but in others are doubtful, on account of the difficulty of obtaining good extinctions under crossed nicols. All the microscopic characteristics point to the conclusion that it

consolidated quickly, and under little pressure. Sections were taken from both the top and bottom of the flow to determine if there was any difference in these two regions, but the results were disappointing, and it would clearly require a flow of much greater thickness to give any distinct points of difference in crystallisation due to pressure. This rock appears to stand the influence of the weather and sea, and little sign of decomposition was noticed in any of the sections, though here and there, in some of the more weathered sections, traces of some chloritic mineral were seen. If occurring in larger flows it would no doubt make a good stone for such purposes as the foundations of buildings, road-metal, &c.

Appended are two water-colour drawings of Sections—

No. 1. Low power (× 50) showing (*a*) fayalite crystals; (*b*) apatite crystal. The relative proportions of Fayalite and base are here shown.

No. 2. Shows a fayalite crystal under a higher power (× 300). The small rod-like inclusions are here shown; also the character of the felspar microlite and magnetite grains in the base. Both drawings are taken under ordinary light.



1. x 50

2. x 300.