8. *Occurrence of Fayalite in the Plagioliparite from Sakkabira, Tarumizu-machi, Kimotsuki-gun, Kagoshima Prefecture, Japan.*

By

Ryōhei MORIMOTO,

Earthquake Research Institute

and

Hideo MINATO,

Mineralogical Institute.

(Read Apr. 21, 1946.—Received June 20, 1949.)

Occurrence of fayalite in some dacites had already been reported by KUNO from North Izu and adjacent area, and its petrogenic meaning had also been discussed by him[1]. In March of 1944, the writers found the euhedral minute crystals of fayalite, commonly 1mm×0.5mm×0.2mm in size, with brownish colour (Fig. 1) in the drusy cavities of the biotite-bearing hypersthene-plagioliparite (Table 1) that was described as "cordierite-bearing lava" in the previous paper[2]. In this paper, optical properties of the mineral and the result of goniometry (B-type of V. GOLDSCHMIDT's Two-circle Refraction Goniometer being used.) are supplemented to the previous one. Mode of occurrence of the present fayalite is quite similar to that of the mineral described by KUNO, except the contemporaneous occurrence with cordierite in the former case. It occurs as minute euhedral short prismatic crystals (1–1.5mm or less in length) in the drusy cavities associated intimately with scaly crystals of tridymite, and also as anhedral irregular grains in

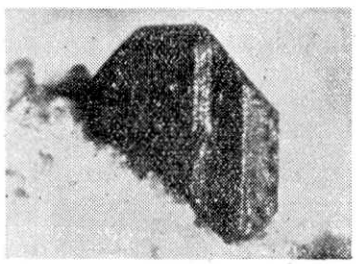

Fig. 1. Microphotograph of the fayalite (× ca. 23).

1) H. KUNO, *Jour. Geol. Soc. Japan*, **47** (1940), 228–232.

2) R. MORIMOTO, *Bull. Earthq. Res. Inst.*, **25** (1947), 33–35.

R. MORIMOTO and H. MINATO, *Jour. Jap. Assoc. Mineralogists, Petrologists and Economic Geologists*, **33** (1949), 51–61, (in Japanese).

Table 1.

Petrography of the biotite bearing hyperthene-plagioliparite.

Chemical composition[3]	Phenocrysts	Groundmass
SiO_2 .....74.65—72.75 wt%	Plagioclase:	Glass:
Al_2O_3 ....14.54—13.67 ,,	An 35—48	$n_D = 1.487—1.492$
Fe_2O_3 .... 0.64— 0.40 ,,	Quartz	Oligoclase: (Microphenocrysts)
FeO..... 1.92— 1.43 ,,	Hypersthene:	Alkalifeldspar
MgO ..... 0.67— 0.61 ,,	En 60—55 wt%[4]	Quartz
CaO..... 2.77— 2.66 ,,	Biotite:	Tridymite
Na_2O..... 4.23— 3.05 ,,	$r_D = 1.654$	Biotite:
K_2O..... 2.50— 2.16 ,,	$(-)2V = 0°$	$r_D = 1.608$
$H_2O(+)$... 0.47— 0.24 ,,	X-Cinnamon Buff (27)*	$(-)2V \fallingdotseq 0°$
$H_2O(-)$... 0.39— 0.02 ,,	Y-Sudan Brown (40)	X-Colourless to Sulphur Yellow (1)
TiO_2..... 0.17— 0.13 ,,	Z-opaque, owing to strong absorption	Y, Z-Old Gold (36) to Orange Rufous (45)
P_2O_5..... 0.26— 0.07 ,,	$X = Y \ll Z$	$X < Y, Z$
MnO ..... 0.04— — ,,	Magnetite	Cordierite:
		$\alpha_D = 1.545—1.548$
		$\beta_D = 1.546—1.549$
		$r_D = 1.549—1.551$
		$2V$ is variable
		Hypersthene:**
		$r_D = 1.720$, $2V$ n. d.
		Fayalite:
		$\alpha_D = 1.800$ $\rho > v$ about X
		$(-)2V = 56°, 57°$
		Fa_{16}[5]
		Iron ore dust

* After WADA's Colour Chert.

** An euhedral hypersthene, 2*mm* in length, in the drusy portion of the lava.

microscopic size among the higher crystalline parts of the groundmass. In such parts of the groundmass, the considerable tridymite, representing those parts of the groundmass where the volatiles were concentrated during the final stage of crystallization, are usually observed. And this mineral, as well as the cordierite described in the previous paper, is not found in the glassy parts of the plagioliparite with obsidian appearance.

From the textural relations among the druse-filling minerals observed under the microscope, and from the mineral association in the druses and in the higher crystalline parts of the groundmass (Table 2), it may be said

3) The ranges of each constituent are quoted from YAMAGUCHI. K. YAMAGUCHI, *Jour. Geol. Soc. Japan*, **45** (1938), 333. In his paper, occurrence of fayalite and also of cordierite had never been talked about. It is of much interest however that he wrote down in his description of the lava, "there are some grains whose refractive indices are higher than that of methylene-iodide among the frakes of biotite in the groundmass."

4) Inferred from $(-)2V = 62—58°$ and dispersion about X $(\rho > v)$ by means of the diagram by KUNO. H. KUNO, *Proc. Imp. Acad. Tokyo*, **17** (1941), 205.

5) Inferred from optic angle or index of refraction by means of the diagram by Winchell. Optical Mineralogy Part II (1933) p. 191.

that crystallization of the cordierite and of the quartz from the residium were slightly preceded by formation of the fayalite. The cordierite are always associated with tridymite and quartz, and commonly include the last, while the quartz often fulfills the central part of cavities, the walls of which are covered with comparatively coarse scaly crystals of tridymite. These tridymite crystals in the druses are seriated to the minute grains of the same mineral in the surrounding groundmass. The cordierite must have crystallized out *in situ* at the latest stage, for it often includes the structures of the rock which might had been formed during the eruption and crystallization of the country magma. In volcanic rocks, it is inevitable for the crystallization of mineral phases from residual liquid to be sensibly controled by the physical condition during or after eruption of the magma. And occurrence of these minerals in those parts of the lava, crystallization of which would have easily been disturbed by rapid cooling of the country magma, may be mainly due to the role of volatiles sealed in such parts of the lava enveloped by the other quenched parts of the same lava flow. Besides the physical conditions having prevailed after the eruption of the lava, the

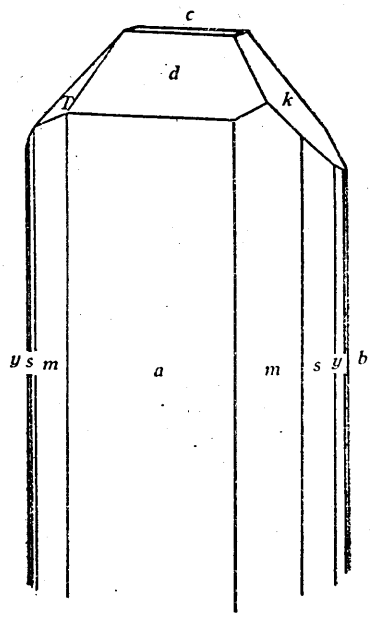

Fig. 2. Crystal figure of the fayalite.
a (100), *b* (010), *m* (110), *y* (150), *s* (120), *d* (101), *k* (021), *T* (375), *c* (001).

Table 2.

The trend of association of the minerals in druses of the plagioliparite.

Tridymite	Biotite	Fayalite*	Quartz	Cordierite
+	−	−	−	−
+	+	−	−	−
+	−	+	−	−
+	−	−	+	−
+	−	−	+	+

\+ existence − none

* Associated rarely with the hypersthene comparatively rich in Ferrosilite molecule (cf. Table 1)

writers suppose, however, that the chemical environment favourable for the crystallization of these minerals, at least cordierite, from the residium, may be ascribed to the effects of foreign assimilation on the crystallization of the magma in later stage.

Goniometry was performed about a single crystal of fayalite (Fig. 1) growing its c-axis perpendicular to the wall of druse covered with the aggregate of tridymite. The result of measurement are mentioned in Fig. 2 and Table 3.

Table 3.

Forms		ρ calc.*	φ calc.*	ρ obs.	φ obs.	Size
m	110	90°00′	65°18′	90°00′	65°43′	M
s	120	,,	47°23′	,,	47°25′	M
y	150 cf.	,,	23°30′	,,	26°20′	S
m	$1\bar{1}0$	,,	114°42′	,,	113°00′	$M-S$
s	$1\bar{2}0$	,,	132°27′	,,	136°05′	S
y	$1\bar{5}0$	,,	156°30′	,,	158°40′	S
s	$\bar{1}20$	,,	−47°23′	,,	−46°16′	M
E	$\bar{1}70$	,,	−17°15′	,,	−16°20′	S
m	$\bar{1}\bar{1}0$	,,	−114°42′	,,	−115°45′	L
a	100	,,	90°00′	,,	90°00′	L
a	$\bar{1}00$	,,	−90°00′	,,	−89°58′	L
b	010	,,	0°00′	,,	5°25′	$V.S.$
b	$0\bar{1}0$	,,	180°00′	,,	−178°54′	S
d	101	51°32′	90°00′	51°20′	91°44′	M
k	021	49°11′	0°00′	51°07′	0°06′	M
k	$0\bar{2}1$	,,	180°00′	51°45′	−177°05′	$S-M$
T	$3\bar{7}5$	38°34′	137°02′	38°45′	136°55′	S
c	001	0°00′	——	0°00′	——	$V.S.$

* After GOLDSCHMIDT's "Winkeltabellen."
cf. z (140) φ calc = 28°31′

In conclusion, the writers express their sincere thanks to Prof. Tei'ichi ITŌ of the Mineralogical Institute who afforded them every facility throughout this study. And to Dr. Toshio SUDŌ of the Geological Institute their special thanks are also due for his kind instructions to the junior author during his goniometry.