7. *Geological and Petrological Notes on the Eruption of Sakura-jima in 1946. Part II. Petrography of 1946-lava.*

By Ryōhei MORIMOTO,

Earthquake Research Institute.

(Read Sept. 16, 1947.—Received June 20, 1949.)

Since the great eruption in 1914, Sakura-jima, one of the most famous active volcanoes in southern Kyūsyū, has comparatively been in her calm state and has never outpoured her volcanic material in the form of lava flow, though the minor activities ejecting ash, bomb, and other gaseous or solid material, being accompanied with or without felt earthquakes, were recorded in Sept. 1935[1], Oct. 1939[2], and in Apr.–May 1941. The 1946-eruption occurred at the eastern flank of Minami-dake, south cone of the volcano, at the point about 750m above sea level without any conspicuous forerunning phenomena[3], and the blocky andesite lava was extruded through the adventive vent already formed in the minor activity in 1939, enlarged in the former explosion of 1941. The eruption lasted about 11 weeks from March 11th to May 25th, during which two pyroxenes-andesite was almost stationarily emitted and covered the area of about 5.4 sq. km[4]. Actual scene of activity, distribution of the recent lava, result of microscopic observation on the andesite, and the summary of a geologic history of the volcano were preliminarily reported in the previous paper[5]. In this paper, however, detailed description of the rock under the petrographic microscope, and the results of chemical analyses of it are supplementally noted in the following Tables (Table 1, 2).

Three great eruptions of the volcano in a historic age, recorded in 1468–76, 1779, and 1914, were exclusively characterized by their bilateral eruption viz. flank eruption taking place on both sides of the central cone during a series of activity. The positions of the vent holes in each above-

1) S. ATA, *Nippon Gakujutsu Kyōkai Hōkoku*, **12** (1937) 184–187, (in Japanese).

2) H. TSUYA and T. MINAKAMI, *Bull. Earthq. Res. Inst.*, **18** (1940) 318–339, (in Japanese). K. YAMAGUCHI, *Jour. Geol. Soc. Japan*, **47** (1940), 143–164, (in Japanese).

3) No felt earthquake was recorded during this eruption, though the seismic activity represented by many non-perceptible quakes were reported. T. MINAKAMI and K. IWAMA, *Bull. Earthq. Res. Inst.*, **24** (1946), 171, (in Japanese).

4) R. MORIMOTO, *Bull. Earthq. Res. Inst.*, **24** (1946), 237, (in Japanese).

5) R. MORIMOTO, *op. cit.* 229–238.

mentioned great eruption, being plotted on a topographic map, lie on the linear lines passing through radially the northeastern margin of the summit crater of Minamidake as indicated in Fig. 1. And the crater through which the recent activity took place lies also on the linear line along which the vent holes formed during the former great eruption in 1914 are plotted. Thus, geologically the recent eruption, which is distinguished from the preceding minor activities in 1935, 1939, and 1941, in extruding a lava flow, may be considered as one of the phenomena following the former great eruption in 1914. From the petrochemical standpoint, also, the chemical composition of the recent lava is almost involved in the range of that of 1914-lava (Table 1). In mode, however, the former differs

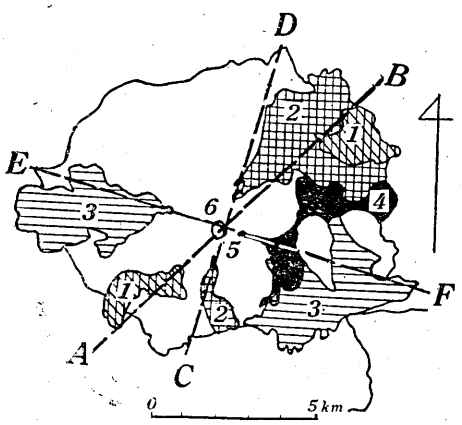

Fig. 1.
1....1463-1476-lava, 2....1779-lava,
3....1914-lava, 4....1946-lava,
5....The vent from which 1946-lava was extruded,
6....Summit crater of Minamidake,
AB..Imaginary fissure line in 1468-76,
CD..Ditto in 1779, EF..Ditto in 1914.

Table 1.
Chemical Composition of 1946-lava.

Constituent	1	2	3
SiO_2	61.26	61.24	62.29-59.07
Al_2O_3	16.14	16.76	17.81-16.56
Fe_2O_3	2.88	2.42	2.33- 1.02
FeO	4.71	4.84	5.90- 4.40
MgO	2.77	2.69	3.41- 2.17
CaO	6.80	6.62	7.57- 6.05
Na_2O	2.65	2.81	3.41- 2.72
K_2O	1.46	1.49	1.74- 1.40
H_2O (+)	0.21	0.17	0.63- 0.19
H_2O (—)	0.09	0.16	——
TiO_2	0.74	0.72	0.77- 0.51
P_2O_5	0.18	0.20	0.29- 0.08
MnO	0.14	0.13	0.24- 0.08
Total	100.03	100.25	——

Norms			
Quartz	20.76	19.44	—
Orthoclase	8.90	8.90	—
Albite	22.53	23 06	—
Anorthite	27.52	28.91	—
Wollastonite	7.66	1.28	—
Enstatite	6.90	6.70	—
Ferrosilite	5.02	5.94	—
Magnetite	4.41	3.48	—
Ilmenite	1.52	1.37	—
Apatite	0.67	0.34	—
Modes*			
Plagioclase	24.5	24.6	20.0
Augite	2.0	2.0	2.9
Hypersthene	3.2	3.3	2.6
Olivine	—	—	0.8
Magnetite	1.8	2.0	1.0
Groundmass	68.5	68.1	72.5

1. Collected from the front of "live" lava at Arimura, Apr. 7, 1946. T. ANDO analyst. (RM46040701)
2. Collected from the front of "live" lava at Kurokami, Apr. 10, 1946. T. ANDO analyst. (RM46041001)
3. Range of the chemical composition, of 1914-lava, quoted from HONMA (*Bull. Vol. Soc. Japan* **2**, 1935, 262.)

* Volume percentage

from the latter only in absence of olivine (Tables 1 and 2). But it is not rare that olivine crystals are found in the lava or in a part of the lava, irrespectively of their absence in the other lavas or in the other parts of the lava extruded during the same eruption[6]. And it is rather common for most of the lavas extruded from this volcano except some parts of 1914–lava to contain no olivine crystal.[7]

The recent lava is, petrographically, two pyroxene-labradorite-andesite, containing mainly labradorite, hypersthene, augite, iron ore, and rarely anorthite as the phenocrysts in the cryptocrystalline groundmass. The microcrystals of plagioclase, rhombic and monoclinic pyroxene, and iron ore are recognizable in the brown glass of the groundmass. Under the metallographic microscope, these iron ores are identified as magnetite and pyrite. The former occurs as the euhedral phenocrysts that are sometimes associated with pyroxene phenocrysts, as the groups of vermicular

6) B. KOTO, *Jour. Coll. Sci. Tokyo Univ.*, **38** (1916), 179. G. A. MACDONALD, *Amer. Journ. Sci.*, **242** (1944), 177–189.

7) K. YAMAGUCHI, *op. cit.* 155.

crystals (pseudomorph after olivine) in the central part of the pyroxene crystal or of the aggregate of pyroxene grains, and as the minute grains in the groundmass. The latter, whose quantity is quite negligible compared with the former, is found as the enclosures in the isolated magnetite phenocrysts. Inclusions are common in this lava, among which ceramicite[8], noritic or micronoritic rocks[9] are predominant.

Table 2.

Optical properties of the constituent minerals.

Phenocrysts	1946-lava	1914-lava	1939**
Plagioclase	*An n.d.* *An*75–51	*An*86–95, *An*65	*An*89–93, *An*66
Hyperthene	$(-)2V = 59-69°$ $\rho > v$	$(-)2V = 57-65°$ $\rho > v$	$(-)2V = 62^*-72°$ $n_{1D} = 1.698^* 1.704$
Augite	$2V = 43-55°$ ($\beta_D = 1.694, 1.697$)	$(-)2V = 46-51°$ ($n_{1D} = 1.696$)	$2V = 53-55^*$ ($n_{1D} = 1.692, 1.696$)
Olivine	–	+	$\beta_D = 1.700^*$ $(-)2V = 86°$
Magnetite	+	+	+
Groundmass	Brown glass; $n_D = 1.515-1.523$ Plagioclase An n.d. Hypersthene Augite Magnetite	Brown glass; $n_D = 1.515$ Plagioclase An n.d. Hypersthene Augite Magnetite	Brown glass; $n_D = 1.520^*-1.522$ Plagioclase: An 64,* 66 Hypersthene Augite Magnetite

** Juvenile block ejected during the minor activity in 1939. H. TSUYA and T. MINAKAMI, op. cit. 334.

* K. YAMAGUCHI, *op. cit.* 155. In this paper, chemical analyses of these blocks are given as follows: SiO_2 57.11, Al_2O_3 16.94 Fe_2O_3 1.91, FeO 6.09, MgO 3.87, CaO 8.42, Na_2O 3.09, K_2O 1.35, H_2O (+) 0.14, H_2O (–) 0.04, TiO_2 0.82, P_2O_5 0.15, MnO 0.13, T tal 100.96 (Average).

Concluding this remark, the writer wishes to have his opportunity of offering his cordial thanks to Kagoshima Prefectural Government who afforded him every facility during his field work,. and to Dr. Y. KAWANO of the Geological Survey of Japan for his kind instructions about chemical analyses of the rock. His sincere thanks are also conveyed to Mr. T. ANDO, analyst of this institute, to Mr. T. WATANABE of this institute who prepared many thin slices of the lava, and to Mr. TAKESHITA's who gave him a field station.

8) B. KOTO, *op. cit.* 196-208.

9) K. YAMAGUCHI, *Jour. Geol. Soc. Japan*, **34** (1927), 381-408, 461-473, 479-497.

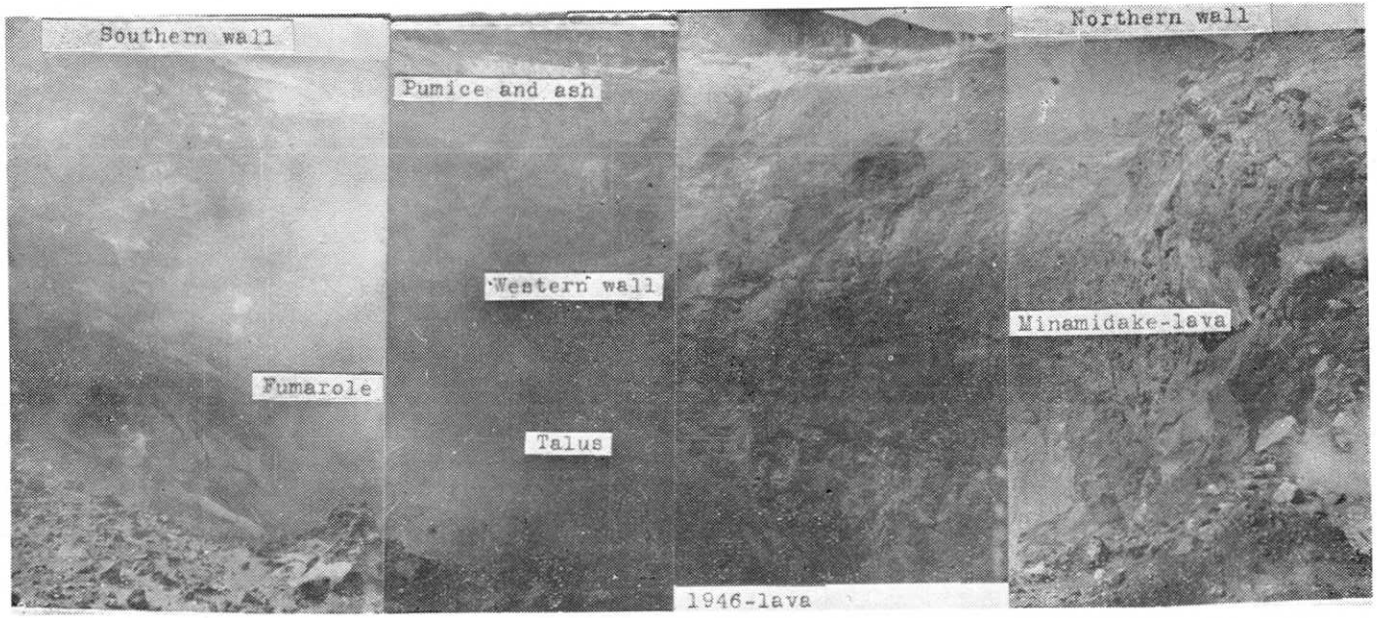

Fig. 2. Panoramic view of the inner wall of the vent, January 1947. (cf. R. MORIMOTO, *Bull. Earthq. Res. Inst.* **24** (1946), 232.)