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7. *Geochemical Notes (1): Chemical and Mineral Compositions of Ejecta of 1973 Eruption, Asama Volcano.*

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1. Introduction

Eruptive activity of Asama volcano, central Japan, lasted for several months, beginning on February 1, 1973, after 11 years of quiescence (SHIMOZURU, 1973; SHIMOZURU et al. 1975, ARAMAKI, 1973, etc.). Nature of explosive eruption was mainly Vulcanian, sending out of crater volcanic blocks, lapilli, and bread-crust bombs as projectiles and air fall pyroclastics. Results of chemical analysis made on some of these projectiles are presented in this report. Electron-probe x-ray microanalysis was made using JEOL type-5 analyzer at the University Museum. Data correction was after NAKAMURA and KUSHIRO (1970).

2. Sample

All the reported analyses except for wet analysis of the groundmass glass (No. 2, Table 1) from a bread-crust bomb ejected on March 10, were made on a projected block about 10 cm across which fell in front of the Asama Volcano Observatory, at the time of the opening eruption in the evening of Feb. 1, 1973 (SHIMOZURU, 1973). The block penetrated through about 50 cm of snow and found firmly stuck on the surface of asphalt pavement on the highway 246. The temperature of the block was high enough to melt asphalt. The rock is solid andesite with euhedral phenocrysts of plagioclase, hypersthene, augite, and magnetite set in a hyalopilitic groundmass composed of plagioclase, hypersthene, augite, magnetite, and glass.

3. Bulk composition of rock and groundmass glass

The bulk composition (Table 1, No. 1) is very similar to analyses

Table 1. Chemical composition of ejecta of the 1973 eruption of Asama volcano. Analyst: H. HARAMURA.

	1	2	3
SiO_2	62.41	67.97	82.47
TiO_2	0.68	0.82	0.39
Al_2O_3	15.64	13.99	7.60
Fe_2O_3	1.98	1.94	0.71
FeO	4.16	2.94	0.97
MnO	0.10	0.08	0.01
MgO	3.50	1.41	0.18
CaO	6.32	4.46	1.02
Na_2O	3.23	3.67	2.44
K_2O	1.47	2.16	3.81
$H_2O(+)$	0.22	0.18	n.d.
$H_2O(-)$	n.d.	n.d.	n.d.
P_2O_5	0.12	0.15	n.d.
Total	99.83	99.77	99.60
Q	18.74	27.22	53.17
or	8.69	12.76	22.53
ab	27.32	31.04	17.88
an	23.84	15.33	—
ns	—	—	0.10
wo	2.81	2.43	0.95
en	8.71	3.51	0.45
fs	5.06	2.59	1.15
ac	—	—	2.08
mt	2.87	2.81	—
il	1.29	1.56	0.74
ap	0.28	0.35	—
M	24.8	11.8	2.2
F	42.0	39.3	20.2
A	33.2	48.9	77.6
DI	54.75	71.02	93.68

1. Volcanic block ejected during the eruption of Feb. 1, 1973, Asama volcano (SA73020304). Whole rock analysis.
2. Glass separated from the groundmass of a bread-crust bomb which fell about 300 m WSW of the Asama Volcano Observatory during the eruption of March 10, 1973 (SA73031101-G).
3. Groundmass glass analyzed by electron microprobe (interstitial in groundmass of the block SA 73020304). Original iron value is total Fe as FeO=1.62%. Fe^{2+}: Fe^{3+}=5 : 3 is assumed.

of ejecta of historic eruptions (ARAMAKI, 1963, Table 21, Nos. 47–49) and those of 1281 and 1783 eruptions (Fig. 1). Brown volcanic glass was separated by Clerici's solution and isodynamic separator from the groundmass of the bread-crust bomb ejected during a major eruption of March 10. The chemical composition of this glass (No. 2, Table 1) is considered to represent that of the erupting magma. Compared with composition of similar glass from the projectiles of the 1970 eruption of Akita-komagatake volcano, northeastern Japan (ARAMAKI and KATSURA, 1973, Table 2), magma of the 1973 eruption of Asama is nearly 2% higher in both SiO_2 and Al_2O_3 and 4% lower in total iron, which may substantially contribute in raising the viscosity of magma. This relation is compatible with more explosive behavior of Asama as compared with Akita-komagatake. When plotted in the A–F–M diagram (Fig. 1), this glass falls on the general trend of Asama lavas. Microprobe analysis of interstitial glass present in small amount in the groundmass of the analyzed block (Feb. 1, 1973) indicates abnormal enrichment in SiO_2 and depletion of Al_2O_3, leading to formation of normative sodium-metasilicate (Table 1, No. 3). From Fig. 2, which shows plottings in Q-Or-An-An tetrahedron, it is clear that this interstitial glass is not on the normal "liquid line of descent".

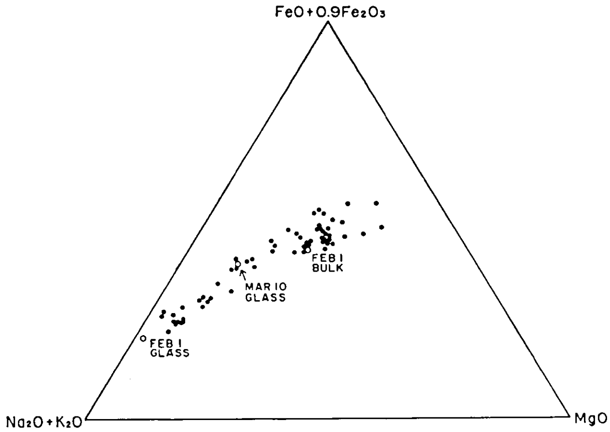

Fig. 1. A-F-M plotting of chemical compositions of Asama lavas. Open circles: analyses given in Table 1, filled circles: other analyses of Asama volcano given by ARAMAKI (1963, Table 21).

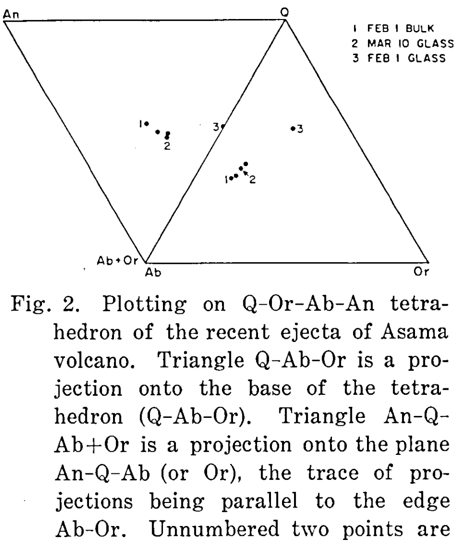

Fig. 2. Plotting on Q-Or-Ab-An tetrahedron of the recent ejecta of Asama volcano. Triangle Q-Ab-Or is a projection onto the base of the tetrahedron (Q-Ab-Or). Triangle An-Q-Ab+Or is a projection onto the plane An-Q-Ab (or Or), the trace of projections being parallel to the edge Ab-Or. Unnumbered two points are for 1783 ejectas.

4. Plagioclase

In Table 2, microprobe analyses of strongly zoned phenocrystic plagioclase are given. FeO* is characteristically higher in smaller grains as compared with larger ones. General level of FeO* content is comparable with those of Akita-komagatake (1970 eruption, ARAMAKI and KATSURA, 1973, Tabe 4) and Nishinoshima (1973 eruption, ARAMAKI, 1974, Table 3), some exceeding 1% wt. Partial analyses of plagioclase (phenocrystic and groundmass) are plotted in Fig. 3 together with data in Table 2.

5. Pyroxene

Hypersthene and augite phenocrysts and microphenocrysts are analyzed by microprobe (Table 3). Fig. 4 is a plotting in Ca-Mg-Fe diagram with additional data by partial analysis. Compositions of normative pyroxenes are also given (triangles). Normative pyroxene of the

Table 2. Chemical composition of plagioclase in a block projected out of crater Feb. 1, 1973, Asama volcano. Though effective numerals are to three digits, data are presented to second decimals.

	1	2	3	4	5	6	7	8	9	10
SiO_2	52.93	53.01	54.69	51.28	51.43	51.36	53.56	51.86	52.99	53.85
TiO_2	0.00	0.02	0.03	0.05	0.02	0.04	0.05	0.08	0.07	0.08
Al_2O_3	27.80	27.51	26.54	28.19	28.03	29.25	28.11	28.98	28.07	27.38
FeO*	0.58	0.60	0.72	0.97	0.75	0.67	0.75	0.87	1.01	0.78
MnO	0.02	0.01	0.02	0.00	0.01	0.00	0.01	0.02	0.01	0.00
MgO	0.08	0.07	0.05	0.07	0.07	0.09	0.10	0.10	0.12	0.10
CaO	12.43	12.17	10.23	13.19	13.20	13.59	12.04	11.25	12.85	10.05
Na_2O	4.50	4.74	5.56	4.01	4.04	3.58	4.52	4.64	3.95	5.30
K_2O	0.20	0.20	0.47	0.28	0.24	0.14	0.28	0.34	0.25	0.45
Total	98.54	98.33	98.31	98.04	97.78	98.71	99.42	98.13	99.31	97.98
Si	2.441	2.451	2.519	2.391	2.401	2.371	2.447	2.402	2.430	2.487
Al	1.511	1.499	1.441	1.549	1.542	1.591	1.513	1.582	1.517	1.490
Fe*	0.022	0.023	0.028	0.038	0.029	0.026	0.029	0.034	0.039	0.030
Si+Al+Fe*	3.974	3.973	3.988	3.978	3.972	3.988	3.989	4.018	3.986	4.007
Ti	0.000	0.001	0.001	0.002	0.001	0.001	0.002	0.003	0.002	0.003
Mn	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000
Mg	0.006	0.005	0.003	0.005	0.005	0.006	0.007	0.007	0.008	0.007
Ca	0.614	0.603	0.505	0.659	0.660	0.672	0.589	0.558	0.631	0.497
Na	0.402	0.425	0.497	0.362	0.365	0.321	0.401	0.416	0.351	0.475
K	0.012	0.012	0.028	0.017	0.014	0.008	0.016	0.020	0.014	0.026
Ca+Na+K	1.028	1.040	1.030	1.038	1.039	1.001	1.006	0.994	0.996	0.998
mol An	59.7	58.0	49.1	63.5	63.5	67.1	58.5	56.1	63.4	49.8
mol Ab	39.1	40.9	48.2	34.9	35.2	32.1	39.9	41.9	35.2	47.6
mol Or	1.1	1.1	2.7	1.6	1.3	0.8	1.6	2.0	1.4	2.6

FeO*, Fe*=total Fe as FeO or Fe.
Atomic ratios on O=8.000 basis.

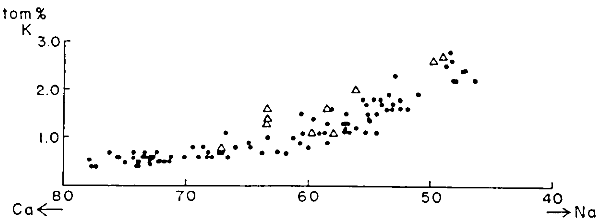

Fig. 3. Diagram showing relations between Ca(An), Na(Ab), and K(Or) atomic(molecular) ratios of the analyzed plagioclase from the ejected block of Feb. 1, 1973 eruption. Filled circles: partial analyses; open triangles: data from Table 2.

Table 3. Chemical composition of pyroxenes in a block ejected on Feb. 1, 1973, Asama volcano.

	Hypersthenes					Augites				
	1	2	3	4	5	6	7	8	9	10
SiO_2	51.92	51.52	52.66	51.25	51.97	51.59	50.99	51.29	50.92	51.38
TiO_2	0.27	0.22	0.24	0.24	0.33	0.49	0.54	0.56	0.58	0.47
Al_2O_3	0.70	0.75	0.79	1.20	0.89	1.39	1.74	1.69	2.00	1.42
FeO*	21.51	21.42	20.70	21.29	20.81	11.03	10.28	10.57	10.08	11.13
MnO	0.53	0.52	0.57	0.48	0.42	0.32	0.28	0.31	0.32	0.31
MgO	21.13	21.70	22.40	21.06	21.19	14.35	14.40	14.93	13.93	13.55
CaO	1.62	1.60	1.69	1.76	1.83	19.25	19.58	19.65	20.31	20.11
Na_2O	0.03	0.05	0.02	0.08	0.03	0.25	0.29	0.24	0.30	0.28
K_2O	0.00	0.00	0.00	0.03	0.01	0.01	0.00	0.00	0.00	0.02
Total	97.70	97.78	99.08	97.40	97.48	98.69	98.11	99.24	98.44	98.66
Si	1.982	1.967	1.974	1.964	1.982	1.957	1.943	1.935	1.937	1.957
Al^{IV}	0.018	0.033	0.026	0.036	0.018	0.043	0.057	0.065	0.063	0.043
Al^{VI}	0.013	0.001	0.009	0.018	0.022	0.019	0.021	0.010	0.026	0.021
Ti	0.008	0.006	0.007	0.007	0.010	0.014	0.016	0.016	0.017	0.013
Fe*	0.687	0.684	0.649	0.682	0.664	0.350	0.328	0.334	0.320	0.354
Mn	0.017	0.017	0.018	0.016	0.014	0.010	0.009	0.010	0.010	0.010
Mg	1.202	1.235	1.251	1.203	1.204	0.811	0.818	0.839	0.790	0.769
Ca	0.066	0.065	0.068	0.072	0.075	0.783	0.800	0.794	0.828	0.820
Na	0.002	0.004	0.002	0.006	0.002	0.019	0.021	0.017	0.022	0.021
K	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.001
Z	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
W+X+Y	1.995	2.012	2.004	2.006	1.992	2.006	2.013	2.020	2.013	2.009
atom Ca	3.4	3.3	3.5	3.7	3.9	40.3	41.1	40.4	42.7	42.2
atom Mg	61.5	62.2	63.6	61.5	61.9	41.7	42.1	42.7	40.8	39.6
atom Fe*	35.1	34.5	33.0	34.8	34.2	18.0	16.8	17.0	16.5	18.2

FeO*, Fe*=total Fe as FeO or Fe.
Atomic ratios on O=6,000 basis.

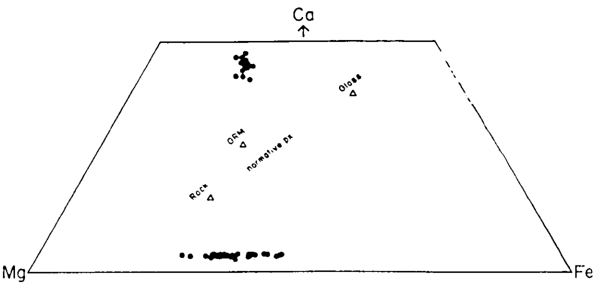

Fig. 4. Ca-Mg-Fe plotting of the analyzed pyroxenes from the ejected block of Feb. 1, 1973 eruption. Triangles are normative pyroxenes from Table 1.

groundmass (glass, No. 2, Table 1) is compatible with trends of modal augites and hypersthenes. It is noted that augite shows only a limited zonal variation while hypersthene shows a wide range of variation in Fe/Mg ratios.

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7. 地球化学ノート (1): 浅間火山 1973 年の噴出物の化学・鉱物組成

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1973 年 2～3 月の浅間火山の噴火の際に放出された火山岩塊やパン皮火山弾の化学組成と造岩鉱物の組成についてのデータを報告する. 湿式分析により全岩, 分離したガラス, マイクロプローブにより, 石基中の小量のガラスの組成を求めたが, 前 2 者は浅間火山の正常な変化方向に一致するが, 後者は SiO_2 に富み Al_2O_3 に乏しく異常である. プローブによる斜長石と輝石の分析値を掲げた.