Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SVC50-08 Room:104 Time:May 23 15:45-16:00

Petrology of 2011 ejecta from Shinmoe-dake in Kirishima volcano 3-Phase equilibria experiment for low-T endmember magma-

SUZUKI, Yuki[1*], YASUDA, ATSUSHI[1], HOKANISHI, Natsumi[1], KANEKO, Takayuki[1], NAKADA, Setsuya[1], FUJII, Toshitsugu[1], HIRABAYASHI, Jun-ichi[2]

[1]Earthq. Res. Inst., Univ. Tokyo, [2]Tokyo Tech

The determination of magma storage depths beneath active volcanoes helps to understand origin of pressure sources detected by geophysical observations. The previous petrological results on 2011 eruption of Shinmoe-dake (Suzuki et al., 2011) include, 1) most erupted magmas are mixing products between basaltic andesite and dacite (1:1) and dacite partly erupted without mixing (white pumice, very scarce), 2) variable Mg/Mn contents of magnetite phenocrysts from dacite indicate temperature variety in dacite magma body, and the white pumice corresponds to low-temperature part, 3) crystallization of basaltic andesite took place over a depth of 10-6 km (melt inclusion analyses of olivine). The skeletal form of olivine and the variable crystallization depth indicate the crystallization is associated with syneruptive magma ascent.

To further constrain magma storage conditions, we have performed phase equilibria experiments that requires magma erupted without syneruptive mixing. Therefore, our target is white pumice and a pumice block erupted on January 26, 2011(SiO_2=63.3wt%) was selected. The pumice includes orthopyroxene (Opx), clinopyroxene (Cpx), plagioclase (Pl) and Fe-Ti oxides as phenocrysts (48.2 wt% in total), with groundmass of SiO_2 76.6 wt%. Plagioclase phenocrysts have rims with An 53.2-58.9 mol%. The magma was at conditions of 861-874C and NNO+1.5.

The experiments were performed with internally heated pressure vessels at ERI. Hydrous glass that ensures water saturation in 875C runs (110-250MPa) was formed at 1200C and 310MPa, from crushed white pumice. The capsules for 875C runs had triple structure (Innermost $Ag_{75}Pd_{25}$, Pt, and Au). The hydrous glass was placed in the AgPd capsule, and buffering material (mixture of Ni, NiO and water) was placed between Pt and Au. The innermost capsule minimizes Fe loss from hydrous glass to capsule. Pt prevents reaction between Ag-Pd alloy and Ni and contamination of glass by Ni. Lower H_2 permeability of Au keeps H_2 from buffering material inside capsules. Buffering material was once replaced with new one in the middle of whole run term. Even if buffering was not successful, Fe-Ti oxide pairs in products indicate oxygen fugacity was NNO+2.3 or lower.

Coexistence of all phenocryst phases are found at 210MPa or lower; Opx lacks in 250MPa run. Phenocryst contents and compositions of plagioclase rims and groundmass in natural pumice are best replicated at 110MPa. SiO_2 contents of experimental glass are mostly constant (ca. 70wt%) between 250MPa-160MPa, but that of 110MPa reaches 74.1wt%. Crystallinity of run products (wt%, calculated using K_2O contents in glass) show systematic increase with decreasing pressure; ca. 20% at 250-210MPa, 29.3% at 160MPa, 42.1% at 110MPa. Mass balance calculation with use of all major elements in all phases yields similar change, but higher estimates (26.9% at 250MPa and 52.8% at 110MPa). An mol% of experimental plagioclase decreases with decrease of pressure (79-74 at 210MPa, 69-62 at 160MPa, 62-58 at 110MPa).

100MPa would be created at a depth of 4km, which is similar to storage depth of mixed magma (estimated with plagioclase hygrometer), but is shallower than crystallization depth of the high temperature magma (10-6km). It is believed that most erupted magma in the 2011 activity came from a region of 6-10km depth beneath 7km NE of Shinmoe-dake, based on 1) large-scale deflation just after the sub-Plinian event in January, 2011(Nakao et al., 2011, GSI, 2011) and 2) the volume change in the deflation matches volume of ejecta (Nakada et al., 2011). The shallower estimated depth (4km) in this study may be explained by as follows. As described, the dacite magma of the white pumice had lower temperature than the dacite magma that mixed with high temperature magma. Thus, it is possible that magma of white pumice occupied shallow end of the dacite magma body.

Keywords: 2011 eruption of Shinmoe-dake, magma plumbing system, magma mixing, basaltic andesite, dacite, phase equilibria experiment