

## Magma process and systems of the Kyoho eruption of Shinmoe-dake volcano in Kirishima volcanoes, Japan

Tsuyoshi Miyamoto

Center for Northeast Asian Studies, Tohoku University, Japan

E-mail: t-miya@cneas.tohoku.ac.jp

Shinmoe-dake volcano in Kirishima volcanoes at south Japan has erupted in January 2011. This activity has been in about 300 years since the Kyoho eruption (AD1716-17). From the similarities in the magma composition and the eruption sequence between the 2011 eruption and the early stage of the Kyoho eruption, it is important to understand the magma process of the Kyoho eruption. But the 2011 eruption after the first stage has a longer dormancy than the Kyoho eruption. Thus I examined the Kyoho eruption products to understand the difference of magma systems between two episodes.

The Kyoho eruption products are classified into eight units (Sm-KP1 to Sm-KP7, and Sm-MP) (Imura and Kobayashi, 1991; Tsutsui and Kobayashi, 2011). Pumice clasts in all units are dark-gray and rare yellow. Dark-gray pumices have lower bulk-rock SiO<sub>2</sub> content (57-58.5 wt.%) than the yellow ones (62 wt.%). Almost pumice show the heterogeneous texture on a scale from millimeters to tens of micrometers. Mineral assemblages of phenocrysts in all pumices are composed of plagioclase, orthopyroxene (Opx), clinopyroxene (Cpx), and Fe-Ti oxides. Olivine phenocrysts are contained only in the dark-gray pumice of Sm-KP4.

In dark-gray pumices, the distribution of the core Mg-value in Opx is bimodal in the range of 64-66 and 73-76. Low-Mg core Opx has thick rim of 72-74 with reverse zoning. The other mineralogical features in the dark-gray pumice also show the mixing of mafic and felsic magmas. But the olivine (Fo<sub>77-80</sub>) in Sm-KP4 is not in equilibrium with high-Mg core Opx. This indicates that high-Mg pyroxene was derived from mixed magma without mafic magma, whereas the low-Mg pyroxene was from felsic magma.

Mafic magma did not erupt independently in both eruptions. The heterogeneous texture in pumice indicates that two magmas ascended in conduit at the same time. In addition, the absence of isolated olivine and a thick reverse-zoned rim of Opx in mixed magma show that mixed magma was already produced before the magma ascent. The strong chemical zoning and the various zoning profiles of the Usp component in a magnetite phenocryst indicate that mafic injection occurred repeatedly before eruption. The magnetite phenocrysts have significant compositional variation, which is larger than the zoning within each phenocryst. In spite of mingling magmas on the ascent, the bulk chemical compositions lie in a narrow range; these imply that the heterogeneity is derived not from the chemical composition but from physical conditions such as temperature and oxygen fugacity. The 2011 pumice are similar to the Kyoho products. However, whereas the olivine is rare in Kyoho pumice, 2011 eruption products almost contain the olivine without pyroxene reaction rim. This discrepancy would indicate that the mixed magma produced before eruption decreases, and at the next stage the activity might change to the other eruption style for an increase of the ratio of mafic magma.