

The injection of high-sulfur basaltic magma into shallower reservoir beneath Aso

*Masataka Kawaguchi¹, Toshiaki Hasenaka¹, ATSUSHI YASUDA², Natsumi Hokanishi², Yasushi Mori³

1. Graduate school of science and technology, Kumamoto University, 2. Earthquake Reserch Institute, the University of Tokyo, 3. Kitakyushu Museum of Natural History and Human History

We analyzed the major elements of bulk rock, melt inclusion (MI) of minerals and host minerals and volatiles (H₂O, Cl, S) of MI of Holocene volcanic products from the northwestern part of Aso central cones to obtain the information of magma reservoir.

In this study, we used scoria samples of Ojodake and Kamikomezuka, which erupted in Holocene. Bulk rock composition of samples were determined by X-ray fluorescence (XRF) at Kitakyushu Museum of Natural History and Human History. Sample preparation techniques and analytical procedures are based on those of Mori and Mashima (2005). Major elements and volatiles (S, Cl) of MIs, host minerals and glasses were determined by SEM-EDS at Kumamoto university and EPMA at Earthquake Research Institute, University of Tokyo. Water concentrations in MIs were measured by Fourier transform infrared (FT-IR) micro-reflectance spectroscopy at ERI, university of Tokyo (Yasuda, 2011, 2014).

MIs of the phenocrysts shows two compositionally different types. One is mafic (SiO₂ 46.7-57.5 wt. %) and high-S (<4000 ppm), and the other is felsic (SiO₂ 52.3-59.8 wt. %) and low-S (<1000 ppm). Mafic group is hosted in olivine (Ol), felsic group are hosted in plagioclase (Pl), clinopyroxene (Cpx) and orthopyroxene (Opx). Matrix glass has intermediary composition of them. Volatiles of matrix glass were almost degassed. The S contents of Ol hosted MI tend to decrease with decreasing hosted-Ol Mg#. About felsic group, measured H₂O contents in melt inclusions from Ojodake are highest (<3 wt. %); Kamikomezuka inclusions have lower H₂O values (<1 wt. %). Those of mafic group were mostly below detection (Max 0.8 wt. %). Some phenocrysts of Pl and Cpx exhibits reverse zoning at the rim. Pl phenocrysts were divided into two groups, an Ab-rich core (An 60-65) and an An-rich core (An 85-87). Opx phenocrysts typically have a reaction rim of Cpx and Ol.

High volatile/K₂O ratios of MI hosted Ol indicates that it has high volatile contents initially. High-S content mafic magma was found by melt inclusion studies beneath the frontal volcanoes in central and northeastern Japan (Yamaguchi et al., 2003; Yamaguchi, 2010). It has become clear that volatiles in arc magma are enriched by subduction (Wallace, 2005; Zellmer et al., 2015). In general, the high S contents of basaltic melt require oxygen fugacity (fO₂) greater than FMQ+1 (Wallace, 2005; Jugo et al., 2005; Jugo, 2010). And there is some correlation of S content in the melt with Fe content, fO₂ and temperature (Wallace & Carmichael, 1992). The compositional gap of S contents between mafic and felsic group may reflects the degree of differentiation.

In considering the low-SiO₂, high-Mg# and volatiles in MIs and disequilibrium texture of felsic group phenocrysts, it is concluded that mafic group derived from deep-reservoir. These observations are explained by the injection of high-S basaltic magma into shallower reservoir.

Keywords: Aso, EPMA, FT-IR, melt inclusion, sulfur, water content