

Compositions of minerals in volcanic products from pre- and the early stage of Aso-4 large-scale pyroclastic flow

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Formation of Omine scoria cone, Takayubaru lava flow, and Oyatsu pumice flow are a series of volcanic events just before and after the large-scale Aso-4 pyroclastic eruption. Compositions of volcanic products change from 62-66 SiO₂ wt.% for Omine scoria, 63-66 SiO₂ wt.% for Takayubaru lava, to 67-69 SiO₂ wt.% for Oyatsu pumice. The difference between Omine-Takayubaru compositional trend and Oyatsu trend is small but evident (Yamasaki et al., 2013). Common phenocryst assemblage is plagioclase, orthopyroxene, clinopyroxene, and opaque minerals. In addition, Omine scoria and Takayubaru lava contain hornblende microphenocrysts, whereas Oyatsu pumice contains phenocrysts of hornblende. Most plagioclase characteristically shows sieve texture among Omine-Takayubaru samples. Such texture is not so common among Oyatsu pumice samples. We analyzed these minerals using EPMA in order to characterize the change in magma supply system that lead to large-scale pyroclastic eruption.

In response to different compositional trends observed between Omine-Takayubaru and Oyatsu samples, different mineral compositions are also found. Plagioclase phenocrysts in Omine-Takayubaru samples are An50-An60 with uni-modal peak, where as those in Oyatsu samples are An37-An56 with three peaks. Slight difference in Mg# are also found between orthopyroxene, clinopyroxene, and hornblende of Omine-Takayubaru and those of Oyatsu samples.

Estimated temperature for Omine scoria using Wells (1977) pyroxene thermometer is 950 °C, and dry viscosity is 10^{5.6} Pa • s. That for Tamaraigawa lava (SiO₂=61 wt.%) extruded before Aso-2 pyroclastic eruption was reported as 1120 °C and 10^{3.9} Pa • s, respectively, by Kobayashi (2013). The difference in viscosity is reflected by different aspect ratio, i.e. 100 m thick and 7 km long for Takayubaru lava flow, and 10 m thick and 10 km long for Tamaraigawa lava flow.

Sieve texture and microphenocrysts in Omine scoria and Takayubaru lava make an important restriction for making models of magma supply system before and after the large-scale pyroclastic eruption. If sieve texture suggests melting process of plagioclase, it indicates temperature ascent and/or water vapor pressure increase. In contrast, growth of hornblende microphenocryst suggests temperature drop and/or water vapor pressure increase. Omine-Takayubaru samples do not contain mafic inclusions and mafic minerals with reverse zoning, thus possibility of magma mixing and temperature ascent is small. The change in physico-chemical condition in Aso-4 magma supply system is yet to be solved.

Keywords: Aso-4 pyroclastic flow, Takayubaru lava, Omine volcano, lava flow