Magma plumbing system in the Yufune-2 scoria eruption, Fuji volcano-Constraints from MELTS calculations and water contents in melt inclusions-

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We have studied the latest summit eruption (2200 years ago) of Fuji volcano which produced Yufune-2 scoria deposit. We have divided the scoria deposit into 5 units (a-e in ascending order in the deposit; 10, 90, 5, 15, 60 cm thickness, respectively), each of which is distinctive in scoria size. Suzuki and Fujii (2010) showed that eruption intensity and eruption column height have changed during the summit eruption. On the other hand, bulk rock compositions of scoria (50.5-51.2 wt. % SiO_2) are almost constant throughout the eruption. All scoria samples include phenocrysts of olivine and plagioclase (less than 2mm). Suzuki (2017, JpGU meeting) examined thin sections of 4-6 scoriae for each unit and analyzed phenocryst compositions of representative scoriae. The main conclusions were, 1) magmas with different degrees of crystallization, but with the same bulk composition, were present in the magma plumbing system just before the eruption, and 2) the two endmembers were erupted independently or mixed. Mixed magma of the two endmembers were erupted in unit-a. Then, the high-crystallinity endmember erupted without mixing in the climax (unit-b and unit-c). In the ending stage (unit-d and unit-e), low-crystallinity endmember magma erupted independently, accompanied by mixed magma of the two endmembers. The low-crystallinity endmember includes only 3vol. % crystals, while the high-crystallinity endmember includes 18-19 vol. % crystals. The different total crystal contents between the endmembers are mainly due to those of plagioclase contents. The following evidence from plagioclase phenocrysts indicates that the high-crystallinity magma was derived from the low-crystallinity magma. The low-crystallinity endmember magma includes high An plagioclase (>85) with sizes less than 500 μm. The high-crystallinity endmember magma includes only low An plagioclase which is much larger than the high An plagioclase. The core compositions of low An plagioclase extend to lower An contents (An 85~65). The low An plagioclase rarely includes high An (>85) region in the center. The high An region has similar size as the high An plagioclase. On the other hand, olivine composition is distinctive in each of low-crystallinity and high-crystallinity endmember; high-Fo (80~76) in the former and low-Fo (76~73) in the latter. We could identify the parts that crystallized when crystallinity of magma was low only for plagioclase. This can be explained by much more sluggish diffusion of CaAl-NaSi in plagioclase in comparison with Mg-Fe in olivine. More examination of diffusion profiles (including other elements) is necessary to constrain the timescale from the generation of high-crystallinity magma to the final ejection. To answer where the evolution from low-crystallinity magma to high-crystallinity magma had occurred, we tried to constrain the storage conditions of the two endmember magmas. The water content analyses were carried out for inclusions in olivine phenocrysts, but only for high-crystallinity endmember. For the analyses, we used reflectance Fourier transform infrared (FT-IR) method following the procedures described in Yasuda (2011, 2014). The water contents varied between 1.1~1.6 wt. %. We constrained the storage condition of the low-crystallinity endmember magma by assuming that olivine and plagioclase were the liquidus phases in the melt of its groundmass composition. The MELTS algorithms yields less than 2.5kbar, H_2O content of ca. 1.5wt.%, and 1110-1120C. These lines of evidence indicate water contents in melt were mostly unchanged in the evolution from low-crystallinity magma to high-crystallinity magma. This does not necessarily indicates the two endmembers were in the same depth, because the low-crystallinity magma was undersaturated with water. In this presentation, we will further try to discuss which of isobaric cooling-induced crystallization and decompression-induced crystallization is more practical to form high-crystallinity endmember magma.

Keywords: Fuji volcano, Yufune-2 scoria , crystallinity of magma , MELTS calculation, phenocryst-hosted melt inclusions, reflectance FT-IR method