Magma plumbing system of Fuji volcano inferred from product of latest summit eruption (Yufune-2 scoria)

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Because of no recent eruption in Fuji volcano, syneruptive geophysical observations have not constrained magma plumbing system. Petrological studies of past eruptive products thus have an important role. As a target, I have selected a latest summit eruption, 2200 years ago. Yufune-2 scoria, product of this eruption, has an eastern dispersal axis (Miyachi, 1988). Scoria samples were collected from an outcrop locating 10 km to the east of the summit. I have divided the scoria deposit into 5 units (a-e; 10, 90, 5, 15, 60 cm thickness, respectively), each of which is distinctive in scoria size. The scoria size increases upward between unit-a and unit-b, but decreases in the upper units. The change in scoria size implies those of eruption intensity and eruption column height, if wind direction and intensity did not change. Bulk rock composition of scoria (50.5-51.2 wt. % SiO_2) does not change with eruptive unit. To further characterize erupted basaltic magma, I have analyzed thin sections of 4-6 scoriae for each unit.
Except the xenolith of basaltic lava included in scoriae of unit-a (Suzuki and Fujii, 2010 JVGR), scoriae seem almost homogeneous regardless of the eruptive unit. Phenocrysts of olivine and plagioclase (less than 2mm) are euhedral and lack in reaction rims. As a whole eruption, Fo contents of olivine cores vary between 73 and 80, while An contents of plagioclase cores vary between 65 and 92. Core compositional distribution is distinctive in each unit. All scoriae of unit-b and c are dominated by low-Fo (<76) and low-An (<85) cores. On the other hand, unit-e scoriae and half of unit-d scoriae are characterized by cores of high-An (>85) and high-Fo (>76), although some scoriae show wide Fo variety extending to Fo73. In unit-a scoriae and rest of unit-d scoriae, cores of phenocrysts show wide compositional range (Fo73-80, An65-92). As a whole, rim compositions of phenocrysts have correlation with compositional distributions of phenocryst cores.
Phenocrysts are divided into two types depending on dominant core composition. High Fo (>76) olivine and low Fo olivine (<76) have no overlap in composition and have similar crystal size. High An plagioclase (>85) has homogeneous core and is characterized by small crystal size (less than 500 μm). On the other hand, low An plagioclase (<85) rarely includes high An (>85) region in the center of the core. The high An (>85) region resembles the high An type in size. Scoria only with high Fo olivine and high An plagioclase (e.g. unit-d) have clearly lower amount of phenocrysts (3 vol. %) than scoria with only low Fo olivine and low An plagioclase (e.g. unit-b, c; 18-19vol. %).
These lines of evidence indicate that 1) magmas with different degree of crystallization (two endmembers), 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 erupted in unit-a. Then, the high-crystallinity part erupted without mixing in the climax (unit-b and unit-c). In the ending stage (unit-d and unit-e), less-crystallized magma erupted, accompanied by mixed magma. It is highly possible that the high crystallinity magma was derived from the less crystallized magma, judging from the continuous core composition of phenocrysts. I could identify the parts that crystallized when crystallinity was low only for plagioclase, not for olivine 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 in order to constrain the timescale from the generation of high-crystallinity magma to the final ejection. It is also important to discuss the storage depths of two endmember magmas by the H_2O analyses of melt inclusions in phenocrysts (Yasuda et al., 2014) . At present, only rough estimation is available. Near-liquidus coexistence of olivine and plagioclase in the

melt of the groundmass composition requires less than 2.5kbar and H2O content of ca. 1.5wt.%, and 1110-1120C, if QFM buffer is assumed.

Keywords: Fuji volcano, Yufune-2 scoria, Magma plumbing system, Phenocryst size, Phenocryst abundance, Magma mixing

