Magma process in the eruption which generated Yufune-2 scoria in Fuji volcano

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The rate and manner of syneruptive magma ascent from a reservoir are crucial parameters that influence eruptive behavior. One approach to investigating syneruptive magma ascent is to quantify the crystal and bubble textures of ejecta. At present, more case studies for basaltic magma eruptions are needed, to promote understanding basaltic magma eruption mechanisms. We have selected latest summit eruption in Fuji volcano, as present target. The eruption produced Yufune-2 (Yu-2) scoria deposit about 2200 years ago (Miyachi, 1988, 2007). The whole-rock compositions of the scoria fragments are almost homogeneous through the eruption (50-51wt. percent SiO_2; Fujii, unpublished data). Because of no recent eruption in Fuji volcano, we have no knowledge about how magma ascends and how it is detected by geophysical methods. Therefore, study on ejecta is meaningful.

Yu-2 scoria is distributed in the eastern area in Fuji volcano. Scoria samples were collected from an outcrop locating 10 km to the east of the summit. We 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. Furthermore, a, b and c units were divided into 2, 2 and 3 sub-units, respectively. The maximum diameter of scoria in each eruptive unit increases toward the upper level between a-lower (2cm) and b-middle (6cm), but decreases in the upper units (3cm in unit-e). The change in scoria size implies those of eruption intensity and eruption column height, if wind direction did not change. For apparent density, we have measured about 10 scoria fragments (4 for unit-c) for each eruptive unit. To characterize groundmass microlite texture, we have observed 4-6 scoria fragments whose apparent densities cover whole range in each eruptive unit. The apparent densities decrease between unit a (1.2-1.8g/cm^3 and Ave. 1.4; a-middle) and b+c (0.8-1.7g/cm^3, Ave. 1.0), and increases between unit b+c and e (0.9-2.3 g/cm^3, Ave. 1.4).

Some scoria fragments include heterogeneous parts characterized by groundmass microlites of lower number densities and larger sizes than other. The boundaries between parts with different microlite textures are smooth, and no crystal and bubble are cut at the boundaries. These indicate even parts with low-density and large-size microlites were magma (magmatic inclusion) when entrained into host. Phenocryst assemblages are the same between magmatic inclusion and host (olivine, plagioclase), but orthopyroxene reaction rims on olivine are limited to magmatic inclusion. Because scoria fragments with magma inclusion are mostly found in unit-a, we infer magmatic inclusion magma once stayed at shallower level than the host magma. Also, different groundmass textures imply that the two magmas underwent different physicochemical changes at shallower levels than magma reservoir. Possible origins for magmatic inclusions are; 1) magma of past eruption, 2) magma batch which ascended earliest from the reservoir and then entrained into succeeding magma. As far as olivine core compositions are considered (Fo 78-72 in host vs. Fo 73-68 in magmatic inclusion), model 1) seems preferable.

Groundmass microlite textures for the host change systematically with eruptive unit; microlite-free in unit b and c, and microlite-bearing in unit a, d and e. The presence and absence of microlites have good correlation with apparent density of scoria; scoria fragments of low-apparent density are microlite-free. Based on that longer magma ascent timescale promotes microlite nucleation and growth, we infer that synerutive magma ascent speed once increased and then decreased with the progress of the eruption. The groundmass textures also correlate well with the changes in eruption intensity which is deduced from scoria sizes. Further textual studies on groundmass may reveal how diverse eruption intensities were generated in a series of explosive activities.