

Changing timescale from magma mixing to ejection with eruptive timing-An example from the Shinmoe-dake 2011 eruption-

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Investigating mechanism and timescale of eruption triggering is one of the important tasks in volcanology. Injection of high temperature magma into the low temperature magma reservoir triggered the Shinmoe-dake 2011 eruption, by remobilizing the mush-like, immobile low temperature magma (Suzuki *et al.*, 2013). Some studies (Tomiya *et al.*, 2013; Suzuki *et al.*, 2013) already reported timescale from magma mixing to eruption for this eruption, by using zoning (diffusion) profiles in magnetite phenocrysts originated from the low temperature magma; that varies between 0.7h and 15.2h in Suzuki *et al.* (2013) which investigated several magnetite phenocrysts in a pumice clast erupted in the late stage of the second sub-Plinian (Jan 27AM) event. However, it remained unsolved whether timescale from magma mixing to eruption has correlation with eruption timing. If the timescale is constant throughout the 2011 eruption, it means magma mixing occurred repeatedly (e.g. Nakamura, 1995). We here focus on three sub-Plinian events (Jan 26PM, 27AM, 27PM) that occurred intermittently in the climactic phase of the 2011 eruption. To answer above question, we examined a succession of sub-Plinian deposit (Layer 2-5, Nakada *et al.*, 2013).

In this preliminary study, only Layer2-low, Layer3-low and Layer4-low ("low" means lower part of each unit) were investigated. According to Suzuki *et al.* (2014, JpGU meeting), Layer-2low and Layer-3low are from the first sub-Plinian event, and Layer-4 low is from the second sub-Plinian event. Magnetites included in ash size particles (500-1400 μ m) were investigated. Relatively large magnetites are preferable to read chemical and thermal history, and maximum size of magnetite phenocryst in thin sections of hand-size pumice reaches 300 μ m (Suzuki *et al.*, 2013). The ash particles (both pumice and free crystal) including large magnetite can be more than 500 μ m. The reason why we used ash size particles was to randomly pick up magnetites with various histories and mount them on single microscope slide. For EPMA analyses, we used magnetite whose rim is in contact with groundmass and whose 2D size is more than 150 μ m to minimize cut-section effect. To acquire zoning profiles, point analyses were carried out at 5 μ m intervals and 10 μ m intervals for marginal part (up to 20 μ m from rim) and inner part, respectively. Number of investigated magnetite reached ca. 20 for each eruptive unit.

Although shapes of zoning profiles have a variation for 20 crystals, all show reverse zoning in MgO. Maximum MgO contents in reversely zoned parts do not systematically change with eruptive unit, which is consistent with the continuous ejection of equally mixed magmas of the same endmember magmas (Suzuki *et al.*, 2013). We found two tendencies this time. First, most magnetites from Layer2-low have reversely zoned parts only in the marginal parts (e.g. up to 20 μ m from the rim), which differs from magnetites of other units. This might indicate timescale from mixing to eruption was mostly shorter in mixed magmas erupted as Layer2-low deposit. This could happen if major magma mixing occurred only in the beginning of the whole sub-Plinian activity. The second point is related to MgO contents of the unzoned inner parts. The MgO contents for 20 grains show bimodal distribution only in Layer2-low. In addition, minimum MgO contents for 20 magnetites seem lower in Layer2-low. This might show the different thermal and chemical history of the remobilized low temperature magmas depending on the stage of whole sub-Plinian activity. Additional analyses for other eruptive units (Layer2-up, Layer3-up, Layer4-up and Layer5) and calculation of absolute timescale from mixing to eruption are necessary to confirm above models.

Keywords: Eruption triggering, Shinmoe-dake, Mush-like felsic magma, Magma mixing, Magnetite, Diffusion profiles