

The mechanisms of cyclic sub-Plinian activity and shifting eruption style in the 2011 eruption of Shinmoe-dake

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The climactic phase of the 2011 eruption of Shinmoe-dake is characterized by sub-Plinian eruptions (Jan 26-27) and lava accumulation in the crater (Jan 28-31), both of which accompanied vulcanian eruptions (Nakada et al., in review). Referring real-time observatory data on crater image, tremor and infrasound (Ichihara et al., in review) and tilt variation (e.g. Kozono et al., in review), a geological study (Maeno et al., in review) showed three sub-Plinian events (26PM, 27AM and 27PM, the most intense phase of each lasted 2.5-1.7 hours) occurred every 12 hours with a decrease of erupted magma volume and with a constant mass discharge rate.

This study reveals evolution of conduit flow through the climactic phase, by combining, a) records in groundmass microlite and vesicle textures and b) the above-mentioned, time-resolved observatory results. Based on a petrological result (Suzuki et al., in review JVGR), we judge that variable groundmass textures among the samples reflect different conditions in syneruptive magma ascent, not different characteristics of the magma at the reservoir. Although most ejecta (gray and brown ones as to pumice clasts) are products of magma mixing that resulted from syneruptive injection of basaltic andesite magma into a silicic andesite magma reservoir, the mixed magmas were homogeneous in the reservoir owing to constant mixing ratios (SiO₂ 57-58 wt.%, 30vol. % phenocrysts, 960-980C, 4wt. % H₂O).

The volcanological questions we would like to address after we reveal evolution of conduit flow through the climax phase are, 1) mechanisms that led to the cyclic sub-Plinian eruptions, including the triggering processes of each event, 2) timing and conditions of syneruptive magma ascent that are responsible for shifting eruption intensity and eruption style (explosive and effusive). We expect this groundmass textural study also helps us newly define a boundary between the 26PM and 27AM pumice deposits. The corresponding deposit exhibits reverse and normal gradings, as if it was generated in a single event (Maeno et al., in review; Nakada et al., in review). Regardless of that, the groundmass textures of the samples may record waxing and waning phases of conduit magma flow in each sub-Plinian event.

Keywords: Shinmoe-dake, conduit flow, sub-Plinian eruption, lava emplacement, bulk density, groundmass texture