Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SVC50-P39 Room:Convention Hall Time:May 24 15:30-17:00

Dynamics and timescales of magma ascent in the shallow conduit of Shinmoedake volcano, Japan, deduced from ash texture

VINET, Nicolas[1*], OISHI, Masayuki[1], GESHI, Nobuo[1], SHINOHARA, Hiroshi[1], TOMIYA, Akihiko[1]

[1]Geological Survey of Japan, AIST

Shinmoedake, Kirishima volcano, located in southern Kyushu, Japan, renewed its activity after almost 300 years of near-dormancy on January 19, 2011 through a phreatomagmatic eruption. It was followed by sub-Plinian eruptions on January 26-27 that emitted $7x10^7$ tons of andesitic tephra, extrusion of lava that filled the summit crater, repeated Vulcanian eruptions and minor ash emission. The variety of eruption styles during a year of near-continuous activity and the extensive on-site sampling of fresh tephra over time, make it possible to investigate the textural and petrochemical variations of the tephra through time, and gain insights into shallow conduit processes. The juvenile materials consist mostly of gray pumice, along with small amount of brown or white pumice plus banded pumice. They contain olivine, orthopyroxene, clinopyroxene, plagioclase and Fe-Ti oxides as phenocrysts and microlites. The mineral and groundmass content varies regarding the eruption and type of material. Gray pumices has a whole-rock composition of 57 wt% SiO_2, while white pumices have 62-63 wt% SiO_2. Both types of pumice represent two different magmas. The erupted ash contains different types of juvenile grains, which are pumiceous grains, scoriaceous grains, and dense glassy blocks (see Oishi et al., this JpGU meeting). The proportion of the different types to the total population of ash grains is variable with time and eruption, but the constituents are the same throughout the eruptive sequence. Thus, Vulcanian eruptions are not generated by dome (lava plug) destruction but are likely driven by input of fresh magma and/or change of the conduit processes (including cooling and ascent rates). The textural approach using the crystal size distribution (CSD) analysis can aid in determining and quantifying such conduit processes and timescales. We determined CSDs of plagioclase microlites for each type of ash grain from each major event from January 19 to September 2011, using backscattered-electron images. No typical CSD was found to be fully representative of each juvenile grain type. Many samples from different types of grains have a curved concave-up CSD, which indicates several crystal populations in the conduit, and maybe mixing of magmas with different texture. Such curved CSDs can be found together with straight CSDs in grains of the same type and from the same eruption, either of sub-Plinian or Vulcanian type. This shows that the crystallization, and thus undercooling, conditions in the conduit are changing in a short timescale during a single event. In addition, we observed at least one straight CSD with the same characteristics (slope, intercept, size range) for the ash from every eruption type (phreatomagmatic, sub-Plinian or Vulcanian), but not necessarily from every single event. This suggests similar conduit properties and processes (simple nucleation and growth) with respect to the eruption style. The CSD-derived timescales of magma ascent in the shallow conduit are within hours to days. The same order of magnitude was found based on diffusion profiles in magnetite.

Keywords: Kirishima volcano, Shinmoedake, 2011 eruption series, Crystal size distributions, Timescales of magma ascent