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Heterogeneity of mushy magma reservoir and its role in the pre-eruptive process: A case study of Unzen historical eruptions.

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It has recently become known that a mushy magma reservoir with high crystalline contents (>50 vol.%) often exists beneath island arc volcanoes. One of the main triggers of volcanic eruptions is the penetration of high-temperature magma into mushy magma reservoir. The mushy magma reservoir is thought to have heterogeneity in its composition and temperature. Since they play an important role in the pre-eruptive process of volcanic eruption, it is essential to reveal how that heterogeneity works in the process at mushy magma reservoir.

To reveal the condition of the mushy magma reservoir, we used crystal clots, the aggregation of several dozens of crystals. These crystal clots are likely to be part of a mushy magma reservoir from the results of previous studies, for example [1].

As a case study, we investigated the historical eruptions of the Unzen volcano (1663, 1792, 1991-95). During these historical eruptions, there was a mushy magma reservoir beneath the volcano and magma mixing occurred in the magma reservoir [2].

In our study, chemical composition analysis of minerals and melts constituting crystal clots and phenocrysts in the product of each eruption was conducted. EPMA was mainly used for the analysis. We also analyzed the minerals and glasses that consist of crystal clots. Then, to apply thermometry, chemometry, and barometry, to the measured values, we clarified the chemical composition of the melts that involved in the magma mixing during the pre-eruptive process of the historical eruptions of Unzen volcano. Moreover, from the results of the thermometry, we also estimated the temperatures of the melts.

From these results, we construct the pre-eruptive processes of each eruption and discuss how the heterogeneity in the mushy magma reservoir has a role in these pre-eruptive processes.

[1] Magma evolution beneath Bequia, Lesser Antilles, deduced from petrology of lavas and plutonic xenoliths, Camejo-Harry, Melekhova, Blundy, Attridge, Robertson, & Christopher (2018), *Contributions to Mineralogy and Petrology* 173, 1-26.

[2] Intermittent generation of mafic enclaves in the 1991–1995 dacite of Unzen Volcano recorded in mineral chemistry, Sato, Holtz, Botcharnikov, & Nakada (2017), *Contributions to Mineralogy and Petrology* 172, 4.