

Plinian eruptions without precursory basalt injection: Case study of the Sakurajima historic eruptions

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Injection of new magma into a shallow differentiated magma chamber is often considered as a trigger of volcanic eruptions. This is primary based on the petrological observation that magma mixing precedes the eruptions by a short interval. However, some petrological records such as oscillatory zoning of phenocrysts, in addition to geophysical monitoring of active volcanoes (e.g. Iguchi et al., 2008), suggest that magma injections had occurred repeatedly without triggering eruptions immediately. In such a case, the mafic magma injection may be regarded as a preparation process for eruption rather than a trigger. To clarify the magma injection and accumulation processes prior to the past large eruptions is crucial for forecasting the volcanic activity. For this purpose, we investigated the pumice clasts of the three historic Plinian eruptions of the Sakurajima volcano, Kyusyu Japan in 1914-1915 (Taisho Era), 1779-1780 (Anei) and 1471-1476 (Bunmei). We have focused on compositional zoning of magnetite phenocrysts, because element diffusion in magnetite is relatively fast and thus has high time resolution.

The magnetite phenocrysts showed scarce compositional zoning in all the eruptions. This result indicates that the last magma injections occurred more than a few months before the eruptions. Hence, we infer that the magma injection did not trigger the historic eruptions immediately. This leads to an implication that a Plinian eruption may occur in the Sakurajima volcano without the injection of new magma prior to several months.

Keywords: Sakurajima Volcano, eruption trigger, magnetite, magma injection, magma mixing