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# Investigation of magma ascent paths in the conduit during the Sakurajima 1914 eruption based on groundmass pyroxene crystals with various combinations of crystallographic faces

**SHOTA H OKUMURA**[1], SATOSHI OKUMURA[2] AND AKIRA MIYAKE[1]

[1]Kyoto University
[2]Tohoku University

Presenting Author: okumura@kueps.kyoto-u.ac.jp

**Background**

Magma ascent conditions are recorded in crystal textures in pyroclasts. Crystal nucleation rates are generally assumed to be positively correlated with the degree of effective undercooling induced by dehydration and/or cooling during ascent. However, there are cases where the magma ascent rate is too fast to increase crystal number densities, such as the pumice from the 1914 Plinian eruption of Sakurajima volcano [1]. Aside from crystal number densities, therefore, other indicators such as crystal shape are required to investigate magma dynamics during explosive eruptions.

**Purpose**

In this study, we focus on the combinations of crystallographic faces (i.e., "tracht") of groundmass pyroxene crystals. To reveal whether the pyroxene tracht depends on magma decompression conditions, we performed isothermal single-step decompression experiments on hydrous Sakurajima dacite magma. Based on the results, we investigate the magma ascent dynamics in the conduit during the 1914 Sakurajima eruption.

**Method**

We conducted the experiments in a cold-seal pressure vessel using two starting materials: crushed Sakurajima pumice and homogenized glass made from the pumice. The samples were held under water-saturated conditions at 920 °C, 120 MPa, and oxygen fugacity conditions no more oxidizing than one log unit above Ni-NiO equilibrium for 1–24 hours. Then, control experiments were immediately quenched, whereas others were decompressed to final pressures of 20 or 10 MPa and held for three hours before quenching. After the experiments, the run products and the pumice clasts were observed in a scanning electron microscope to verify pyroxene tracht.

**Result & Discussion**

The pyroxene tracht changed from octagonal to hexagonal and further to parallelogrammatic prism as the degree of effective undercooling increased (Figure 1). We also confirmed the kinetic effect of pre-existing crystals on the tracht of newly nucleated ones. In contrast to the recent study [2] which proposed that the magma was stored at shallow conduit prior to the 1914 Sakurajima eruption, the pyroxene tracht in the Sakurajima pumice indicates that a large amount of microlite-free magma at depth ascended rapidly to erupt as pumice.

**Reference**

[1] Nakamura (2006) *J. Miner. Petrol. Sci.*, 101, 178–198.
[2] Araya et al. (2019) *Sci. Rep.*, 9, 1979.

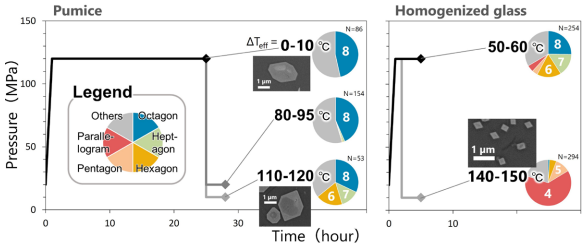


Figure 1. Results of isothermal SSD experiments about pyroxene tracht.