Pyrrhotite oxidation as a tool for reconstructing thermal structure of eruption columns

K. MATSUMOTO[1]*, M. NAKAMURA[1], Y. J. SUZUKI[2]

[1]Graduate School of Science, Tohoku Univ., Sendai 980-8578, Japan (*correspondence: k.matsu@dc.tohoku.ac.jp)

[2]Earthquake Research Institute, The University of Tokyo, Tokyo 113-0032, Japan

Dynamics of eruption columns is strongly dependent on how the surrounding air is entrained and heated to produce buoyancy. Recent fluid dynamics modeling has successfully reproduced quantitative features of air entrainment observed in laboratory experiments [1], but not been tested from field observations. Because the essential processes include heat transfer from pyroclasts to the entrained air, oxidation conditions and temperature to which the pyroclasts were exposed may be clues to test the simulated thermal structure of eruption columns. In this study, we propose that oxidation reaction of pyrrhotite (Po) may be used as a maker for temperature and oxidation conditions of pyroclasts.

The oxidation of Po in pumice clasts of the Sakurajima 1914 eruption (Figure 1) proceeded in the eruption column syn-eruptively [2]. We measured area fraction of Fe-oxide in the pseudomorph of 37 Po crystals, which corresponds to the oxidation degree of Po proceeded during cooling. Based on a 3D numerical simulation of the Sakurajima 1914 eruption column with initial temperature of 1000 K, discharge rate of $10^{6.8}$ kg/s and vent diameter of 114 m, and experimental data on the Po oxidation rate [3], we obtained preliminary calculation results of the oxidation degree of Po for ca. 500 grains. The frequency distribution of these two results will be compared and discussed.

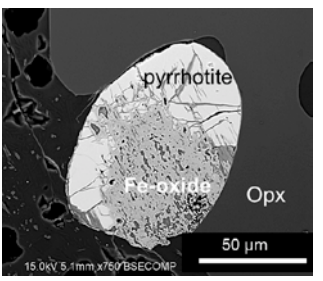

Figure 1: A BSE image of a representative oxidized Po grain (modified after Fig. 1c in [2]).

[1] Suzuki *et al*. (2005) *J. Geophys. Res*. **110**, B08201. [2] Matsumoto and Nakamura (2012) *J Mineral. Petrol. Sci*. **107**, 206–211. [3] Asaki et al. (1983) *Metall. Trans. B* **14B,** 109–116.