Relationship between the change of eruption style and the rock texture of ejecta during the Shinmoe-dake 2018 eruption, Kirishima, Japan

*Sayaka Shohata[1], Fukashi Maeno[2], Yuki Suzuki[3], ATSUSHI YASUDA[2], Natsumi Hokanishi[2]

1. Department of Earth and Planetary Science, School of Science, The University of Tokyo, 2. Earthquake Research Institute, The University of Tokyo, 3. Faculty of Education and Integrated Arts & Sciences, Waseda University

The amount of crystals and crystal size distributions (CSD) in the groundmass reflect the history of crystal nucleation and crystal growth responding to processes of magma decompression and cooling. Recent eruptive events are well observed directly in detail, so there is a possibility to advance understanding the main factor which decide eruptive style by analyzing groundmass texture. Shinmoe-dake volcano, Japan, erupted in 2011 and 2018. The 2011 eruption was characterized by three sub-plinians and lava dome effusion, but the 2018 was only lava dome effusion. This difference is important to understand the eruptive style branching factor. However, discussion based on the detail analysis of ejecta is not enough. The purpose of this study is to compare the texture of different types of rocks erupted from the 2018 eruption and reveal the magma process, and to compare with the 2011 eruption which has been already studied (Suzuki et al., 2018) and discuss the cause of different eruptive style. The samples of the 2018 products are classified into four groups. Pumice ejected from the early stage eruption (P1), pumice ejected from the latter eruption (P2), lava effused from the summit crater after the P1 eruption (L), and ballistic ejecta that the eruption date is unidentified but after P1 (B). The samples were analyzed with EPMA and FE-EPMA. Chemical composition data analyzed by EPMA were used to calculate the crystallinity of groundmass based on mass balance. High magnification photos and element mapping data were processed and used for quantitative textural analysis. In quantitative analysis, plagioclase microlite number density and CSD were calculated mainly using the method of Higgins (2000). According to the analyzed composition data, the magma is almost the same as the 2011. However, there were textural differences for each type and it reflects different effective undercooling. L has the highest groundmass crystallinity, followed by P1 and B, and P2 has the lowest. Plagioclase number density of P1 was the largest, L and B had almost the same value, and P2 was the smallest. The CSD peak value of P2 was the highest, P1 was the second and near to the P2, L was the third, and B was the lowest. These results suggest the condition which crystallization occurred. L showed smaller number density than P1 and P2, but the highest crystallinity, so I presumed it experienced crystal growth effectively. B showed the smallest number density and steep slope in CSD. This means nucleation rate was larger than L. P1 had highest number density and CSD peak, it was formed under the highest nucleation rate. P2 showed the steepest slope in CSD so that it was formed under the lowest growth rate. The relationship between nucleation/ crystal growth rate and effective undercooling shows a bell-shaped. According to the result this time and comparison with the 2011 eruption, it can be arranged in ascending order, L, B, P1, P2 in terms of effective undercooling. Effective undercooling has a positive correlation with magma ascending rate. It can be presumed to reflect the slowest and constant ascent rate for the lava dome. Ballistic product rose slowly as lava but ejected with high speed from shallower conduit. At the early phase, pumice ascended slowly above the lava-forming magma. In contrast, latter phase pumice ascended quickly. Additionally, CSD value is higher than 2011, the features of P2 and 2011 sub plinian pumice, B and 2011 ballistic ejecta were similar. This can be interpreted that the 2018 eruption had lower magma discharge rate than 2011, and changing during the eruption. It was presumed that lava dome grew at a constant rate from the data of time-sequence observation (NIED), but textural analysis results suggest the speed of lava effusion

was not constant.

Keywords: Shinmoe-dake volcano, Crystal size distribution

