Textural observation and chemical analyses of 1716-1717 Kyoho eruption pumice at Shinmoedake, Kirishima volcano group

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Volcanic products have the historical eruption Information of magma chamber in their texture. For instance, after classifying volcanic products by the result of textural observation and chemical analysis, we can calculate the rate of magma supply from mantle from the crystal size distribution (CSD) (Yamashita and Toramaru (2019)). Kyoho eruption, occurred in 1716 and 1717 in Kirishima Shinmoedake volcano, produced pumice fall and volcanic ash fall of the total amount of volcanic products of 200 million tons. In this study, I did textural observation and chemical analysis for fall pumice of Kyoho eruption. The aim of this study is to clear how magma chamber exist and act at Kyoho eruption by the result of textural observation and chemical analyses.

Samples are taken at outcrops, located in southeast east Shinmoedake volcanoes. The deposits consist of seven units (from the bottom Sm-Ky1, Sm-Ky2, …, Sm-Ky7), as described by previous studies. We focus on five pumice units except two units (Sm-Ky1 and Sm-Ky3) of ash fall. We conducted particle size analyses, bulk density measurement, textural observation, and chemical analyses. To be specific, we did particle analyses by using sieve for eight sub-layers in each unit. For two pumices in a sub-layers for each unit, we conducted bulk density measurement by using a 3D scanner and electronic weighing instrument. Using thin sections of the pumices, we performed mineral description, calculated phenocryst crystallinity for photos taken by SEM We define the phenocryst crystallinity as the areal fraction of phenocrysts in whole grain area, multiplied by 100 as percent . Similarly, we define phenobubble% as the areal fraction of phenobubble (Phenobubble is defined as bubbles with area larger than 0.01 mm^2 and presummed to be formed in the magma chamber.) We conducted chemical analyses for plagioclase phenocrysts by using FE-EPMA and SEM-EDS .

The result of particle size analyses, all units showed the characteristics of fall deposits. Previous studies said that these units are fall deposits, so this result corresponded to previous studies. The result of bulk density measurement showed that Sm-Ky2 layer’ s pumice had remarkably high density compared with other sub-layers. Mineral description showed that most of phenocrysts in all units are plagioclase and clinopyroxene. The result of crystallinity and phenobubble% of Sm-Ky2 layer also show the different signature. From the histogram of anorthite contents, it is found that core compositions have one peak (near 70(big)) in Sm-Ky2 and Sm-Ky4 layer, whereas they have three peaks (near 55, 70(big), and 85) in Sm-Ky5 and Sm-Ky6 layer, and two peaks (near 60(big) and 80) in Sm-Ky7 layer. Rim compositions have two peaks (near 30 and 70(big)) in Sm-Ky2 layer, 3 peaks (near 30, 70(big), and 80) in Sm-Ky4 and Sm-Ky5 layers, and 3 peaks (near 60, 70(big), and 80) in Sm-Ky6 and Sm-Ky7 layers.

It is found that the relationship between phenobubble% and crystallinity shows different trend between Sm-Ky2 and other layers. This difference can be seen in the relationship between bulk density and phenobubble%. The difference cannot be seen in the relationship between bulk density and crystallinity. From these results, we can draw two conclusions. First, bulk density was affected phenobubble% rather than crystallinity in volcanic deposits of Kyoho eruption . And, from the different trend of correlation diagram, Sm-Ky2 layer and other layers’ magma component are different. So, they came from different magma chamber. From this, it is suggested that Shinmoedake may have more than two magma chambers.

Second, from the result of anorthite contents showing similar distribution for Sm-Ky2 and Sm-Ky4 , we think that plagioclase phenocrysts in Sm-Ky2 and Sm-Ky4 layers formed in the similar condition.