姶良カルデラ形成における前駆プリニー式噴火の軽石の組織分析
Textual analyses for pumice from precursory Plinian eruption of Aira caldera forming eruption

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Aira caldera is located in northern part of Kagoshima bay, southern Kyushu. The caldera forming eruption (29,000 BP) produced Osumi pumice fall (+Tarumizu pyroclastic flow), Tsumaya pyroclastic flow, Kamewarizaka breccia, and Ito pyroclastic flow (+ AT ash). In this study, we focus on bubbles in the ejecta because the vesiculation of magma is a driving force of magma ascent and it is expected that vesicular textures reflect the condition in the magma chamber and in the conduit. The aim of this study is to quantitatively describe the vesicle textures in Osumi pumice fall from Aira caldera forming eruption.
We sampled Osumi pumice fall in Tarumizu, Kagoshima, where the deposits are inclined to the ground, showing a typical mantle bedding structure. Samples were basically taken horizontally by intervals of 50 cm from the lower boundary to the welded part of Ata pyroclastic flow in the total horizontal length of the deposits of 850 cm (totally 18 layers), separately for characteristic two fine grain-rich thin layers (fine 1 and fine 2). Near the upper boundary to the Tarumizu pyroclastic flow, samples were taken vertically by intervals of 30 cm (3 layers).
We selected 8 layers by the equal interval (0 cm, 150 cm, fine1, 300 cm, 450 cm, 600 cm, fine2, 750 cm, +30 cm and +90 cm) and two fine-rich layers for the analysis of grain size distribution by using sieves($-5 \leqq \Phi \leqq 1$). For bulk density measurements, we selected ten pumices with size range 8~16 mm for each layer (4 pumices for fine 1). The bulk density measurements were conducted by using 3D laser scanner DAVID (3D model construction software) and Hira 3D viewer (calculation software of bulk volume). For the textual analysis, we made 8 chips (each chip includes 2 pumices (maximum and minimum bulk densities)) for 8 layers. We observed vesicle textures by SEM (HITACHI TM3030Plus:15keV). After image processing, we conducted vesicle textual analyses and phenocrysts area measurements by imageJ software.
The bulk density of 10 layers ranges from 0.46 to 1.18 g/cm^3 (maximum difference of 0.6 g/cm^3 at 300 cm layer, minimum difference of 0.2 g/cm^3 at fine 2 layer). We define a bubble with an area of 0.01 mm^2 or more as a pheno-bubble and a bubble with an area less than 0.01 mm^2 as a matrix-bubble. Matrix-bubbles had three characteristic textures: 1. Single spherical bubbles, 2. Elongated bubbles, 3. Connected bubbles. The vesicularity of 8 layers ranges from 64.8 to 92.7 %. There is a correlation between pheno-bubble abundance and bulk density but no correlation between amount of phenocrysts and bulk density.
The presence of elongated bubbles indicates that bubbles experience a sort of deformation. Connected bubbles in small scale suggest that pheno-bubbles increase their sizes by the coalescence process of bubbles. The correlation between pheno-bubble abundance and bulk density suggests that bulk density is determined by pheno-bubbles. The differences in bulk density in one layer can be thought to result from the differences in pheno-bubble abundance. If pheno-bubbles are the relic of bubbles in the magma chamber before eruption, it is expected that pheno-bubbles heterogeneously distribute by spatial scales of several millimeters in the magma chamber, which triggered the eruption.

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