論　説

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安山岩質降下軽石と溶岩流の結晶破砕度

―浅間火山と桜島火山の噴出物の場合―

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Degrees of Fragmentation of Crystals Contained in Andesitic Pumice Fall Deposits and Lava Flows: Case Study of the Eruptive Products of Asama Volcano and Sakurajima Volcano

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Broken crystals are often contained in the eruptive products of explosive and nonexplosive eruptions. Although little is known of the actual mechanism of crystal fragmentation, the broken crystal itself is useful for understanding phenomena in the course from magma ascent to eruption. In order to describe the nature of broken crystals, the degrees of fragmentation of plagioclase (referred to as “b/a value”, hereafter) were measured in this study. The b/a values were obtained by dividing the length of a broken surface (b) by the circumference of the crystal (a) on the thin section. Plagioclase contained in the following lava flows and pumice fall deposits of Sakurajima Volcano and Asama Volcano were measured. In the case of the 1783 Asama eruption, the activity culminated to its climactic, pyroclastic eruption that generated Plinian pumice falls and clastogenic lava flows and formed a pyroclastic cone after the intermittent Vulcanian eruptions for about three months. The 1914−1915 Sakurajima eruption progressed from the initial vigorous pyroclastic eruption (Stage 1) via lava flowage with intermittent Vulcanian eruptions (Stage 2) to the long-lasting, gentle outflow of lava (Stage 3). The eruptive style of Stage 1 is similar to that of the climactic stage of the Asama 1783 eruption. The eruptive style of the 1946 Sakurajima eruption was similar to that of Stage 2. Concerning the pumice fall deposits, crystals in a single pumice clast and free crystals of various grain sizes were measured. Multiple timings and fields of crystal fragmentation are indicated from the following results. In the case of Stage 3 of the Sakurajima 1914−1915 eruption, a small amount of plagioclase shows smaller b/a values suggesting that a small amount of poorly fragmented crystals was produced prior to the eruption. In this case, crystal breakage related to melt inclusions foaming during the decompression of ascending magma and to shear-induced fragmentation of ascending magma near the conduit wall are instanced as the possible mechanism. In the cases of Stage 2 and the 1946 eruption, b/a values are higher than that in Stage 3. Crystal fragmentation within the conduit could occur, probably due to shock by repetitive Vulcanian explosions. In the cases of Stage 1 of the Sakurajima 1914−1915 eruption and the climactic stage of the Asama 1783 eruption, average b/a values increased in the order of crystals in pumice clast, free crystals, and crystals in lava. Free crystals consisting of broken surfaces without glass coating and crystal faces covered by vesicular glass are dominant. It is considered that the abundant broken free crystals are produced by magma fragmentation and then by quenching of erupting pyroclastic materials in the eruptive column. Additional fragmentation during flowage can be considered within the clastogenic lava flows.

Key words: broken crystal, fragmentation, pumice, free crystal, lava

1. はじめに

火山噴出物にはしばしば破片状の結晶が含まれる（例えば Ross and Smith, 1961）．破片状結晶は，降下軽石堆積物のような著しいマグマの発泡・破砕を伴う火砕噴火の産物に多く含まれるが（安井・菅沼，2003），溶岩にも様々な含有量で含まれることがわかってきた（安井，

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