

Reconstruction of stratigraphy and time-series variation in composition of ejecta of the An'ei eruption, Izu-Oshima

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In Izu-Oshima, a large-scale eruption that is referred to as the An'ei eruption began in 1777 and lasted for 15 years. Lava flows were effused, and several hundreds of million tons of scoria and ash were ejected in this eruption (Koyama and Hayakawa, 1996). It is considered that the An'ei eruption began with the ejection of scoria (basal scoria), effused lava flows in the middle stage, and ceased after the ash ejection of several years based on geological surveys and analyses of historical records (Isshiki, 1984; Nakamura, 1964; Tsukui et al, 2009). Although the outline of this eruption has been unveiled, lava flows occurred several times to various directions and the base scoria is distributed extensively, so the variation of eruption style and sequence and their relations to the deposits are not studied in detail yet. It gradually becomes clear in this study that the proportion of phenocrysts of basal scoria is different by its stratigraphic level.

We carried out field surveys in Izu-Oshima, and it was proved that the basal scoria layer can be divided into major two units: the lower basal scoria unit (Unit A) that is poor in plagioclase phenocrysts (PI) and the upper basal scoria unit (Unit B) that is richer in PI than Unit A. Although the scoria of Unit A (A-scoria) is widespread except the western part of the island, the scoria of Unit B (B-scoria) lies only on the eastern narrow area of the island. We conclude from these observations that the plume dynamics was different between the two eruption stages. The proportion of PI in the basal scoria which contacts with lava is the key to reveal the chronological order between the basal scoria layer and lava flows.

We also conducted whole-rock analyses of A- and B-scoria and lavas of the An'ei eruption. The results of these analyses follow the plagioclase-control trend indicated by Nakano and Yamamoto (1991), and B-scoria is most abundant in Al_2O_3 . Lavas contain less Al_2O_3 than the scoria of both units, and Al_2O_3 content of A-scoria is intermediate between B-scoria and lavas. It is noteworthy that the lowermost part of Unit A is the poorest in PI and the lowest in Al_2O_3 , and similar to lava flows. As the magma erupting from the summit crater is generally rich in PI as a result of flotation and concentration of PI in magma chamber (Aramaki and Fujii, 1988), it is expected that the magma most abundant in PI erupts in the early stage of eruption. Field observations and compositional analyses suggest that PI-poor magma was discharged in the beginning and PI-rich magma erupted after that, although the basal scoria of the An'ei eruption is considered to have been ejected from the summit crater.

We analyzed plagioclase by EPMA. Regarding the basal scoria, the anorthite value of PI in A-scoria is higher than B-scoria. The anorthite value of PI in lavas is almost the same as A-scoria. The matrices of lavas and A-scoria contain a lot of microlites of plagioclase. It is notable that Unit A also contains scoria that is poor in microlites. Based on these results, the products of the An'ei eruption have different petrological features for each unit. It is suspicious if the magma process of the An'ei eruption is explained only by concentration of PI in single magma chamber. Magma ascent process might be also different for each eruptive phase. It is a future issue to reveal why such compositional and textural differences occurred.

Keywords: Izu-Oshima, An'ei eruption, stratigraphy, compositional variation