

Magma Evolution of Izu-Oshima Volcano for the Past 40,000 Years

Yuko Okayama[1]; Setsuya Nakada[2]

[1] Earth & Planetary Sci., Univ. of Tokyo; [2] ERI, Univ. Tokyo

Izu-Oshima Volcano is located in the northernmost part of the Izu arc. Many petrological studies were carried out for the Izu-Oshima volcanic rocks exposed at the surface, especially for the ejecta of the 1986 eruption. However, the investigation for magma evolution throughout the history of the volcano was impossible, because the exposed rocks are limited mainly to recent rocks and determination of age of eruption was difficult. In this study, cores and slimes (cuttings) of the drill hole within the summit caldera (WIC site) were used to understand the petrological evolution of magma for past 40 thousand years. The drilling hole penetrated into the base of the volcano and samples of the Izu-Oshima volcanic rocks were recovered successively from the Senzu Group (SZG), the Older and Younger Oshima Groups (OOG and YOG, respectively).

Mineral (phenocryst) compositions of the Izu-Oshima volcanic rocks consist of dominant plagioclase and minor pyroxene, olivine, and magnetite. Accumulation of plagioclase phenocrysts in the 1986 eruption products has been proposed by previous investigators (e.g. Fujii et al., 1988). The idea was also supported in this work by chemical comparison between the bulk and the groundmass. Plagioclase phenocrysts of SZG and OOG involve the dusty type whose existence suggests the mixing of magmas of different compositions. Since the volcanic rocks construct linear trend in the Y/K vs Zr/K plot, common occurrence of magma mixing can be proposed. The average An content of plagioclase phenocrysts cores and the Zr/K ratio were examined as indicators of fractionation and mixing.

Zr/K ratios, which are not modified by fraction of phenocrysts minerals but by magma mixing, are distinctly different among three geological groups; Zr/K is variable in the SZG, variable in the lower OOG and low in the upper OOG, and low in the YOG. The average An contents were remarkably variable in the YOG, and in other two groups An-rich is abundant and the lower An is few. Assuming magma containing plagioclase phenocrysts with the An-rich cores are least differentiated, variable Zr/K ratios in the least differentiated lavas can be explained by mixing of two endmember magmas with different Zr/K ratios. The chemical characteristics observed above can be explained only by the existence of these two endmember magmas throughout most of the 40 thousand history of Izu-Oshima Volcano.

In the early stage of Izu-Oshima, mixing of low and high Zr/K parental magmas was repeated, being associated with additional fractionation from the mixed magma. In the later stage, fractionation from low Zr/K parental magma occurred, and magma derived from or mixed with high Zr/K parental magma was not erupted. The ejecta of the 1986 eruption are also the products fractionated from low Zr/K parental magma.