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先小御岳火山のマグマの分化にかかわるザクロ石・角閃石の分別作用
Garnet-amphibole fractionation generating basalt to dacite magmas of Pre-Komitake volcano, Japan

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The Pre-Komitake volcano, which was discovered by scientific drilling into Mt. Fuji, is an older volcanic body than Fuji and Komitake volcanoes buried beneath the NE flank of Fuji volcano (Nakada et al., 2004; Yoshimoto et al., 2010). The Fuji, Komitake, and Pre-Komitake volcanoes are situated in a complex tectonic setting near the junction of three plates: the North American Plate in the east, the Eurasian Plate in the west, and the Philippine Sea Plate in the south, under two of which the Pacific Plate subducts from east to west. The magmas of Pre-Komitake are different from those of Fuji and Komitake (Yoshimoto et al., 2010). According to Yoshimoto et al. (2010), the Pre-Komitake lavas are characterized by hornblende-bearing andesites and dacites, in contrast to the hornblende-free basaltic rocks of Fuji and Komitake. These authors also suggested that the concentrations of incompatible elements increase with increasing SiO_2 in the magmas of Pre-Komitake, whereas those of Fuji increase despite SiO_2 remaining fairly constant (Fujii, 2007). They suggested that the variations in magma chemistry in this area between 250 ka and recent times might have occurred as a result of a change in regional tectonics that occurred ˜150 ka, although this remains unproven. To our knowledge, no detailed research has yet been carried out into Pre-Komitake magma genesis on the basis of comprehensive major and trace elements, and isotopic compositional data sets. Therefore, we analyzed the trace element and Sr-Nd isotopic compositions of the Pre-Komitake magmas in order to better understand their genesis.

The Sr and Nd isotope ratios ranged from 0.703320?0.703476, and 0.512885?0.513087, respectively, which are very similar to those of the lavas from Fuji and Komitake volcanoes (Nagai et al., 2004) that erupted subsequently. Enrichment of large ion lithophile elements, Pb and Sr, can be seen in the primitive mantle-normalized multi-element diagram of the Pre-Komitake, Komitake, and Fuji lavas. These collectively show island arc lava signatures, however, the middle to heavy rare earth elements are more depleted in the Pre-Komitake lavas, compared to those from Fuji. Positive Eu anomalies are observed, although the extents of these anomalies decrease with increasing SiO_2 in the Pre-Komitake lavas, whereas this is not observed in Fuji lavas. The Sr/Y ratios of Pre-Komitake lavas increase from basalt to basaltic andesite, but decreases through andesite to dacite. This occurs in combination with a rapid increase in La/Yb ratios, followed by a more gradual increase. A gradual decrease in Dy/Yb ratios is also seen over the entire compositional range. These data suggest deep ($>$12 kbar) fractionation of garnet and amphibole followed by shallow (i.e., ˜5 kbar) fractionation of amphibole and plagioclase. Such variations are not observed in the Komitake and Fuji lavas, for which deep fractionation of clinopyroxene and shallow fractionation of plagioclase have been suggested. All three lavas, including those from the Pre-Komitake volcano, show similar isotopic, major, and trace element compositions in the unfractionated basalts. The differing geochemical trends found in the Pre-Komitake lavas are likely to be due to different mineral fractionations occurring in the hydrous Pre-Komitake basalts compared to the dry Fuji and Komitake basalts.

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