Genesis of the low-Sr Granitoid in the northern Kyushu

*Yayoi Muraoka[1], Masaaki Owada[2], Teruyoshi Imaoka[2], Atsushi Kamei[3], Kazuhiro Miyazaki[1]

1. Advanced Industrial Science and Technology, 2. Yamaguchi Univ., 3. Shimane Univ.

The Cretaceous granitoids are widely exposed on the northern Kyushu, Southwest Japan. These granitoids were distinguished between the low-Sr and high-Sr granitoids by their Sr contents (Izawa et al., 1990). The boundary of these is the Kokura-Tagawa Tectonic Line (KTT). In the east side of KTT, the low-Sr granitoids are distributed. On the other hand, the high-Sr granitoids are exposed on the west side of KTT. The Hirao granodiorite and related granite dike are exposed on the east side of KTT. The Hirao granodiorite occurs as a stock with 16 km N-S and 4 km E-W, and has Sr contents of 213-291 ppm. In this study, the authors discussed the magmatic processes of the Hirao granodiorite and petrogenesis of the low-Sr granitoids by comparing the Ushikiri-yama granodiorite (high-Sr granitoid, details reported by Eshima et al., 2019).

The Hirao granodiorite and the granite dike have similar mineral assemblage, consisting mainly of plagioclase, quartz, K-feldspar, biotite and hornblende. In addition, the granodiorite and the granite dike geochemically resemble each other; for instance, their REE patterns and Sr-Nd isotopic values. The result of mass balance calculation reveals that the granite dike magma can be formed by subtraction of plagioclase and hornblende from the Hirao granodiorite magma.

The different Sr contents between the high- and low-Sr granitoids in this region can be explained by the following magmatic processes; magma mixing, assimilation of host rock, degree of fractional crystallization or partial melting, and composition of source materials. The magma mixing and assimilation of the host rocks were ruled out in terms of field occurrence. The geochemical study including trace elements and Sr-Nd isotopic compositions revealed that the Hirao granodiorite and the Ushikiri-yama granodiorite were shared with similarity source materials. Moreover, the magmatic processes of the both granodiorite were similar regarding the degree of fractionation and partial melting. Considering geochemical characteristics combined with melting experiments, the Hirao granodiorite representative of the low-Sr granitoid magma can be produced by relatively low-pressure melting rather than the high-Sr granitoid; thereby, leaving plagioclase as the residual phase at the source region.

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