

Rapid emplacement of granitic magma and formation of upper crust, Cretaceous Hirao granodiorite, North Kyushu, SW Japan

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Cretaceous to Paleogene granitic rocks are widely exposed on the eastern margin of Asian continent. The northern part of Kyushu, Southwest Japan, is underlain by the Cretaceous plutonic and volcanic rocks. The granitic rocks exposed on the eastern part of north Kyushu emplaced into the shallower level of crust accompanied by coeval volcanic rocks. The Hirao granodiorite located in the eastern part of north Kyushu contains magmatic epidote. The magmatic epidote is known that the crystallization is of deeper than middle crust conditions. Sial et al. (2008) reported constraints on depth of emplacement and ascension rate of epidote-bearing magmas. In this study, the author discusses the emplacement process of the Hirao granodiorite magma.

The Hirao granodiorite occurs as a stock with 16 km N-S × 4 km E-W. The granodiorite consists mainly of plagioclase, quartz, K-feldspar, biotite and hornblende with small amounts of epidote. Epidote grains almost show subhedral shapes. In addition, the granodiorite dike occurs in the study area. The granodiorite dike also has mineral assemblage similar to that of the stock.

SiO₂ contents of the Hirao granodiorite range from 62 to 67 wt.%, and increase with decreasing modal values of hornblende. In Sr-Y diagram, the bulk chemical trend can be explained by crystallization of hornblende from parental granodiorite magma. The granodiorite dike shows more evolved compositions with fractionation of plagioclase in addition to hornblende.

Inferred emplacement P-T conditions are of 0.2-0.4 GPa and 650-700 degrees. These conditions are consistent with contact metamorphic P-T conditions of the Tagawa metamorphic rocks, which are undergone by thermal effect of the Hirao granodiorite magma. These pressure conditions correspond to 6-9 km depth equivalent to upper crust.

Epidote grains in the Hirao granodiorite show subhedral shapes with corrosion texture. It means that the epidote underwent corrosion through rapid ascending after crystallized from deeper part of crust. Such rapid ascending system would be caused by a dike (Sial et al., 2008). Therefore, the Hirao granodiorite magma is considered to crystallize epidotes at the deeper part of crust, and emplaced into the upper crust by rapid ascending along the dike.

Keywords: North Kyushu, Granitoids, Magmatic epidote