Compositional relationship of olivine-spinel pairs during supercooling: an example of the basaltic magmas from Daisen Volcano

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Relatively undifferentiated basaltic magmas are distributed in Daisen Volcano, Southwest Japan. These basalts contain olivine phenocrysts with tiny chromian spinel inclusions. Two types of magmas are recognized in the Daisen basalts from chemical relationship between the host basalts and olivine phenocrysts (Tamura et al, 2000). One type is characterized by equilibrium chemical relationship, which was formed by equilibrium crystal fractionation from a primary magma. The other type of magmas has disequilibrium relationship and contains olivine phenocrysts which are characterized by iron-rich composition and skeletal morphology. These magmas were produced by disequilibrium fractional crystallization during supercooling (Tamura et al., 2000). The Daisen basalts have olivine phenocrysts with wide chemical composition, which range from 89 to 66 in Fo content and from 0.41 to 0.08 wt % in NiO content. Olivine phenocrysts of the disequilibrium basalts have lower Fo contents than those of the equilibrium ones. We analyzed chemical composition of chromian spinel inclusions coexisting with olivine in the Daisen basalts. The chemical composition of the chromian spinel inclusions systematically changes between the equilibrium and disequilibrium magmas. The ferric/ferrous ratio of spinel inclusions is high in the disequilibrium magmas relative to that of the equilibrium ones. In this study, we will discuss chemical change of chromian spinel and olivine affected by supercooling during crystal fractionation.