

SVC051-03

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Chrome-spinel inclusions in olivine and plagioclase as a marker of phenocrysts in a differentiating magma system

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Crystal accumulation is an important process in magmatic differentiation. Although whether cumulus crystals were *intratelluric* phenocrysts or *newly-formed* crystals after magma emplacement is an important issue concerning mechanisms of magmatic differentiation, there has been no effective criteria for the judgement. We demonstrate, from a study of the Murotomisaki Gabbroic Intrusion, that Cr-spinel inclusions in silicates may be used as a useful marker to identify the intratelluric phenocrysts and also as a tracer to study the crystal redistribution in a differentiating magma body.

The Murotomisaki Gabbro is a sill-like layered mafic intrusion (~200 m thick) emplaced in Tertiary sediments in Shikoku, Japan. Several olivine-rich zones have been identified in a lower 100-m zone. Olivine and plagioclase phenocrysts in the chilled margin commonly contain tiny Cr-spinel inclusions, which are uniform in composition regardless of kind of the host mineral. Cr-spinels occur as olivine- or plagioclase-hosted inclusions in the lower 40-m cumulates (AC subzone), while there are no Cr-spinel crystals in the overlying cumulates (40-100 m; GR subzone). In the AC subzone, Cr-spinel contains more Fe³⁺ than that in the chilled margin. This tendency is more pronounced in olivine-hosted inclusions than in plagioclase-hosted ones. Within olivine crystals, closer the crystal margin, the more modified are the compositions of the spinel inclusions. From the above observations, we infer that all olivine- and plagioclase-hosted Cr-spinel inclusions from the AC subzone are originally of the same in compositions as those from the chilled margin, but their compositions have been modified in situ during solidification of magmas by diffusional exchange with the residual melt through the host minerals.

Keywords: crystal settling, intratelluric phenocryst, magmatic differentiation, Cr-spinel, diffusion, Murotomisaki Gabbroic Intrusion