

The Murotomisaki layered gabbroic complex, Shikoku Japan - olivine crystal settling vs crystal growth

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The Murotomisaki gabbroic complex, Shikoku, Japan, is a layered intrusion (maximum thickness 230 meter) emplaced in the Moroto Formation (Shimanto Group) about 15 Ma. The rocks mostly composed of olivine, augite and plagioclase and display diversitied lithology, which was produced by crystallization differentiation in the gravity field (Yajima, 1972). In particular the picrite gabbro about 20 meter above the bottom was formed by crystal accumulation by the gravity settling of olivine crystals and the rate of accumulation has been estimated (Akatsuka, Obata and Yokose, 1999). However, another olivine enrichment is observed 50 to 60 meter further above (the medium-grained pictitic gabbro) and also in the uppermost horizon just about 10 meter below from the top (the upper picrite gabbro). It has been left uncertain if the olivine crystal enrichment was brought about my means of the crystal settling-enrichment at these horizons as well.

In order to re-examine the differentiation processes, we measured the size and the number densities of the olivine crystals using the collection of Akatsuka et al 1999. It was found out that crystal number density is increased, starting from the initial condition preserved in the chilled marginal dolerite, in the lower picrite gabbro but that it is decreased in the medium-grained picrite gabbro above. We therefore conclude that the olivine enrichment observed in the the medium-grained picrite gabbro was not caused by the crystal settling-accumulation processes but probably occurs by means of element migration as chemical species coupled with the crystal growth of olivine. The enrichment of the olivine component probably occurred by means of the element diffusion through the melt phase or by means of mass transport by fluid flow either by the magma convection or by the permeable flow of interstitial melts through grain boundaries or both.