

Compositional layering of the Higashi-akaishi peridotite body in Sanbagawa belt -A record of fractional crystallization-

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The Higashi-akaishi peridotite body (HA) in the Sanbagawa belt, Shikoku Besshi area, southwest Japan. The body, represents a rare example of hanging wall peridotite exhumed from the deeper part of oceanic-type subduction zone. The HA is mainly composed of dunite with a small amount of clinopyroxene (CPX)-bearing and garnet-bearing rocks. At present, two ideas are proposed for the origin of the body: (1) a cumulate body formed from a basaltic magma, (2) a complex of CPX-rich cumulate and residual dunite. These ideas are mainly based on mineral chemistry and bulk rock composition and are not correlated with detailed observation of lithological variation, that is important to distinguish a primitive cumulate from a depleted source mantle.

In this study, we described a 300 m-thick section of the compositional layering in the central part of the HA. Lithology is varied in a centimeter to 10 meter scale showing a CPX-increasing trend (dunite → wehrlite → olivine-clinopyroxenite). The trend directs towards a 60 m-thick lens of garnet clinopyroxenite to form a symmetric structure. Dunite is thicker at the part of the sequence below the garnet clinopyroxenite lens. Mineral chemistry at the igneous stage is calculated, considering element partitioning due to serpentinization and low-temperature re-equilibration. It shows systematic variations in accord with the modal ratio between olivine (OL) and CPX. The Fo (93 to 82) and NiO contents (0.33 to 0.1 wt%) of OL decrease with the CPX-increasing trend. The variations of mineral chemistry and the modal composition can be explained by fractional crystallization of CPX following OL and spinel. Difference in modal proportion between the upper and lower sides of garnet clinopyroxenite suggests crystallization from a sill-like body although the original thickness has been modified by the later deformation. Existence of dunite forming a part of layered sequences is inconsistent with the recent discrimination that dunite is residual and the others are cumulate.

Keywords: fractional crystallization, layered structure, subduction zone, peridotite