

Petrogenesis of olivine-clinopyroxene rocks: an example from the Takashima xenolith suite, northern Kyushu

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Olivine-clinopyroxene rocks (dunite, wehrlite, olivine clinopyroxenite and clinopyroxenite) very frequently occur as ultramafic xenoliths in volcanics and as plutonic rocks in ophiolites. Dunites and olivine-clinopyroxenites can be formed by cumulates during fractional crystallization, but wehrlites, intermediate in mode and very frequently observed, cannot be formed in the same work. Olivine-clinopyroxene rocks containing green clinopyroxene from the Takashima xenolith suite, northern Kyushu, show a gradual variation ratio of olivine to clinopyroxene from dunite to clinopyroxenite. The olivine-clinopyroxene rocks from Takashima are examined to understand their formation processes. They have recrystallization textures formed at subsolidus conditions, leading to change of Mg# ($=\text{Mg} / (\text{Mg} + \text{total Fe})$ atomic ratio) of olivine and clinopyroxene. Based on compositions and modal amounts of olivine and clinopyroxene from high temperature magmatic values, the igneous Mg# of olivine and clinopyroxene is recalculated to be 0.927-0.902 for dunites, 0.869-0.854 for wehrlites, and 0.886-0.876 for clinopyroxenites. Relationships between the Fo content and the NiO content of olivine and the Cr/(Al+Cr) atomic ratio of spinel suggest that these rocks were basically formed by crystal accumulation in fractional crystallization. The Takashima dunites and clinopyroxenites are cumulates by fractional crystallization. Intermediate wehrlites are a mixture of accumulated crystals of olivine with high Mg#s and olivine-clinopyroxene precipitated crystals with lower Mg#s from evolving intercumulus melt. These crystals were homogenized structurally and compositionally through subsolidus recrystallization.

Keywords: olivine-clinopyroxene rocks, wehrlite, fractional crystallization, intercumulus melt, Takashima xenolith suite