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Olivine megacrysts in the Horoman Peridotite Complex, Hokkaido, northern Japan

MINAMIYAMA, Akari[1*] ; SODA, Yusuke[1] ; HAMADA, Morihisa[2] ; MORISHITA, Tomoaki[1]

[1]Kanazawa University, [2]Japan Agency for Marine-Earth Science and Technology

Mineral grain size in the upper mantle affects many geological processes, such as mantle flow, fluid/melt migration and so on. Olivine grain size in the upper mantle conditions is generally less than 1 cm (Ave Lallemant et al, 1980; Karato, 2011). However, olivine, which is larger than 1 cm in grain size (olivine megacryst hereafter), often occurs in peridotites. Therefore, understanding of the characteristic of olivine megacrysts is crucial to investigate a possibility of the formation of megacrysts in the upper mantle conditions. In this study, peridotite samples with olivine magacrysts from the Horoman peridotite complex, Japan, are studied by crystallographic orientation analysis, FT-IR analysis, EPMA. Especially, we focused on the change of crystal and subgrain boundary orientation by deformation

Peridotite samples are from MHL (Main Harzburgite-Lherzolite) suite of Takahashi (1991) in the Lower Zone of the Horoman peridotite complex (Niida, 1984). Olivine magacryst, which is often darker in color than fine-grained olivines, occurs subparallels to the foliation. Fine-grained layer shows porphyroclastic texture. Olivine megacryst and porphyroclast olivine in the fine-grained layer develop subgrain boundaries and include lamellae of chromian spinel, clinopyroxene and amphibole.

Slip systems of olivine [001](100) and [100](001) are estimated observed in the central part and the edge of olivine megacryst, respectively, based on the U-stage measurements of subgrain boundaries and crystal orientations. Olivines in fine-grained layers show A-type fabric resulting from the dominance of [100](010) slip system (Jung et al., 2006). Crystal orientation of fine-grained olivines near megacryst show transitional characteristics in olivine fabric between the megacryst and the fine grains.

Structural hydroxyl species are not observed by FTIR in both olivine megacryst and olivine grains in fine-grained layer. There are no differences in the Fo content and NiO wt% between olivine megacryst and fine grains by EPMA.

Presence of amphibole lamellae in olivine megacryst suggest that olivine megacryst had existed under wet condition. Fine-grained olivine fabrics near megacryst and slip system of olivine megacryst edge suggest that olivine megacryst had existed when A-type fabric of olivines forms in fine-grained layer. A-type fabric peridotite was reported in the Horoman peridotite complex and interpreted that the A-type fabric formed during uplifting of the Horoman peridotite complex from the upper mantle to the crust (Sawaguchi, 2004).

Consequently, olivine megacryst had existed under water-rich condition in the upper mantle followed by A-type fabric formation in the fine-grained layers during uplifting of the Horoman peridotite complex from the upper mantle.

Keywords: olivine megacrysts, Horoman peridotite, CPO