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Spatial compositional variability and origin of dunites in the Fizh mantle section, the Oman ophiolite

Anna Suetake[1*], Eiichi Takazawa[2]

[1]Grad School of Sci & Tech, Niigata Univ., [2]Faculty of Science, Niigata Univ.

This study aims to clarify temporal and spatial variability in microstructure and mineral compositions of dunites as functions of depth from the Moho and of position at paleo-ridge segmentation in the Fizh mantle section, the northern Oman ophiolite. In the south of Fizh crust section Miyashita et al. (2003) detected paleo-ridge center while the end of a paleo-ridge segment located in the north. Kanke and Takazawa (2006) reported a highly depleted zone in the northern part of Fizh block where harzburgites with spinel Cr# (=100xCr/[Cr+Al] mol%) greater than 70 frequently occur. Murakami et al. (2008) considered that the highly depleted zone formed by remelting of residual harzburgites due to a melt ascent through the distal segment end. This study reports an evidence for comprehensive met migration in the Fizh mantle section at island arc stage on the basis of mineral compositions of dunites.

It is well known that spinel with Cr# greater than 65 has never been reported from abyssal peridotites and only occurs in the island arc environment (Arai, 1984). We found dunites with spinel Cr# greater than 70 widely distribute in the vicinity of the basal thrust. However, harzburgite in this region contains spinels with Cr# around 50-60 that is the upper bound of compositional range for spinel in abyssal peridotites. We consider that a large amount of melt migrated in the vicinity of ridge segment end and influenced the compositions of host harzburgites. On the other hand, in the southern Fizh block, i.e., the center of ridge segment, melt migration was restricted to the dunite channels without significant influence on host harzburgites.

In the Fizh mantle section, three kinds of microstructures are observed for dunites such as coarse granular microstructure, fine granular microstructure, tabular granular microstructure. The spatial distribution of these microstructures corresponds to those of harzburgite such as coarse granular microstructure, mylonitic microstructure and porphyroclastic microstructure, respectively. It indicates that the dunites have suffered similar deformation processes along with host harzburgites. It is noted that some dunites with coarse granular microstructure are distributed in the region where harzburgites with porphyroclastic microstructure occur. We infer that these dunites have formed after deformation of host harzburgite. Because of their spinels with high Cr# we consider that these dunites formed in the island arc environment.

Keywords: Oman, dunite, mantle section, peridotite, spinel, ophiolite