Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SIT05-P10 Room:Convention Hall Time:May 21 18:15-19:30

Olivine crystal fabric variations in the Hilti mantle section, Oman ophiolite

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The purpose of this study is to investigate macroscopic structure of ocean lithospheric mantle by structural analyses of the Hilti mantle section in Oman ophiolite that is the largest ophiolite in the world located in the easternmost end of Arabian Peninsula. Coarse granular harzburgites were measured crystal-preferred orientations (CPO) and chemical compositions of their constituent minerals. Olivine grain sizes within the harzburgites range from coarser grains (>3mm) to medium grains (~1mm) and show undulose extinctions as well as kink bands. Orthopyroxene grains have exsolution lamellae. Olivine CPOs of all samples are a-axis girdle type (i.e. AG type) that are characterized by intense [010] maxima normal to the foliation with both [100] and [001] forming weak girdle distributions sub-parallel to the foliation. Chemical compositions of spinel, olivine and orthopyroxene were measured in the three samples (99OK163, 99OK164, 99OK165), which were located at the different distances from the mantle-crust boundary. The Cr/(Cr+Al) number (Cr#) of spinel is 0.5~0.6. The Mg/(Mg+Fe) number (Mg#) of olivine is 0.91~0.92. The chemical compositions show that they are residual peridotites of the mantle origin. Furthermore, spinel Cr# shows that they are abyssal peridotite. It is suggested that the peridotite samples in this study have been derived from the ocean lithosphere formed in the mid-ocean ridge. The olivine CPOs in the Hilti mantle section are dominated by AG type, whereas A type is rather minor. These results may indicate that the olivine CPO could be dominantly AG type rather than A type in the ocean lithosphere. It was shown by an experimental study that olivine CPO appears to change from A type to AG type where olivine grains are influenced by melt. Consequently, the development of AG type observed in this study could be related to the occurrence of melt beneath the mid-ocean ridge.

Keywords: Oman, harzburgite, Crystallographic fabric, ocean lithosphere