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Genetic link between basal lherzolites and gabbro of the northern Fitz massif, the Oman ophiolite

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Genetic link between basal lherzolites and up-section gabbro of the northern Fitz massif, the Oman ophiolite

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Ophiolite has been interpreted as a fragment of oceanic lithosphere emplaced onto the surface (e.g. Dietz, 1963, GSA Bul.). Numerous studies on ophiolites have been done to understand the structure and formation process of the oceanic lithosphere, because it is difficult to make direct observation on it in detail.

It is widely recognized that magmatism formed the oceanic crust, of which structure is different in accordance with the spreading rate of the axis. Our understanding about the oceanic lithosphere of fast spreading ridge origin has been built, however, mainly on the basis of data from Hess Deep, EPR (e.g. Miyashita and Maeda, 2003, J. Geol.). Therefore, some ophiolites, such as Oman ophiolite, considered to be a fragment of oceanic lithosphere from a fast spreading ridge provide valuable information on its structure and magmatic processes.

It was a simple and important question whether or not there is a genetic relationship between crustal rocks and underlying upper mantle peridotites in ophiolites. McCulloch et al. (1981, JGR) observed a genetic link between the crustal and upper mantle rocks based on the data of harzburgite that plotted on a mineral-whole rock Sm-Nd isochron of gabbroic rocks in the Ibra block, southern Oman. In the case of the Trinity ophiolite, accumulation of Sr-Nd isotopic and trace element data of clinopyroxenes required a more complex process; that is, the older lithospheric mantle was interacted with various melts at each block (e.g. Guruau et al., 1995, CMP). The accumulation of Nd isotopic compositions of peridotitic clinopyroxenes from the Oman ophiolite will help our more detailed understanding for magmatic processes at fast spreading ridges.

In this study, we obtained mineral compositions, and trace elements and Sr-Nd isotopic compositions of clinopyroxenes in the basal lherzolites form the Fitz block (Takazawa et al., 2003, G3) the northern Oman ophiolite. The chondrite-normalized rare earth element (REE) patterns of the clinopyroxenes display gentle to steep slopes from heavy REE to light REE. Nd isotopic compositions of the clinopyroxenes show an extremely wide range of variations. These features are compatible with an idea of interaction between residual peridotite and MORB-like melt. The Sm-Nd isotopic data of the clinopyroxenes are plotted on the mineral-whole rock isochron of a gabbroic rock from the Fitz massif (McCulloch et al., 1980, EPSL). We suggest that the gabbro and basal lherzolites were formed within the same magmatic regime.

Keywords: Oman ophiolite, Sm-Nd isotope systematics