Distribution of ultra-depleted peridotites in the northern Fizh mantle section from the Oman ophiolite

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This study reports wide presence of highly refractory harzburgite and dunite with spinel Cr# (=100xCr/[Cr+Al]) greater than 60 in a scale of km in the northern Fizh block in the Oman ophiolite. According to Arai (1994) Cr# of spinels in abyssal peridotites are generally lower than 60. The spinels with Cr# greater than 60 have been only found in peridotites with island arc settings. The spinel with Cr# greater than 60 has already been reported from boulders in the study area by Matsukage et al. (2001). In this study we show two-dimensional distribution of such high Cr spinels.

The northern Fizh block in the Oman ophiolite has been considered as a paleo-fast-spreading ridge system associated with segment boundaries (e.g., Nicolas et al., 2000; Miyashita et al., 2003; Adachi and Miyashita, 2003; Umino et al., 2003). To understand evolution of oceanic lithospheric mantle we investigated spatial variations of mineral and whole rock compositions for peridotites collected from the mantle section of the northern Fizh block in the Oman ophiolite. The peridotites used for this study are mostly harzburgites with minor amounts of lherzolites and dunites.

Most harzburgites are strongly depleted in melt components due to high degree of partial melting and melt extraction. Km-scale patches of harzburgites with Cr# greater than 60 are widely spread in the study area. These highly refractory harzburgites seems to be present along a shear zone that penetrates the mantle section with a NW-SE direction. In the field the area with highly refractory harzburgite contains greater amount of dunites associated with a cm~m scale chromite deposits.

Peridotites with spinel Cr# greater than 60 are systematically depleted in heavy rare earth elements (HREE) and more enriched in light to middle REE than those with spinel Cr# less than 60.Chondrite-nomalized patterns of the former show a negative anomaly in Eu.

We consider that the highly refractory harzburgites in the mantle section of the northern Fizh block may have formed by a remelting of depleted uppermost mantle. The most depleted peridotites are aligned with a NW-SE trend in the studied area being consistent with the direction of low-T shear zones in the northern Fizh block. A fluid flowing along shear zone may have lowered the solidus temperature of depleted peridotite thereby causing the remelting of the lithospheric mantle. Chondrite-normalized REE patterns for highly refractory harzburgites indicates that the peridotites may have reacted with a fluid enriched in light to middle REE.