Silica enrichment and related phenomena in mantle peridotite massifs due to infiltration of slab-derived components

Tomoaki Morishita[1]; Akihiro Tamura[2]; Shoji Arai[2]

[1] FSO, Kanazawa Univ.; [2] Dept. Earth Sci., Kanazawa Univ.

http://fso.w3.kanazawa-u.ac.jp/profile_morishita.html

It is widely accepted that the continental mantle xenoliths are enriched in Opx/Olivine ratio relative to residual peridotite after simple partial melting from the primitive mantle (e.g, Boyd, 1989 EPSL 96, 15-26). In addition to the continental mantle, secondary orthopyroxene, which suggests silica addition to the mantle, is also frequently observed in subarc mantle xenoliths (Papua New Guinea, McInnes et al., 2001 EPSL 188, 169-183; Philippines, Arai et al., 2004 J. Petrol. 45, 369-389; Spain, Arai et al., 2003 Proc. Jap. Acad. 45, 369-389; Kamchatka, Ishimaru et al., 2007 J. Petrol. 48, 395-433). Silica enrichment in the mantle is probably explained by interactions between residual peridotites and silica-rich melts/fluids derived from subducting slab (e.g., Kelemen et al., 1998 EPSL 164, 387-406; Arai et al., 2003) and is therefore a key to understand the elemental fractionation via mantle/slab-derived component interactions .

Here we will introduce field and petrological observations of silica enrichment as well as related phenomena in large peridotite massifs such as mantle section of the so-called 'suprasubduction zone ophiolite' and several alpine-type peridotite massifs. Orthopyroxenite-rich lithologies are frequently observed as network to dike-like rocks in the uppermost section of the suprasubduction zone ophiolite. Some of them were formed by replacement of the preexisting olivine-rich litholgoies. Highly depleted peridotites (e.g., high-Mg, high-Cr) are usually associated with the opx-rich lithologies whereas hydrous minerals (tremolitic amphibole) were also found in opx-rich lithologies and highly depleted rocks. These features are explained by interactions between mantle and silica-rich hydrous fluids/melts, which are probably released from subducting slab. Formation of secondary orthopyroxene will result in selective storages of HFSEs relative to neighbor elements in incompatible element diagrams.