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Petrological characteristics of the mantle wedge deduced from peridotite xenoliths from arcs

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The Western Pacific provides a line of active island arcs, from Kamchatka to Philippines via Japan, a frontier of growth of the Eurasian continent. Here we would like to highlight the petrological characteristics of mantle wedge beneath the active arcs of the Western Pacific to know what is working within the sub-arc mantle. Mantle peridotite quickly changes in lithology from depleted harzburgite to fertile lherzolite from the volcanic front continent-ward. Highly depleted harzburgite comprises peridotite xenoliths from the volcanic front (i.e., Avacha, Kamchatka arc, and Iraya, Luzon arc). Both harzburgite and lherzolite are observes as xenoliths in the back-arc side of the arcs (Northeast and Southwest Japan arcs), and fertile lherzolite is predominant in the continental margin (Korea, eastern China and Sikhote-Alin). Characteristics of the mantle wedge peridotite are as follows: (1) High degree of partial melting, (2) high oxygen fugacity, (3) metasomatism by low-HFSE fluids, (4) silica enrichment, and (5) shearing. Some of the highly depleted harzburgites from the volcanic front have relatively low-Fo olivine and high-Cr# spinel, being residue of partial melting assisted by aqueous fluids. Highly oxidized peridotite frequently contains sulfides and hydrous minerals, indicating involvement of fluids (especially sulfide formation from sulfate component to liberate oxygen) (Avacha, Iraya and NE Japan). Low-Ti hydrous minerals are frequent in some peridotites from Ichinomegata (NE Japan). Silica enrichment is prevalent in the sub-front mantle peridotites, as observed as secondary orthopyroxene formation at the expense of olivine (Avacha and Iraya). The metasomatic agent is either silicate-bearing fluid or hydrous silicate melt. Shearing (formation of fine-grained peridotite) is also prevalent in the sub-front mantle (Avacha and Iraya). This is due to strike-slip movement of the mantle wedge caused by oblique subduction.