Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SMP10-P03 Room:Convention Hall Time:May 26 18:15-19:30

Mg-enrichment at retrograde stage of the Kokchetav UHPM -Pyrope-rich rim of garnet porphyroblasts from the Kulet area -

TAKEBAYASHI, Tomohiro[1*] ; SAKAMAKI, Kunihiko[1] ; OGASAWARA, Yoshihide[1]

[1]Department of Earth Sciences, Waseda University

Garnet porphyroblasts (group A) with pyrope-rich rims (as high as Prp = 68 mol%) were found in discrete subhedral to euhedral crystals (5-35 mm across) without matrices (sample no. ZW61), probably from porphyroblasts in whiteschist, from the Kulet area of the Kokchetav Massif. We also examined garnet porphyroblasts (group B) in a whiteschist (sample no. ZW42) collected from the same outcrop. In the group B, garnet porphyroblasts lack pyrope-rich rim; pyrope components in the outer parts and the margin are up to ca. 30 mol%. Pyrope components of groups A and B garnets are much higher even in the cores than those of coesite-bearing garnets from the same area by Parkinson (2000) (Prp: up to 12.37 mol% at the inner rim).

Group A garnets show strong chemical zonations of Mg and Fe from the core (Prp: 15-35 mol%, Alm: 70-67 mol%) to the rim (Prp: 35-68 mol%, Alm: 67-39 mol%). The pyrope-rich rim characterizes this group. These garnets include chloritoid (Mg/(Mg+Fe): 0.3), rutile, and corundum at the core, and Mg-chloritoid (Mg/(Mg+Fe): 0.7), rutile, chlorite, zircon, talc, and monazite at the rim.

Group B garnets in the whiteschist (ZW42) are subhedral to euhedral crystals (4-15 mm across) and show chemical zonations of Mg and Fe from the inner part (Prp: 16 mol%, Alm: 73 mol%) to the outer part (Prp: 30 mol%, Alm: 72 mol%). The lack of pyrope-rich rim in group B is strong contrast with group A. Garnet in the group B includes chloritoid, quartz, rutile, chlorite, apatite, and monazite throughout a grain. The matrix of the whiteschist (ZW42) shows lepidoblastic texture and consists of phengite, biotite, quartz, and kyanite; the mineral assemblage of the matrix is similar to that of whiteschist described by Parkinson (2000)

Pyrope-rich rim is recognized only in discrete grains (group A). In spite of no direct information about matrices for group A, the inclusion mineralogy of the garnet indicates that the protolith of group A was not rich in Mg. To explain the overgrowth of extremely pyrope-rich rim requires other factors excepting the bulk chemical composition of the protolith. In addition, the lack of pyrope-rich rim in group B garnet from the same outcrop suggests that the overgrowth process of pyrope-rich rim was strongly heterogeneous on the order of a meter. One possible cause is Mg-enrichment by aqueous fluid and its heterogeneous effect to the whiteschist from Kulet area during the retrograde stage. During Mg-enrichment in the retrograde stage, the portions strongly affected by Mg-rich fluid were altered completely except for garnet porphyroblasts and changed protolith bulk chemistry mainly in matrices to Mg-dominant chemistry. The portions not affected by Mg-enrichment kept the protolith bulk chemistry and the overgrowth of pyrope-rich rim did not occur. Later, another fluid infiltration occurred to change matrices completely; the micaceous matrices of whiteschist are the product of the later stage alteration. The matrices of already Mg-enriched portions could be easily altered during later fluid effect and weathering; so, only garnet porphyroblasts remain as discrete grains with pyrope-rich rim. The lack of pyrope-rich rim in group B means no or very weak participation of Mg-enrichment in whiteschist.

Conclusively, at least two stage fluid effects during the exhumation process could be possible for the Kulet whiteschist; the first stage means the Mg-enrichment by fluid and the second stage implies alteration of matrices to the phengitic assemblage after Mg-enrichment. As described above, the petrology based on the matrix mineralogy and the bulk chemistry only gives the retrograde stage information strongly affected by fluid infiltrations. Only garnet porphyroblasts have the information of the protolith chemistry and the metamorphic history as their chemical compositions and inclusions. There are some possibilities of misunderstanding UHPM rocks based on the matrix information.

Keywords: garnet, Kokchetav, Kulet, pyrope-rich, whiteschist, Mg-enrichment