Evidence for melt impregnation from Nikanbetsu peridotite complex

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Nikanbetsu peridotite complex, the Hidaka belt, Hokkaido, is regarded as a part of the Horoman peridotite complex, and has possibly taken a P-T path higher in temperature than the Horoman complex. Here I report lines of evidence for melt impregnation from plagioclase lherzolite in the Nikanbetsu complex.

The evidence of melt impregnation can be observed in plagioclase lherzolite with plagioclase-rich veins. The plagioclase-rich vein a size of 0.5 cm X 1 cm X several cm. The plagioclase-rich vein consists of plagioclase + orthopyroxene + olivine +/- clinopyroxene. Clinopyroxene porphyroclast, surrounded by orthopyroxene and plagioclase, is partly dissolved and replaced by orthopyroxene at the center of the grain. Rampone et al. (1997) observed a peculiar microstructure with melt impregnation in the Internal Ligurides peridotites, i.e., partial dissolution of mantle clinopyroxene and its replacement by orthopyroxene and plagioclase aggregates. Kelemen et al. (1992) interpreted that the melt formed at high pressure is oversaturated only with olivine at low pressures, and will dissolve pyroxenes through interaction with the host mantle peridotite during their ascent. The ascending melt will be modified to be orthopyroxene-saturated. Further percolation and interaction will cause dissolution of mantle clinopyroxene and precipitation of orthopyroxene (Kelemen et al., 1992). Film-like orthopyroxene occurs between olivine and plagioclase.

The partly replaced clinopyroxene has high TiO_2 concentrations (0.47~0.53wt%). Clinopyroxene in vein also has high TiO_2 (0.45~0.59wt%) and low Al_2O_3 abundances (3.80~4.18wt%). Clinopyroxene porphyroclast near the vein, which does not show replacement texture but contacts with plagioclase, also has high TiO_2 concentrations (0.36~0.63 wt%; average 0.49wt%), and clinopyroxene porphyroclast 2.5cm away from the vein, which does not contact with plagioclase, has low TiO_2 concentrations (0.24~0.42wt% ; average 0.32wt%). Orthopyroxene which surrounds clinopyroxene, has similar concentrations of Al_2O_3 to the normal porphyroclast (2.39~4.76wt%). The film-like orthopyroxene has lower Al_2O_3 concentrations (2.73~3.32wt%), and is similar in composition to the rim of orthopyroxene porphyroclast.

Clinopyroxene in vein has similar TiO_2 concentrations to the replaced clinopyroxene, which was formed by melt impregnation. In contrast, clinopyroxene far from the vein has low TiO_2 concentrations. These facts suggest that the vein was crystallized from an impregnated melt. Clinopyroxene porphyroclasts having high TiO_2 content near the vein have been chemically modified by impregnated melt. In Nikanbetsu complex, replaced clinopyroxene is rare, and only one example can be found in this study. Clinopyroxene near the vein, which does not show replaced texture, has high concentrations of TiO_2, showing an influence by impregnated melt. Moreover, small amount of clinopyroxene is crystallized in the vein. These facts suggest that the condition of the Nikanbetsu complex is not so disequilibrium between melts and host peridotites, when it is compared to the Internal Ligurides. The plagioclase lherzolite with plagioclase-rich veins can be found in five zones in the Nikanbetsu complex. Clinopyroxenes in veins and porphyroclasts from another region have higher concentration of TiO_2 (0.81~1.04wt%). There is a possibility that the chemical composition of involved melt is variable from one zone to another.