Shear localization in the Finero peridotite induced by hydration reaction

Jun-ichi Ando[1]; Ikuo Katayama[1]; Kyuichi Kanagawa[2]

[1] Earth and Planetary Systems Sci., Hiroshima Univ.; [2] Dept. Earth Sci., Chiba Univ.

Shear localization in peridotites occurs in the upper mantle as well as during their tectonic emplacement into the crust. Localized fluid infiltration and associated hydration reactions are believed to be one of the possible shear localization mechanisms in peridotites. We report here such an example from the Finero peridotite.

We found a good sample showing contrasting rheological behavior of dunite and harzburgite during metasomatism of Finero phlogopite peridotite. This peridotite shows a thin-section-scale compositional layering of dunite and harzburgite which contact directly each other. Dunite layer shows a weakly foliated protogranular microstructure. The grain size of olivine in the dunite layer is 3 to 6 mm which is larger than those in harzburgite layer. Olivine grains have straight or slightly curved grain boundaries with 120^o triple junctions. On the contrary, harzburgite layer shows porphyroclastic microstructure. Olivine, orthopyroxene and clinopyroxene grains are elongated whose axial ratios up to 3, and then have irregular grain boundaries. This layer contains planer region which composed of a very fine grains (30 to 100 um) of olivine, orthopyroxene, clinopyroxene, amphibole and phlogopite. This region is concluded as a layer formed by the reaction with infiltrating fluids and pyroxenes.

Large olivine grains in dunite and harzburgite layers develop crystallographic preferred orientations. This fact indicates that the large olivine grains are deformed by dislocation creep. On the other hand, all constituent mineral grains in the fine grains layer show completely random crystallographic orientations, suggesting that they are deformed by grain boundary sliding. Such superplastic deformation of the fine-grained polymineralic reaction products formed by localized fluid infiltration and subsequent hydration reaction likely resulted in reaction-induced localized softening and shear localization.