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Shear Localization in the Finero Peridotite Induced by Hydration Reaction

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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 [e.g. 1]. We report here such an example from the Finero peridotite.

The Finero peridotite we studied shows a thin-section-scale compositional layering of dunite, lherzolite and their interface layers. Olivine (ol) grains in the dunite layer are equigranular with 3 to 6 mm in size, while ol, orthopyroxene (opx) and clinopyroxene (cpx) grains in the lherzolite layer are dynamically recrystallized with irregular grain boundaries resulting in their size ranging from 1 to 3 mm. Both of these two layers contain mica. The interface layer is composed of equigranular fine-grained (30 to 100 μm) polymineralic aggregate of ol, opx, cpx, amphibole (amp) and mica.

Fine-grained amp and ol grains in the interface layer are formed at the expense of opx and cpx porphyroclasts, and are products of the following hydration reaction:

$$\text{opx} + \text{cpx} + H_2O = \text{amp} + \text{ol}$$

The interface layer should therefore be originally of lherzolite.

Ol grains in the dunite and lherzolite layers develop crystallographic preferred orientations such that their [100], [010] and [001] axes are preferentially oriented in the direction ≈30° anticlockwise away from the lineation, in the direction ≈30° anticlockwise away from the foliation-normal, and in the direction subparallel to the foliation and subnormal to the lineation, respectively. Subgrain boundaries are commonly developed in ol grains in these layers, and misorientations across subgrain boundaries suggest activation of {0*kl*}[100] slip system in ol. These lines of evidence indicate that ol grains in the dunite and lherzolite layers are deformed by dislocation creep.

In contrast, all constituent mineral grains in the interface layer are equigranular and 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 described above likely resulted in reaction-induced localized softening and shear localization. The estimation of *PT* history of this peridotite based on compositional zoning of pyroxenes is now in progress.

Keywords: shear localization; hydration reaction; olivine; peridotite.

References

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