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Olivine fabric transition during ductile shearing in the uppermost mantle: an example from Oman ophiolite

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A ductile shear zone across the crust-mantle boundary occurs in the Fizh massif, Oman ophiolite. The dunites in the ductile shear zone were classified into coarse granular texture, medium-grained texture, protomylonite, mylonite and ultramylonite. The average grain sizes of olivine decreased toward the shear zone, by which a high strain zone was estimated approximately 15 m. Amount of hydrous minerals (amphibole and chlorite) and spinel Cr# in the mylonites increased toward the gabbro boundary, suggesting that water infiltration into the ductile shear zone could occur from the gabbro boundary. The amphibole porphyroclasts show deformation structures, indicating that the water infiltration and subsequent water-induced metamorphic reactions occurred before or during shearing. P-T estimate and equilibrium temperatures show that the shear zone may be thought to preserve higher deformation temperature (around 900 degree C) for outside of the high strain zone and lower deformation temperatures (around 750 degree C) for inside of the high strain zone. Olivine CPO pattern evolutions indicate the following continuous deformation scenario. First, the deformation by dislocation creep at high temperature condition have formed A-type CPO or E-type CPO (more close to high strain zone). Next, the deformation by dislocation creep at low temperature and wet conditions have formed C-type CPO. Finally, superplastic deformation by grain boundary sliding at low temperature and wet conditions have occurred and formed random CPO.

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