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Deformation mechanisms of olivine single crystals compressed at 300 MPa and 800-1100°C

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Rheology of mantle rocks at lithospheric temperatures remains poorly constrained, since most experimental studies on creep mechanisms of olivine single crystals ((MgFe)2SiO4, Pbnm) and polycrystalline olivine aggregates were performed at high-temperatures (T » 1200oC). In this study, we have performed deformation experiments on oriented single crystals of San Carlos olivine and polycrystalline olivine aggregate at temperatures relevant of the uppermost mantle (ranging from 800o to 1090oC) in tri-axial compression. The experiments were carried out at a confining pressure of 300 MPa in a high-resolution gas-medium mechanical testing apparatus at various constant strain rates (from 7 × 10-6 s-1 to 1 × 10-4 s-1). Mechanical tests yield differential stresses ranging from 88 to 1076 MPa. All samples were deformed at constant displacement rate and for finite strains ranging from 4 to 23 %, to provide insight into possible effects of hardening, softening or stick-and-slip. The single crystals were compressed along several crystallographic directions to test the possibility of activating different slip systems (e.g. [100](001), [001](100), [001](010) and [100](010)). We will present the characterization of the dislocation microstructures performed in the TEM.