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Effect of pressure on the deformation fabrics of olivine

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Seismic anisotropy (SA) in Earth's upper mantle is widely observed and considered to be caused by deformation-induced to LPO of dry olivine induced by large strains during corner flow at ocean ridges. More recent work shows that flow undre high H2O fugacity induces a change in olivine LPO that explains the SA in the mantle wedge above subducting lithosperic slabs. Whether changes in olivine LPO are uinque to fH2O effects has become controversial and is critical to resolve. Here, we report low-stress, high strain, experiments on dry harzburgite (96% olivine) at T = 1300℃ and P = 2.5-3.6GPa. We show that at ~3GPa, pressure induces the same profound transition in olivine LPO that is produced by high fH2O at 1 - 2 GPa. One important consequence for global tectonics is that trench-parallel SA of the fast S-wave beneath subducting slabs in the direction of subduction rather than trench-parrellel flow as currently interpreted. The variety of olivine LPOs in both exprements and natural rocks suggest that, in addition to the pressure-induced change in olivine slip systems implied here, there are likely further changes at higher pressure and temperature.