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# Relative strength of lithospheric mantle compared to granulite lower crust in orogenic roots: insight from field laboratory.

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The continental lithosphere is composed by strong lithospheric mantle and weak lower crust for average and hot geotherms. However, some experiments and seismic studies show that the strength contrast between mantle and crust can vary in order of several magnitudes. The internal zone of the European Variscan orogen (Bohemian Massif, Czech Republic) contains large complexes of Ky - K-feldspar granulites with incorporated spinel and garnet peridotites that can respond to question of mantle-lower crust strength contrast from the field perspective. The studied spinel-garnet harzburgite body (the Mohelno peridotite) represents probably a fragment of strongly depleted oceanic lithosphere showing peak conditions of 22,4-27,6 kbar and 1120-1275°C. The peridotite forms large folded sheet with steep hinge and vertical axial plane. It exhibits presence of spinel along the outer arc and the internal part of the fold and garnet along inner arc, both related to coarse-grained orthopyroxene - olivine microstructure. This coarse microstructure is dynamically recrystallized forming fine-grained matrix (∼10 - 20 microns) and the EBSD measurements show presence of axial [100] LPO olivine pattern dominantly along the outer arc of the fold and in spinel harzburgite, while the inner arc of the fold and partly also garnet harzburgite reveals presence of axial [010] LPO pattern. Steep foliation and sub-horizontal to moderately plunging lineation determined from olivine EBSD data defines the shape of the megafold. Host rocks exhibit transposed mylonitic fabric S1-2 revealing peak conditions of 18 kbar, 800°C and heterogeneous D3 retrogression at about 10 – 7 kbar, 650°C. The foliation S2-3 is fully concordant with limbs of peridotite megafold, but close to the outer arc it is affected by asymmetrical folds with axial planar leucosomes coherent with the shape of the megafold hinge zone. In contrast, the S2 in the internal part of the megafold is affected by sinistral and dextral melt filled shear zones S3 oriented at high angle to the megafold axial plane. The mineral zoning of coarse-grained peridotite pre-mylonitic microstructure reflects probably metamorphic processes deep in the mantle and is not connected with variations in observed olivine LPO patterns in fine-grained mylonite. The LPO of olivine most likely results from strain partitioning in the intra-mantle transpressive shear zone, along which the mantle sheet was emplaced into orogenic lower crust. At this stage the granulites responded by development of mylonitic fabric S1-2 and the coherency of fabrics may indicate at least partial mechanical coupling and low rheological contrast between lower crust and mantle. The whole sequence was subsequently exhumed, folded and re-deformed at mid-crustal levels during almost orthogonal D3 event. Folding mechanism of peridotite sheet is governed by active amplification, while the flow in retrogressed and partially molten granulites was entirely passive. The folds in front of fold hinge are probably related to propagation of fold head in frontally constrained space, while shear zones in the core of megafold reflect post-buckle flattening. Our observations suggest transient evolution of the rheological contrast between mantle and crust lithologies marked by decrease of competence of partially molten crustal material in mid-crustal levels.