EGU-2020 Session GD4.1/SM4.9/TS14.3

Crust-Mantle Lithosphere-Asthenosphere Interplay, Structure, Deformation and Dynamics

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Structure and dynamics of the lithosphere-asthenosphere system is one of the key questions for understanding geological processes. Constraining the styles, mechanisms and fabrics evolution in the crust and the upper mantle come from both direct and indirect observations with the use of variety of methods. Seismological studies focusing on anisotropy have successfully improved our knowledge of deformation patterns, acting both at present as well as in the past. When combined with tomographic models, velocity anisotropy can shed light on the geometry, structure, and dynamics of deformation in the lithosphere and the asthenosphere. Sophisticated geodynamic modelling and laboratory experiments enhance our understanding of flow patterns in the upper mantle and their effects on vertical motions of the crust and the lithosphere. Combining with inferences from seismic anisotropy, these methods have the potential to reveal mechanisms that create deformation-induced features such as shape preferred orientation (SPO) and lattice-preferred orientation (LPO), which created in the past or during the last deforming processes. Structural and kinematic characterization of deformation events by geometric and kinematic analyses infer the direction and magnitude of the tectonic forces involved in driving deformation within crust and upper mantle. Additionally, both physical analogue and numerical modelling foster our understanding of complex 3D-plate interaction on various timescales, controlled through the degree of plate coupling and the rheology of the lithosphere.

However, additional work is required to better integrate various experimental and modelling techniques, and to link them with multi-scale observations. The session aims at bringing together inferences from different disciplines that focus on structure and deformation of the lithosphere and the sub-lithospheric upper mantle as well as on the dynamics and nature of the lithosphere-asthenosphere system. The main goal is to demonstrate the potential of different methods, and to share ideas of how we can collaboratively study lithosphere structure, and how the present-day fabrics of the lithosphere relates to the contemporary deformation processes and ongoing dynamics within the asthenospheric mantle. Contributions from studies employing seismic anisotropy observation, geodynamical modelling (analogue and numerical), structural geology, and mineral and rock physics are welcome.

Invited Contributions:

- Eric Debayle (Laboratoire de Geologie de Lyon-Terre, Planètes, Environnement, CNRS, France)
- Christof Völksen (Bayerische Akademie der Wissenschaften, Germany)