European LAB constrained from seismic anisotropy

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Exploiting the long memory of the fabric of the deep continental lithosphere, we define the lithosphere-asthenosphere boundary (LAB) as a boundary between a fossil anisotropy in the lithospheric mantle and an underlying seismic anisotropy related to present-day flow in the asthenosphere. We present a uniform updated model of the European LAB recalculated from data collected during our regional studies of seismic anisotropy and other tomographic experiments (Plomerová and Babuška, Lithos 2010). An analysis of static terms of teleseismic P-wave travel time deviations shows that the LAB topography is more distinct beneath the Phanerozoic part of Europe than beneath its Precambrian part and deepens down to ~220 km beneath the two Alpine roots, the South Carpathians and eastward of the Trans-European Suture Zone.

In general, there are similarities between the LAB models derived from various geophysical parameters and techniques, as well as diversities, which might reflect differences in resolution and accuracy of individual methods. On the other hand, different physical parameters can 'see' different LABs and diverse lithosphere structures. Therefore, we advocate the necessity of combining different methods and datasets, and especially 3D approaches considering both seismic anisotropy and the general orientation of symmetry axes to construct more realistic models of large-scale lithospheric structure. We propose processes which could create the observed fossil fabric of the continental lithosphere as a consequence of successive subduction and accretion of micro-continent fragments outboard of continental cratons and a gradual stabilization of the LAB by a mantle flow after a detachment of the lower parts of subducting slabs.