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TESZ as a diffuse paleoplate boundary between the East European Craton and Phanerozoic Europe

Ludek Vecsey, Jaroslava Plomerova, Jan Chyba, Vladislav Babuska, and the PASSEQ Team
Institute of Geophysics, Academy of Sciences, Prague, Czech Republic (vecsey@ig.cas.cz)

The Trans-European Suture Zone (TESZ) manifests a broad transition between the Precambrian and Phanerozoic Europe. To contribute to better understanding the upper mantle structure, we analyse isotropic velocity variations by means of standard teleseismic tomography as well as we analyse anisotropic parameters of teleseismic body waves. The velocity perturbations in the tomographic model down to 600 km indicate the Phanerozoic part of Europe thrust over the Precambrian East European Craton (EEC). Depth of the lithosphere-asthenosphere boundary (LAB) – modelled as a transition between fossil anisotropy in the mantle lithosphere and anisotropy due to present-day flow in the underlying asthenosphere – increases to ∼250 km toward the EEC. For anisotropy study, we examine lateral variations of directional terms of relative P-wave travel-time deviations from about 100 teleseismic events, selected to provide good azimuthal coverage, and evaluate shear-wave splitting parameters from about 20 events recorded during passive seismic experiment PASSEQ (2006-2008). We model in 3D large-scale olivine fabrics of mantle lithosphere domains on a transect from the eastern limit of the Bohemian Massif (BM) through the Polish Paleozoic Platform towards the Teisseyre-Tornquist Zone (TTZ) - the NE limit of the TESZ - to the East European Craton (EEC).

Variations of anisotropic signal around the central part of the TESZ are surprisingly moderate. There is no distinct change of the P-residual pattern and shear-wave splitting parameters across the surface trace of the TTZ. The most distinct change of the anisotropic signal occurs at the northern boundary of the BM. Week changes of the mantle lithosphere structure across the TESZ suggest, in accord with results from P-wave tomography, a south-westward continuation of the EEC beneath this broad and diffuse paleoplate boundary. Inferences from seismic tomography as well as seismic anisotropy indicate that this laterally heterogeneous pervasive shear zone probably contains blocks of EEC mantle lithosphere that were partly deformed during the amalgamation of the Variscan orogenic belt.