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Structure of the mantle lithosphere around the TESZ - from the East European Craton to the Variscan Belt

Ludek Vecsey, Jaroslava Plomerova, Vladislav Babuska, and Passeq Working Group
Institue of Geophysics, Academy of Sciences, Prague, Czech Republic (vecsey@ig.cas.cz)

The Trans-European Suture Zone (TESZ) represents a distinct ∼3500 km long tectonic feature, which can be traced through north-western to south-eastern Europe in various models of seismic velocities (e.g., Bijwaard et al., JGR 1998, Goes et al., JGR 2000) as well as in seismic anisotropy (e.g., Babuska et al., PAGEOPH 1998). The zone manifests the significant contact zone between the Precambrian and Phanerozoic Europe. To contribute to better understanding of the structure of the upper mantle and a depth of the lithosphere-asthenosphere boundary (LAB), we analyse anisotropic parameters of body waves and suggest 3D anisotropic models of individual domains of continental mantle lithosphere. Specifically, we examine lateral variations of teleseismic P-wave travel-time deviations from about 100 teleseismic events, selected to provide a good azimuth coverage, and evaluate shear-wave splitting parameters from about 20 events recorded during passive seismic experiment PASSEQ (2006-2008), whose stations spanned across the central part of the TESZ. We derive large-scale fabrics of mantle lithosphere domains in a vicinity of the Teisseyre-Tornquist Zone (TTZ) - the NE limit of the TESZ - and the Polish Paleozoic Platform, but also further to the SW of the suture (to the southern Saxothuringian – Moldanubian Units) and to the NE (East European Craton).

Variations of anisotropic signal around the central part of TESZ are surprisingly moderate, in comparison with the western part of the TESZ, and exhibit different characteristics, which we summarize as follows:

(1) There is no distinct change of anisotropic signal derived either from the P-residual pattern or shear-wave splitting parameters (the fast shear-wave polarization and slow shear-wave split delay time) across the surface trace of the Teisseyre-Tornquist Zone (TTZ).
(2) The most distinct change of the anisotropic signal occurs at the northern boundary of the Bohemian Massif (BM), whose mantle lithosphere consists of several anisotropic domains (Babuska and Plomerova, Gondwava Res. 2012).
(3) Stations of the PASSEQ array, north-east of the BM, show consistent P-sphere patterns, in general, with early arrivals prevailingly from about NE to SE (high-velocity directions). The pattern is similar to that evaluated in the southern Baltic Shield (Eken et al., Tectonophysics 2010).
(4) Smooth and small variations of the splitting parameters indicate a complex anisotropy on both sides of the TTZ.
(5) Regional changes in the shear-wave splitting parameters are larger along the TTZ, than changes across this zone. These inferences were derived from SKS waves arriving steeply from north-eastern and western backazimuths, i.e. from directions quasi-perpendicular to orientation of the TESZ.

Sharp change of the mantle lithosphere fabrics between the BM and the adjacent broad TESZ region north of it, and only week changes of the mantle lithosphere structure across the TTZ suggest south-westward continuation of the East European Craton beneath the TESZ towards the Variscan front in central Europe.