Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04651, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04651
EGU General Assembly 2008

Mantle fabric of western Bohemian Massif (central Europe) constrained by 3D seismic P and S velocity tomography and anisotropy

J. Plomerova (1), U. Achauer (2), V. Babuska (1) and L. Vecsey (1)

(1) Geophysical Institute, Academy of Sciences, 141 31 Prague 4, Czech Republic,

(2) EOST – Institut de Physique du Globe Strasbourg, R. Descartes 5, Strasbourg, France

(jpl@ig.cas.cz / Fax: +420272761549 / Phone: +420267103391)

We present a high-resolution teleseismic body-wave travel-time tomography and anisotropy study of the lithosphere-asthenosphere system beneath the western Bohemian Massif. Isotropic velocity perturbations down to a depth of 250 km did not image any columnar low-velocity anomaly which could be interpreted as a mantle plume anticipated beneath the Eger Rift, similar to findings of small plumes beneath the French Massif Central and the Eifel in Germany. Alternatively, we interpret the broad low-velocity anomaly beneath the Eger Rift by an upwelling of the lithosphere-asthenosphere transition (Plomerova et al., 2007). We study three-dimensional orientation and strength of seismic anisotropy and model a fabric of the mantle lithosphere from shear-wave splitting and directional terms of relative P residuals. Fast shear-wave polarizations have mostly E-W orientation and split delay times δt are around 1.2s, on average. Only small but systematic changes of the fast S split polarizations were found between the Teplá-Barrandian (TBU)/Moldanubian (MD) tectonic units and the adjacent part of the Saxothuringian (ST). On the other hand, P-velocity anisotropy clearly indicated three different orientations of fossil olivine fabrics with inclined axes of symmetry in the mantle lithospheres of the three tectonic units. We simulate fabrics of the mantle lithosphere domains by different 3D anisotropic models: one with hexagonal 'slow' symmetry axis b and divergently dipping (a, c) foliations (ST, MD) and the other with hexagonal or orthorhombic symmetry with dipping high-velocity lin-

eation a (TBU). These 3D self-consistent anisotropic models are compatible for both the P and S anisotropy observables. Our results suggest that a directionally varying constituent of the anisotropic signal is “frozen” in the mantle lithosphere. Regional changes in body-wave anisotropy thus map tectonic boundaries of lithosphere domains, though with shifted crustal and mantle parts (TBU). Depending on symmetry and orientation of fabrics of the lithosphere domains, lateral changes are reflected in either P-velocity anisotropy and/or shear-wave polarizations. About a half of the shear-wave split-time delays with predominantly E-W polarization azimuths represents a constant anisotropic signal which we associate with an olivine preferred orientation due to a present-day flow in the asthenosphere. Our study emphasizes the importance of combining different methods of analysis and using complementary datasets in the three-dimensional analysis of mantle fabrics.