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Mapping seismic anisotropy of lithospheric mantle beneath the Bohemian Massif (central Europe)

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Olivine lattice-preferred orientation (LPO) creates fabrics observed by different methods in the Earth mantle. Our study of seismic anisotropy of the upper mantle beneath the Bohemian Massif is based on broad-band data from several passive experiments conducted in central Europe since the 90ties (Exp92- Plomerova et al., PAGEOPH 1998, MOSAIC- Plomerova et al., Studia Geoph. Geod. 2005, BOHEMA I-III, Babuska et al., Studia. Geophys. Geod., 2005). We analyse data of dense temporary arrays to refine the mantle structure. Anisotropic parameters of our starting models were constrained by mantle xenoliths. Retrieved 3D self-consistent anisotropic models show lateral variations of lithospheric mantle fabrics resulting from joint inversion/interpretation of body-wave seismic parameters. Contrary to smooth pattern of isotropic velocities within the whole massif, seismic anisotropy deciphers there several domains in the mantle lithosphere with consistent olivine fabric and delimits boundaries or transitions of the blocks, often with an offset of crustal and mantle parts of important boundaries or sutures (Plomerova et al., GJI 2007, Babuska et al., Tectonophysics 2008). We show that besides delimiting very-large provinces defined by their consistent fossil mantle fabrics, e.g., the Proterozoic and Archean domains in Fennoscandia (Vecsey et al., Tectonophys. 2007), mapping the 3D anisotropy works also on smaller scales ($\sim$100km) and helps us to reconstruct the structure and tectonic development of smaller tectonic units. Specifically in the Bohemian Massif, we model three domains of the mantle lithosphere beneath its western part, one domain to the east and another to the north. Each of the domains may represent a micro-plate, or its fragment, with a 'frozen' olivine fabric, which was created prior to their Variscan amalgamation. Different seismic methods allow us to recognize a very large-scale anisotropy related to present-day flow in the mantle (e.g., from dispersion of surface waves) and a fossil fabric of the lithospheric part of the mantle, most probably created during an early form of plate tectonics.