Geophysical Research Abstracts
Vol. 17, EGU2015-4854, 2015
EGU General Assembly 2015

Anisotropic Structure of the Upper Mantle in the Pannonian Basin: From SKS Splitting data and Xenolith Constraints

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The Carpathian-Pannonian region (CPR) is the northeastern end of the Alpine mountain belt. In the Western Alps, available results of anisotropy investigations (SKS splitting) show clear belt-parallel anisotropy. In the Eastern Alps this pattern not only is broken but also does not follow the strike of Carpathians and Dinarides. This study is aimed at evaluating the seismic anisotropy of the upper mantle beneath the Pannonian Basin concentrating on the eastward elongation of the fast anisotropic pattern of the Eastern Alps. We use data recorded by the temporary stations, set up for the Carpathian Basin Project (CBP) extending from the Vienna basin through Hungary into Serbia, together with the petrological indicator of deformation in basalt-hosted upper mantle xenoliths from Szentbékkála analyzed with the EBSD system at Geosciences Montpellier, France (Kovács et al., 2012). We reprocess data from 45 temporary CBP stations consisting of recorded waveform of teleseismic events. The minimum energy method is applied to measure the splitting delay time and fast axis orientation. The dominant fast polarization orientation is NW-SE for the Hungarian part of the stations as well as at the stations located in the easternmost of the Pannonian Basin. This orientation matches well with the anisotropy structure under the Eastern Alps, which has already been attributed to the asthenospheric flow (Qorbani et al., 2015). The NW-SE trend turns more into WNW-ESE at the stations situated in Austria, mostly NW of the Vienna basin. Apart from predominately NW-SE fast orientation, there are a few measurements showing NE-SW and almost E-W trend. The lithospheric thickness in the CPR region is estimated about 60 km, the SKS measurements thus most likely originate mainly from the asthenosphere. Lattice preferred orientation of xenoliths from the deeper lithospheric mantle show A-type fabric of olivine, in which the fast axis azimuth may correspond to the shear direction, possibly present-day asthenospheric flow in the upper mantle. Considering anisotropy magnitude between 5 to 6% from petrological measurements, and 1.0 s delay time would refer to 100 to 75 km thickness of the anisotropy layer. We observe larger delay times in the northwest (Alpine-Carpathian connection) and to the external domain of the Pannonian basin (close to surrounding Carpathian), referring to strong or thicker anisotropy beneath these stations.