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Seismic anisotropy beneath the western part of the Carpathian-Pannonianregion inferred from combined SKS splitting and mantle xenolith studies

Nóra Liptai[1,2], Zoltán Gráczer[1], Gyöngyvér Szanyi[1], Bálint Süle[1,2], László Aradi[1,3], György Falus[4], Götz Bokelmann[5], Máté Timkó[1,2], Gábor Timár[6], Sierd Cloetingh[2,7], Csaba Szabó[1,2,3], István Kovács[1,2], and the AlpArray Working Group[*]
[1]MTA FI Lendület Pannon LitH2Oscope Research Group, Institute of Earth Physics and Space Science, Sopron, Hungary
[2]Institute of Earth Physics and Space Science, Sopron, Hungary
[3]Lithosphere Fluid Research Laboratory, Department of Petrology and Geochemistry, Institute of Geography and Earth Sciences, Eötvös Loránd University, Budapest, Hungary
[4]Mining and Geological Survey of Hungary, Budapest, Hungary
[5]Department of Meteorology and Geophysics, University of Vienna, Vienna, Austria
[6]Department of Geophysics and Space Science, Institute of Geography and Earth Sciences, Eötvös Loránd University, Budapest, Hungary
[7]Tectonics Group, Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, Netherlands
[*]A full list of authors appears at the end of the abstract

Information on mantle anisotropy can be obtained from methods such as studying the lattice-preferred orientation (LPO) in mantle peridotites, or conducting shear-wave splitting (SKS) analyses which allow to determine whether it is a single or multi-layered anisotropy and the delay time of the fast and slow polarized wave can indicate the thickness. In this study we provide a detailed SKS mapping on the western part of the Carpathian-Pannonian region (CPR) using an increased amount of splitting data, and compare the results with seismic properties reported from mantle xenoliths to characterize the depth, thickness, and regional differences of the anisotropic layer in the mantle.

According to the combined SKS and xenolith data, mantle anisotropy is different in the northern and the central/southern part of the western CPR. In the northern part, the lack of azimuthal dependence of the fast split S-wave indicates a single anisotropic layer, which agrees with xenolith data from the Nógrád-Gömör volcanic field. In the central areas, multiple anisotropic layers are suggested by systematic azimuthal variations in several stations, which may be explained by two, petrographically and LPO-wise different xenolith subgroups described in the Bakony-Balaton Highland. The shallower layer is suggested to have a

‘fossilized’ lithospheric structure, which could account for the occasionally detected E-W fast S-orientations, whereas the deeper one reflects structures responsible for the regional NW-SE orientations attributed to the present-day convergent tectonics. In the Styrian Basin, results are ambiguous as SKS splitting data hints at the presence of multiple anisotropic layers, however, it is not supported clearly by xenolith data.
Spatial coherency analysis of the splitting parameters put the center of the anisotropic layer at ~140-150 km depth under the Western Carpathians, which implies a total thickness of ~220-240 km. Thickness calculated from seismic properties of the xenoliths resulted in lower values on average, which may be explained by heterogeneous sampling by xenoliths, or the different orientation of the mineral deformation structures (foliation and lineation).

AlpArray Working Group: AlpArray Working Group