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Deformation in the asthenospheric mantle beneath the Carpathian-Pannonian Region

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To better understand the evolution and present-day tectonics of the Carpathian-Pannonian Region (CPR), we characterize the upper mantle anisotropic structure. We present a shear wave splitting analysis from teleseismic events recorded at the Carpathian Basin Project and permanent stations located in the CPR. The results show a large-scale uniform NW-SE fast orientation under the entire CPR. Compared with the complexity of geologic structures, the anisotropy expresses a relatively simple pattern of deformation. We attribute this anisotropy to an asthenospheric origin and interpret it as flow-induced alignment within the upper mantle. We also observe a few measurements depicting NE-SW fast orientation in line with the Mid-Hungarian Shear Zone. This suggests the likely contribution of either lithosphere or northeastward flow into a slab gap under the northern Dinarides. We observe splitting delay times on average of 1 s, showing noticeable change (60%) in the middle Pannonian basin. This change correlates well with the variation in the thickness of low-velocity zones that were previously imaged between a depth of 75 and 400 km by velocity tomography. In order to evaluate the relation between anisotropy and tectonics, we compare our data with the tectonic models that have so far been suggested to explain the evolution and current-stage tectonics of the region. We present here a plausible tectonic model responsible for the NW-SE anisotropy within the asthenospheric mantle. In this model, NW-SE deformation is mainly generated in a northeastward compressional tectonic regime acting in a wide region between the Adriatic microplate and the East European platform.