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Crustal structure of the Western Carpathians and Pannonian Basin System: seismic models from CELEBRATION 2000 data and geological implication

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During CELEBRATION 2000 experiment the area of the Western Carphathians and Pannonian Basin System on the territory of southeastern Poland, Slovak Republic and Hungary was investigated by dense system of the deep seismic sounding profiles. In this paper, we present results of modelling of refracted and reflected waves with use 2-D ray tracing technique for profiles CEL01, CEL04, CEL05, CEL06, CEL11, CEL12 and CEL28. All seven profiles were jointly interpreted with verification and control the models at crossing points. Obtained P-wave velocity models of the crust and uppermost mantle are very complex and show differentiation of the seismic structure, where the depth of the Moho discontinuity is changing from about 25 to about 45 km. In the southern part of the area the relatively thin Pannonian Basin System crust consists of 3-7 km thick sediments and two crustal layers with 5.9-6.3 km/s in the upper crust and 6.3-6.6 km/s in the lower crust. In the upper crust of ALCAPA beneath profile CEL05 a high velocity body of Vp$\geq$ 6.4 km/s was detected in the uppermost 5 km, which corresponds to the Bükk Composite Terrane. The total thickness of the ALCAPA crust is 1-2 km bigger than in the Tisza-Dacia. In the northern part of the area we observe 10-20 km thick uppermost crust with low velocity (Vp$\leq$6.0 km/s), connected with TESZ and Carpathian Foredeep. Together with ca. 6.2-6.5 km/s and 6.5-6.9 km/s crustal layers they have a total thickness of 30-45 km (north of the Pieniny Klippen Belt). A sub-Moho velocities have in average values of 7.8-8.0 km/s for the Pannonian basin System, while in the Western Carpathian, the Trans-European suture zone (TESZ) and the East European Craton (EEC) part they are slightly bigger, 8.0-8.1 km/s. Lower velocities beneath the microplates ALCAPA and Tisza-Dacia could be caused by the different mineralogical and petrological compositions and the significant higher surface heat flow and temperature within the upper mantle. Beneath some profiles reflectors in the lithospheric mantle were found 10-20 km below the Moho, following its shape and generally dipping to the north. Interpretation of seismic profiles was the background for the tectonic description of two colliding lithospheric plates. The northern one – underthrusting - is represented by the older European tectonic units consists of the EEC and TESZ. The southern one – overthrusting - is built up by the younger tectonic units of the Western Carpathians and the back-arc Pannonian Basin System (generating the microplates ALCAPA and Tisza-Dacia). It is suggested that present day complex structure is a result of the complicated continental collision between microplates ALCAPA and Tisza-Dacia and the south margin of the European Platform, which was accompanied by the thermal back-arc extensional process beneath the Pannonian back-arc Basin System.