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Crustal and lithospheric structure within and around the Vrancea seismogenic zone, Romania

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The highest contribution to the Romanian seismicity is due to the Vrancea seismogenic zone with 2- 3 strong intermediate depth earthquakes (M>7) per century. Deep foci are confined within a depth interval 70-180 km and a volume of about 40 km x 80 km x180 km. The volume is generally related to a lithospheric slab segment subducted about 22 to 10 millions years ago. Before the second half of the 1990s different geodynamic models tried to explain the Vrancea seismicity, but sparce seismic data allowed only qualitative explanations. A large cooperative research program launched by the University of Karlsruhe, Germany in 1996 in partnership with research institutes and universities from Romania resulted in a new lithospheric model of and around the Vrancea seismogenic zone and its adjacent areas. Two seismic refraction lines (VRANCEA 99 and VRANCEA 2001) and a teleseismic tomography experiment (CALIXTO) provided a solide data base. Based on seismic refraction data two crustal models along a N-S line from Bacau town through the Vrancea zone to the south of Bucharest city (VRANCEA99) and a E-W line from Tulcea town through the Vrancea zone to Aiud town (VRANCEA2001) were derived. P- and S-wave models of VRANCEA99 display a multi-layered crust with thicknesses from 30 km (South) and 38 km (North) to 41 km underneath the Vrancea zone (Hauser et al., 2001; Raileanu et al., 2004, 2005). An increase in P- wave velocity with depth and an almost constant velocity in lateral directions are found. Likewise the VRANCEA2001 model displays a layered crust with large variations in crustal thickness from 34 km in Transylvania to 41 km underneath the Vrancea zone and 43 km in Dobrogea, within the eastern part of the seismic line (Hauser et al., 2006, submitted). A large variability in P-wave

velocities is derived for the shallow levels of sedimentary cover (e.g. 2 km/s in the Focsani basin and 5.7 km/ s in Dobrogea). The model also shows a sedimentary cover reaching up to 20 km thickness under the Focsani Basin. Some velocity inversions are found within the lower layers of sediments in the Focsani Basin and within the Carpathian Orogen and Transilvania Basin for the upper part of the basement. During the CALIXTO tomography experiment 120 seismic instruments were deployed within the SE half of Romania. Local, regional and teleseismic events were recorded for 6 months in 1999. A 3-D crustal model for the SE part of Romania is achieved by Martin et al., (2005) based on the two long-range seismic refraction lines, 3-D refraction tomography (Landes et al., 2004), teleseismic Ps conversions (Diehl et al., 2005) and previously published work. Although that model does not contain small-scale heterogeneities $<$10 km, it displays larger structures such as variable sediment thickness, average seismic velocities, and the Moho topography. Latest images from the inversion of teleseismic data display the subducted lithosphere as a SW-NE elongated high velocity anomaly, that hosts all intermediate depth seismicity but extends further towards SW. The high resolution tomography suggests that decoupling from the overlying continental lithosphere already took place SW of the Vrancea zone, whereas it is still attached under Vrancea with its high seismicity (Martin et al., 2006, submitted).