The transition of the East European cratonic lithosphere to that of the Palaeozoic collage of the Trans-European Suture Zone as depicted on the TTZ-South deep seismic profile (SE Poland to NW Ukraine)

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Crustal and uppermost mantle structure along the Teisseyre-Tornquist Zone (TTZ) was explored along the ~550 km long, NW-SE-trending TTZ-South profile, using seismic wide-angle reflection/refraction (WARR) method. The profile line was intended to follow the border between the East European Craton (EEC) and the so called Palaeozoic Platform (PP) of north-central Europe, believed to contain a number of crustal blocks that were accreted to the craton during pre-late Carboniferous times, defining the Trans-European Suture Zone (TESZ).

The seismic velocity model of the TTZ-South profile shows lateral variations in crustal structure. Its Ukrainian segment crosses the interior of the Sarmatian segment of the EEC, where the crystalline basement gradually dips from ~2 km depth in the SE to ~12 km at the Ukrainian-Polish border. This part of the model shows a four-layered crustal structure, with an up to 15 km-thick sedimentary cover, an underlying crystalline upper crust, a 10-15 km-thick middle crust and a ~15 km thick lower crust. In Poland, the profile passes along the TESZ/EEC transition zone of complex crustal structure. The crystalline basement, whose top occurs at depths of 10-17 km, separates the sedimentary cover from the ~10 km thick mid-crustal layer (Vp=6.5-6.6 km/s), which, in turn, overlies a block of 10-15 km thickness with upper crustal velocities (Vp=6.2 km/s). The latter is underlain by a ~10-15 km-thick lower crust. Along most of the model one can see conspicuous velocity inversion zones occurring at various depths. At intersections of the TTZ-South profile with some previous deep seismic profiles (e.g. CEL02, CEL05, CEL14, PANCAKE) such inversions document complex wedging relationships between the EEC and PP crustal units. These may have
resulted from tectonic compression and thick-skinned thrusting due to either Neoproterozoic EEC collision with accreting terranes or intense Variscan orogenic events. Five high velocity bodies (HVB; $V_p = 6.85\text{-}7.2 \text{ km/s}$) were detected in the middle and lower crust at 15-37 km depth. The Moho depth varies substantially along the profile. It is at $\sim 42$ km depth in the NW and deepens SEward to $\sim 50$ km at $\sim 685$ km. Subsequently, it rises abruptly to $\sim 43$ km at the border of the Sarmatian segment of the EEC and sinks again to $\sim 50$ km beneath the Lviv Paleozoic trough at $\sim 785$ km. From this point until the SE end of the profile, the Moho gently shallows, up to a depth of $\sim 37$ km, including a step-like jump of 2 km at $\sim 875$ km. Such abrupt Moho steps may be related to crust-scale strike-slip faults. Along the whole profile, sub-Moho velocities are $\sim 8.05\text{-}8.1 \text{ km/s}$, and at depths of 57-63 km $V_p$ values reach 8.2-8.25 km/s. Four reflectors/refractors were modelled in the upper mantle at $\sim 57\text{-}65$ km and $\sim 80$ km depths.