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3-D velocity model of the upper mantle of the south-western part of the East-European Platform

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An investigation of the upper mantle of the south-western part of the East-European platform (EEP) by a new variety of the seismic tomography method was carried out. It was developed by V.S.Geyko on the basis of Taylor approximation. This variety of method has a number advantages over traditional methods based on linearization: (1) it gives more accurate approximation of nonlinearity; (2) it can be used when a function of velocity has lesser limitation; (3) it doesn't need to set a referent velocity model as an initial approximation; (4) a task is correct according to Tihonov; (5) a task of numerical transformation is smaller.

In course of our research 3-D velocity structure of the upper mantle of the territory under consideration was obtained. It is represented as a number of horizontal and vertical sections. Horizontal ones are constructed as maps of absolute velocities over the depth ranging from 50 to 850 in every 25 km. Vertical sections are represented in discrepancies related to one-dimensional referent model and constructed in longitude and latitude directions from 18˚ to 45˚ E and from 40˚to 52˚ N in every degree.

The velocity structure of the upper mantle appears as interbedding of high- and low-velocity layers. The good correspondence between distribution of the mantle velocity layers and the surface's tectonic structures is apparent. There are several main velocity layers that may be recognized in the mantle structure of the south-western part of the EEP. These from the uppermost one are: (1) high velocity layer traced down to about 300-400 km and identified as seismic lithosphere; (2) low-velocity layer extended down to ca. 600-700 km. It was termed by us as Holitsyn-Geyko layer (HGL); (3) the lowermost layer that is always inversion relatively to HGL.

Map of the thicknesses of the seismic lithosphere of the studied area is drawn. It

demonstrates variability of the lithosphere thickness beneath different tectonic structures. The thinnest (about 50 km) lithosphere was found beneath the southern border region of the EEP in transitional zone to the young folded frame. Further to the north the lithosphere thickness gradually increases and reaches 350 km on average beneath the Ukrainian shield. However, lithosphere structure emphasizes block structure of the shield. Central (Middle-Dnieper and Kirovograd) blocks of the Ukrainian shield are characterized by 300-325 km-thick lithosphere. Lithosphere thickness beneath the easternmost Peri-Azovean block is 350-400 km. Western block are characterized by very thick lithosphere. Its thickness reaches 350 km beneath the Ros-Tikich block and even 400 km beneath the Volyn-Podolie block. Further to the west beneath the Volynian lithosphere gets drastically thinner and do not exceed in thickness 100 km. This area is known as Volynian flood basalt province.