New results of the deep seated geophysical interpretation of the Carpathian-Pannonian-Dinaridic lithosphere

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Abstract: We present an overview of the results based on a combined interpretation of the potential field and seismic data in the 2D and 3D space in the Carpathian-Pannonian region. The interpretation of the gravity anomalies is based on the unified and homogenized gravity database from different countries. We continue in an integrated 2D modeling of the surface heat flow, geoid, gravity, and topography data simultaneously. This approach is applied for determination the lithospheric thermal structure along new transects crossing the Southern, Eastern and Western Carpathians, Dinarides, Pannonian Basin, Transylvanian Basin and European Platform.

The first 3D density model of the Western Carpathian-Pannonian region was constructed based on the results of the newest seismic experiments. The temperature and density distribution in the uppermost mantle was calculated using a combination of petrological, mineralogical and geophysical information. This calculation was performed in order to enhance the 3D gravity modelling, particularly in the Pannonian Basin. The Pannonian Basin is characterized by an asthenospheric upwelling and thus by anomalous temperatures and densities in the uppermost mantle. The 3D model enabled also to perform gravity stripping that was applied as an additional analysis of the gravity field. It allows to identify the sources of the anomalies, to separate their effects and localize the lithospheric inhomogeneities. The gravity stripped image of the region revealed significant differences of the nature of the microplates ALCAPA and Tisza-Dacia from the surrounding regions.

The recent results of modeling of refracted and reflected waves with use 2D ray tracing technique for profiles CEL01, CEL04, CEL05, CEL06, CEL11, CEL12 and CEL28 will be presented. Obtained P-wave velocity models of the

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crust and uppermost mantle are very complex and show differentiation of the seismic structure.

Interpretation of seismic profiles, density and integrated models was the background for the tectonic description of two colliding lithospheric plates. The northern one 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 thermal back-arc extension beneath the Pannonian Basin System.

The new morphologically- and quantitatively-based approach comprehensively defines and characterizes the basic second- and third-order morphostructures of the Western Carpathians by taking into account geological and geophysical data and geodynamic concepts, models and theories to build a synthetic picture. We show that the morphological character of the mountains can mirror the whole complex of young geological, geodynamic and geophysical features that do not have to be visibly reflected in the older geological structures. The suggested subdivision is an improvement on earlier qualitative, morphologically-based subdivision. This improvement comes from quantitative targeted morphometrical analysis and cluster analysis that maximizes the internal morphological homogeneity of the delimited morphostructural regions.

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Key words: gravity, seismics, geothermics, lithosphere, density model, geological model, morphostructure, Carpathian-Pannonian-Dinaridic region