The gravity field of the eastern part of the Western Carpathians and its geodynamic implications

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In recent years, the study of geodynamic evolution of the Western Carpathians has been concentrated mainly in their western and central segments. For an integrated study of the whole Western Carpathians it is very important to investigate also their eastern part. In order to constrain the lithospheric structure and geodynamics of the region a detailed analysis of gravity field is done. The analysis of the gravity field in the eastern part of the Western Carpathians is based on local isostatic equilibrium by using published maps of topography, gravity field, thicknesses of sediments, crust and lithosphere and two-dimensional density modelling. A preliminary, two-dimensional gravity model is also presented along the Profile KP-X, which extends across the region investigated. Unfortunately, the interpretation can not be supported by available seismic refraction and reflection profiling observations, because they are missing in this region.

Density contrast between crust and upper mantle (+300 kgm^{-3}) and lower lithosphere and asthenosphere (–30 kgm^{-3})

results in isostatic equilibrium for approximately 10 km deeping of the Moho and about 70 km thickenning of the lithosphere/asthenosphere boundary from the Pannonian Basin to the Western Carpathian externides. The Moho gravity effect is fully compensated by topography and lithosphere/asthenosphere boundary. In spite of rough approximation of crustal and lithospheric geometry the calculated Bouguer anomaly in local isostasy correlates relatively well with the observed gravity anomaly.

Two-dimensional lithospheric density cross-section indicates that a slope of underthrusting the European lower plate under the upper Carpatho-Pannonian upper plate is very steep and post-collisional crustal shortening is small (about 10–20 km). Furthermore the modelling results suggest a crustal slab under the Vihorlatské vrchy Mts. The analysis of the gravity field taking into account other geophysical and geological data assumes that the eastern part of the Western Carpathians represents very complicated area in which interaction of compression, strike-slip and extension can be observed. This interplay leds to the formation of the East Slovakian Basin. The basin is characterized by a large thickness of sediments, thinning of the crust and lithosphere. Extension process is accompained by intrusions of high-density material into the lower crust and volcanic activity.