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Geological Structure of the Czech Republic Depicted by the New Gravity and Magnetic Field Images

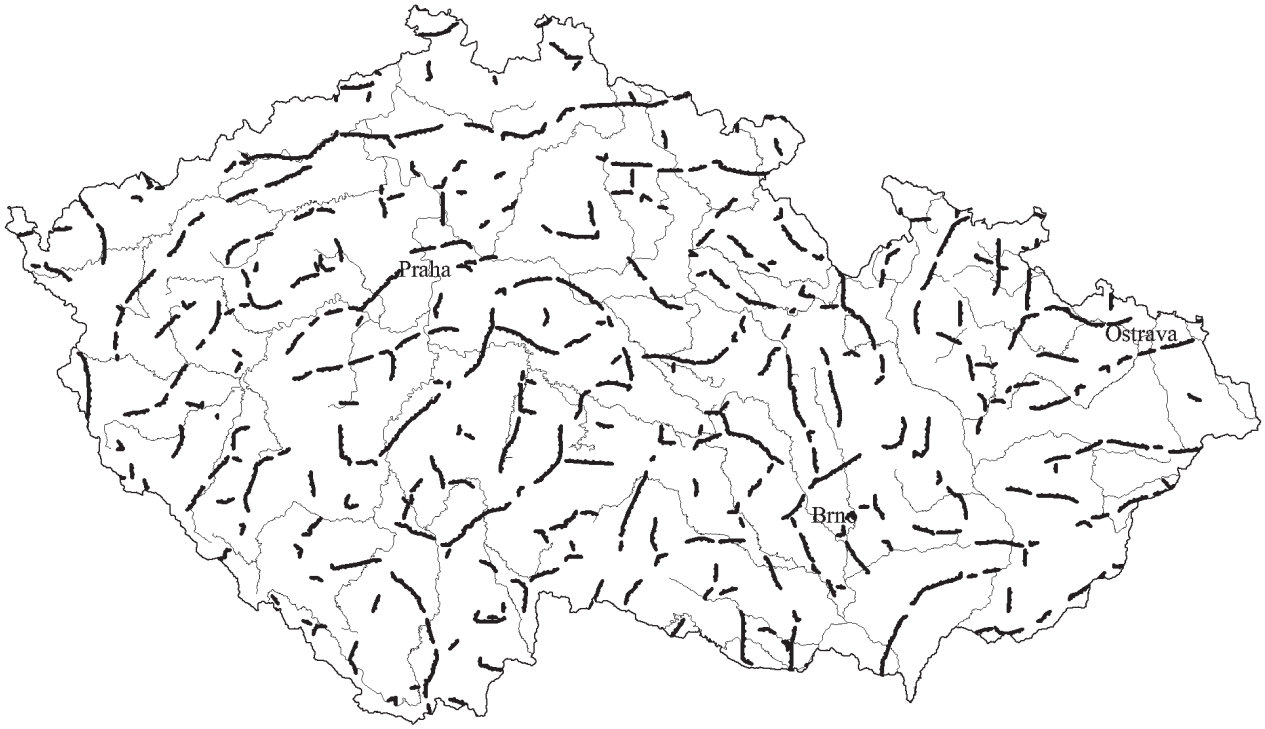
Jiří SEDLÁK, Ivan GNOJEK and Stanislav ZABADAL

Ječná 1321/29a, 621 00 Brno, Czech Republic

Analysis of the Earth's potential fields serves as a useful tool for understanding of the geological structure. The new detailed digital regular grids of the gravity and magnetic fields gives the possibility to evaluate a new set of basic and derived potential field maps of the Czech Republic. These maps offers new stimuli to the interpretation of the geological structure.

A new set of gravity maps

The Bouguer gravity anomalies (reduction density of 2.67 gcm^{-3}) represent the fundamental set of gravity data, from which various secondary maps are derived. The separation of the regional and the local (residual) components by two-dimensional local splines fitting under tension enables to distinguish the pattern of two types of gravity sources. Hence, the huge and extensive geological structures depicted by regional gravity anomalies can be studied separately without the complicating effects of the local-sized structures. The analysis of the regional features of the gravity field enables to characterize the main tectonic units of the Czech Republic such as the Saxothuringian and the Lugian (mostly negative), the Bohemian (predominantly positive), the Moldanubian (negative), Brunovistulian (positive) and it also enables to indicate their burried boundaries.



■ **Fig. 1.** Density boundaries (depth level 3 km).

The residual gravity anomalies, on the other hand, emphasize the presence of the smaller geological bodies without the masking influence of the "regional background". The most striking local negative residual anomaly is caused by the Říčany (adamelite) granite body situated 30 km ESE of Prague in the northern margin of the Central Bohemian Pluton. The most remarkable positive residual anomalies are produced by basic bodies such as the central part of the Doupov Mts. composite volcano or the metabasite zone of the Brno Pluton.

Steep changes in the Earth's crust densities are perfectly shown by horizontal gradients of the gravity field. Marginal limits (boundaries) of the structures owing different densities can be clearly specified using this kind of derived data. The most expressive horizontal gradients border the contact zone of the "light" Karlovy Vary granite pluton with the high density Mariánské Lázně basic complex in the W of Bohemia. Another steep horizontal gradients are developed (among others) in the E-margin of the Bohemian Massif, i.e. in the area where the outcropping Moravian Paleozoic is in the contact with the Carpathian Foredeep.

Another special way to analyse the density environment consists in the calculation of so called Density Boundaries Maps by Linsser method. The position of boundary lines between the geologic structures of different densities can be shown in various depth levels by this method. (The density boundaries calculated for the depth level of 3 km are shown in the Fig. 1).

A new set of magnetic maps

Quite different properties of the rocks (predominantly the magnetic susceptibility) are manifested by magnetic anomalies. The primary map of magnetic anomalies of the Czech Republic (mostly based on the airborne data) shows rather complicated pattern of the complex magnetic response of both the local and the regional anomalies.

The analytical continuation upward which can be worked-out for different levels was proved to be the useful tool in the structural analysis. The secondary map of the analytical continuation upward to the level of 1 km above the ground belongs to the most frequent product applied in geological studies.

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The Eocene to Oligocene Changes of Depositional Environments in the Central Carpathian Paleogene Basin (Spišská Magura Mts., Slovakia)

Ľubomír SLIVA and Michal KOVÁČ

Department of Geology and Paleontology, Comenius University, Mlynská dolina G, 842 15, Bratislava, Slovakia

The Central Carpathian Paleogene Basin (CCPB) is one of well preserved Paleogene basins in Western Carpathians, its sedimentary succession provide good tool for sedimentological studies. Sedimentary fill of the CCPB is consisting terrestrial and shallow to deep marine sediments, from several hundred metres to several kilometres thick (Soták et al. 2001). Basin is interpreted as forearc basin, situated on upper plate on front of Outer Carpathians accretional wedge. The sediments of the CCPB are assigned to four sedimentary formations: Borové Fm., Huty Fm., Zuberec Fm. and Biely Potok Fm. according Gross et al. (1984). The age of sedimentary formations is Bartonian to Lowermost Miocene (Olszewska and Wieczorek 1998, Soták 2001).

In Spišská Magura Mts. are preserved sediments of the Borové Fm., Huty Fm. and Zuberec Fm. (Janočko et al. 2000a,b, Fig. 1). Biely Potok Fm. is not present because of considerable erosion of upper part of basin fill. However, erosion rate decreasing westward and in western part of mountain and in adjacent part of Podhale Basin are preserved upper Oligocene to Lower Miocene deposits, belonging to Brzegi Mb., which are presumable coeval to Biely Potok Fm. (Gedl 2000).

Borové Fm. are laterally very variable, we recognized there sedimentary facies of alluvial fans, wave reworked fan deltas and shallow marine inner shelf facies (Fig. 2a). Fan delta activity is connected with falling to slow rising of relative sea level, during Upper Eocene transgression the shallow marine, fossiliferous sand were deposited. The lowermost part of the Huty Fm. suggest to renewed deltaic build-up near Ždiar village, on other parts of basin outer shelf to deep-marine sedimentation started due to tectonically controlled subsidence (Fig. 2b). During Lower Oligocene early lowstand a 170–200 m deep submarine canyon was cut into basement (Fig. 2c), which was later backfilled by conglomerates and sandstones (Tokáreň Mb.). Due to slow rise of sea level during late lowstand activity in canyon terminated; overlying strata were deposited in slope setting. Upper part of the Huty Fm. represents transgressive, mud-rich fan deposits, with sedimentary facies of channel-levee, depositional lobe to basin