Geophysical Research Abstracts, Vol. 7, 00972, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00972

Gravity signals in the Central European Basin System

T. Yegorova (1,2), U. Bayer (1), H. Thybo (3), Y. Maystrenko (1), M. Scheck-Wenderoth (1), S. Lyngsie (3)

1) GeoForschungsZentrum Potsdam, Telegrafenberg, 14473 Potsdam, tameg@gfz-potsdam.de, 2) Institute of Geophysics, National Academy of Sciences of Ukraine, 03680 Kiev, egorova@igph.kiev.ua, 3) Geological Institute, University of Copenhagen, DK 1350 Copenhagen

During the last decades quite a number of gravity studies have been performed within the area of the Central European Basin System (CEBS). However, due to different reasons these investigations remained local or constrained regional studies. Here we present the results from 3D gravity analysis with special emphasis on the crystalline crust and the upper mantle for almost the entire area of the CEBS. Thereby the main objective of our study is deriving the gravity signals from different parts of the crust: sediments, the deeper crust, and the upper mantle.

We apply gravity back-stripping by subtracting the signal of known layers from the observed gravity field to obtain the signal from deeper layers. The resolution of the resulting gravity field depends on the reliability of an available structural model. The gravity field data were taken from the data base developed by a European working group as part of the EUROPROBE project on studies of the Trans-European Suture Zone (Wybraniec et al., 1998). The structural model for the sediment fill is based on Scheck-Wenderoth and Lamarche (2005). In order to correct for the influence of large salt structures, lateral density variations have been incorporated. Large-scale intra-crustal density heterogeneities have been adopted from the velocity structure (Bayer et al., 2002) for main tectonic provinces of study area. The crustal base is constrained by the recent compilation for the European Moho made by Ziegler and Dezes (in press). The resolution of our model is 8x8 km.

The sediment-free anomalies (DgresI) have been derived by stripping away the sediments down to Permian base. These anomalies are caused mainly by the Moho topography and heterogeneities in the lithosphere (in the crystalline crust and lithospheric mantle). The area of the Permian basins is characterized by positive residuals. The anomaly over the Dutch Basin has approximately the same northwest-southeast orientation. Smaller areas with high potential are found in the southern extension of the Oslo Graben, in the Central and Horn Graben as well as in the Glückstadt Graben and the Rheinsberg Trough. The assumption that sediment-free anomalies are mainly dependent on Moho topography has been examined by modeling. the anomalies from the Moho topography, which mainly compensate the effect of the sediments in the CEBS and in the North Sea. Removal of the effects of large-scale crustal inhomogeneities (Bayer et al., 2002) shows the Variscian arc system at the southern margin of the model area, as well as the old Baltic crust further north-east. The Triassic graben structures (Horn, Glückstadt, Rheinsberg) have pronounced influence on the gravity field, in particular in the PT. After separation, the remaining residual anomalies Dg resIII should mainly be caused by density variations in the upper mantle. The long-wave length component (of supposed mantle origin) shows similarities with gravity signals from the uppermost mantle, obtained from the seismological model of Bijwaard et al. (1998). The short-wave pattern exhibits several chains of north-west trending gravity highs with an amplitude up to 70 mGal located between the Tornquist zone and the Elbe-Odra line. The northern stripe, which marks the NDB, is separated by a gravity low corresponding with the Ringkoebing-Fyn high from a chain of positive anomalies in the NGB and a stripe anomaly of the Polish Trough. In the NGB it consisits of the anomalies of the Prignitz (Rheinsberg anomaly), the Glückstadt and the Horn Graben, and continues further west into the Central Graben. Further north-westwards it joins with the gravity high of the Central North Sea. It can be concluded that the large scale signals of the CEBS are essentially due to large scale variations in crustal thickness and density. Small Mesozoic Graben structures provide strong local signals in the final residuals, which can be explained as a result of Mesozoic (Triassic) extension leading to modification of the density in the crust (mainly in its lower part) and/or in the uppermost mantle locally as well as to the local uplift due to intrusions/underplating of mantle melts into the lower crust.

References

Bayer, U., Grad, M., Pharaoh, T.C., Thybo, H., Guterch, A., Banka, D., Lamarche, J., Lassen, A., Lewerenz, B., Scheck, M., Marotta, A.-M., 2002. The southern margin of the East European Craton: new results from seismic sounding and potential fields between the North Sea and Poland. Tectonophysics, 360, 301-314.

Bijwaard, H, Spakman, W., Engdahl, E.R., 1998. Closing gap between regional and global travel time tomography. Journ. Geophys. Res., 103, 12, 30.055-30.078.

Scheck-Wenderoth, M., Lamarche, J. Crustal memory and basin evolution in the

Central-European Basin System - new insights from a 3D structural model. Tectonophysics (in press).

Ziegler P., Dézes P. Crustal evolution of Western and Central Europe. In:D.Gee and R.A.Stephenson (Eds.), European Lithosphere Dynamics. Memoirs of the Geological Society, London (in press).

Wybraniec, S., Zhou, S., Thybo, H., Forsberg, R., Perhuc, E., Lee, M.K., Demianov, G.D., Strakhov, V.N., 1998. New map compiled of Europe's gravity field. EOS, Trans. Am. Geophys. Union 79 (37), 437-442.