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GRAVITY AND MAGNETIC DATA PROCESSING IN THE MOESIAN PLATFORM

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INTRODUCTION

Processing techniques were applied on gravity and magnetic data on the Moesian Platform in a regional study aimed at detecting deep geological structures. Since the regional gravity and magnetic anomalies are a superposition of geophysical fields perturbations determined by physical properties contrasts at various depths, the main goal of this paper is to apply data processing techniques in order to separate anomalies that may be associated with geological structures located in the vicinity of the sedimentary cover / crystalline basement boundary.

The software utilized to process Bouguer gravity data and Vertical component magnetic ones is the GM-SYS integrated with Oasis Montaj platform, which provides a complete set of filters for gravity and magnetic data processing.

GEOLOGICAL AND TECTONIC SETTING

The Moesian Platform is situated between the Carpathian Mts (north, west and north-west), the Balkan Mts (south) and the Black Sea (east), being located in Romania and Bulgaria.

It is mostly accepted that the Moesian Platform is divided in two main sectors, separated by the regional Intramoesian Fault, considered a regional fault (Sandulescu, 1984): a) the Wallachian compartment (westward); b) the Dobrogean compartment (eastward).

The main fault systems are trending NW-SE in the eastern part of the Moesian platform and E-W in its western part (Visarion et al., 1988).

GRAVITY AND MAGNETIC DATA

Gravity and Magnetic are the first geophysical methods to cover with measurements the territory of Romania. The 1: 200 000 scale sheet format was utilized for geophysical mapping, using the already established format for the geological maps at this scale. Their compilation led to the 1: 1 000 000 scale published maps: Bouguer gravity anomalies and Vertical component of geomagnetic field (ΔZ and ΔZ_a).

The Bouguer gravity map used in this study was built for 2.76 g/cc mean density at a 1:1 000 000 scale and contoured at 5 mGal interval (Nicolescu & Rosca,1991).

The magnetic map of vertical component anomaly (ΔZa) at 1: 1 000 000 scale used in this study (Airinei et al., 1983) was prepared by extracting the “normal geomagnetic field” previously computed for the Romanian territory.

GRAVITY AND MAGNETIC DATA PROCESSING

Gravity data processing consists in a series of techniques (graphical, numerical or analytical) designed to transform the Bouguer map, or to remove a gravitational effect that can be calculated aiming at preparing residual or regional maps, considered to be closely associated with the geological targeted structures.

A relatively new method to obtain the residual and regional components from Bouguer gravity maps is the wavelength filtering, being used in this study to compute both gravity residual and regional maps in the Moesian Platform.

The method is based on the degree of smoothness or wavelength = 1/ wavenumber of anomalies. Filtering can be done by transforming geophysical data to a wavenumber-wavenumber domain using a two-dimensional Fourier transform, removing certain wavenumber components and then doing an inverse transformation to reconstitute the map, but with certain wavelength removed (Telford et al., 1990).

The power spectrum derived from a two-dimensional dataset such as a grid of Bouguer gravity data, also has inherently a two-dimensional form. For ease of interpretation, an azimuthally average of the two-dimensional power spectrum is taken to produce a simplified one-dimension output as shown in Figure 1.

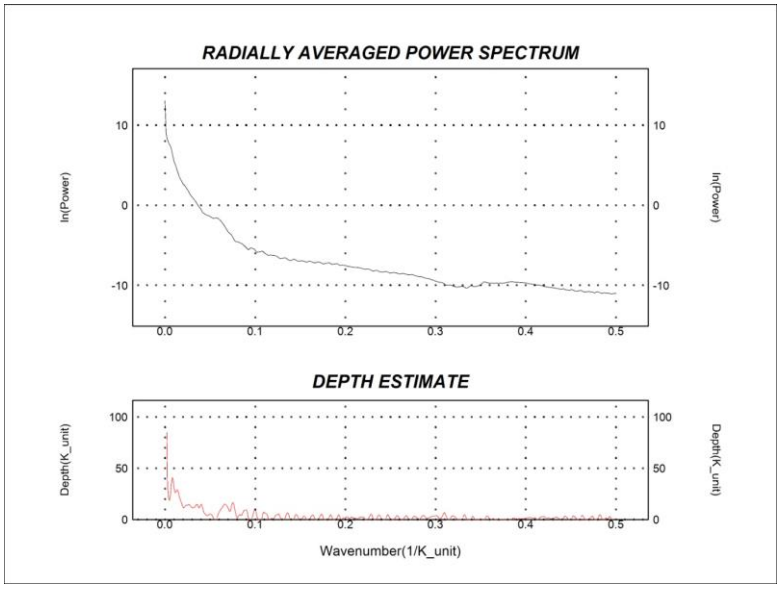

Figure 1 - *Radially averaged power spectrum of the Bouguer anomalies (Oasis Montaj, 2007, Geosoft)*

The logarithmic decay energy curve shows the rapid decrease at low wave numbers, which is indicative of response to deeper gravity anomalies sources. The gentler decline of the remainder of the curve relates to the near-surface sources. The spectrum consists essentially of two components: a very steep part at low wavenumbers and a less steep part at high wavenumbers. This asymptotic character shows that the gravity data has two components:

- A regional component of long wavelength associated with deeply situated sources
- A residual component caused by sources situated at shallow depths.

An important problem when applying the filter is choosing the proper size of the filter for the targeted geological structures. For a filter of a given shape the separation depth is proportional to the grid spacing.

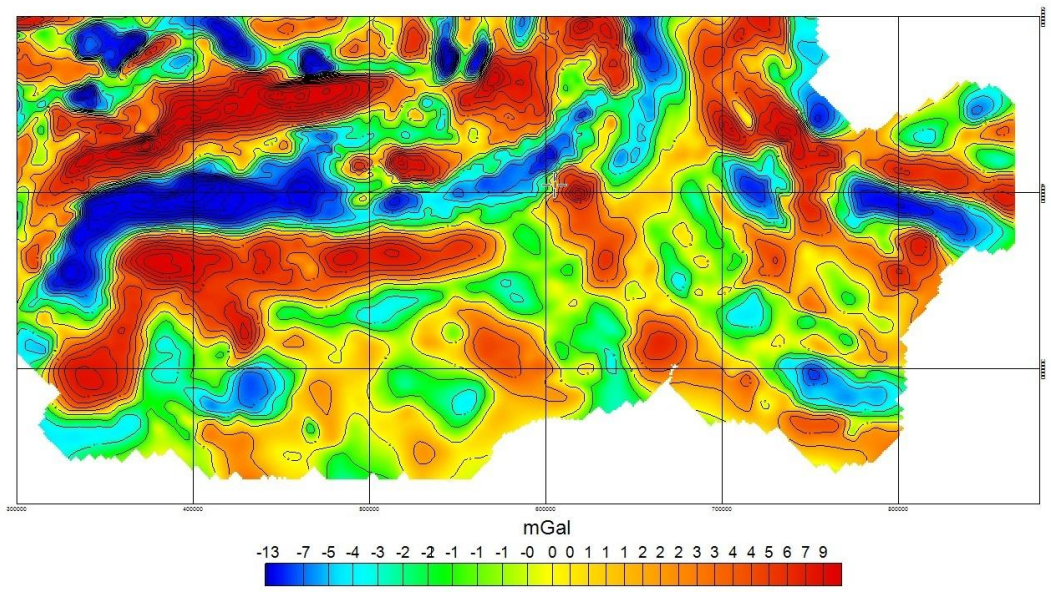

Figure 2 - *Residual Bouguer gravity anomalies*

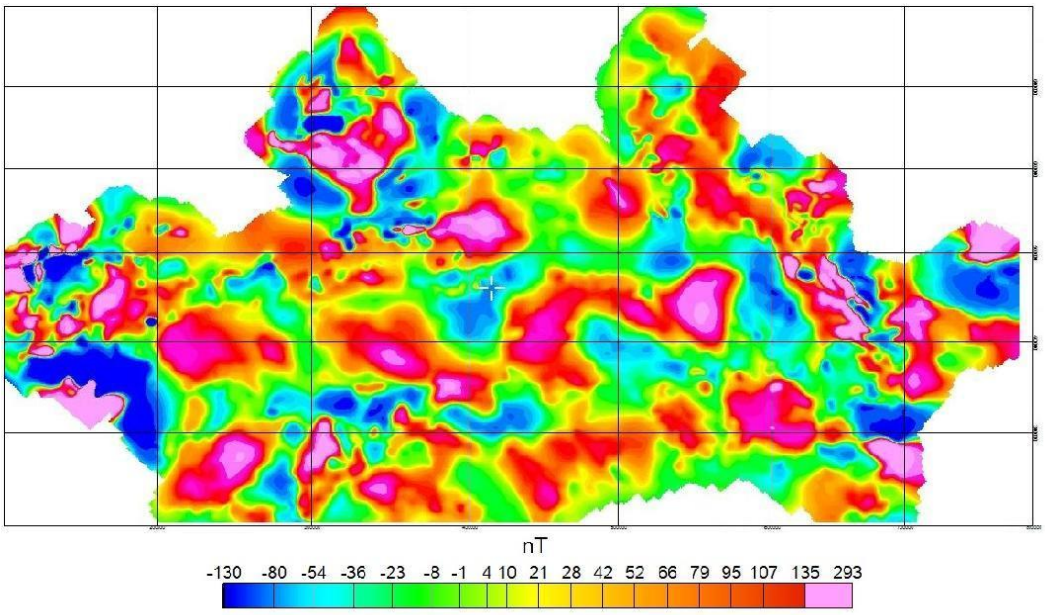

Figure 3 – *Residual magnetic vertical component anomalies*

The results of gravity and magnetic data processing using the wavelength filtering technique are presented in Figure 2 and Figure 3 as residual anomalies maps.

The residual gravity anomalies illustrated in Figure 2 are similar to those previously computed using the "moving averages" filtering technique (Ioane & Atanasiu, 2000). A significant difference consists in the intensity range of the anomalies, the wavelength filtering producing much lower range in anomalies intensity as compared to the moving averages.

CONCLUSIONS

The processing of gravity and magnetic data is a significant stage toward a good quality geological interpretation. A wrong decision in data processing may lead to false geological results, loss of time and funding.

Each map obtained after the processing of gravity and magnetic data is used in interpretation, so the residual gravity and magnetic maps reveal local anomalous sources, the regional maps shows the trend determined by deep gravity and magnetic anomalies sources and the horizontal gradient map highlights structural and tectonic features.

Using residual gravity and magnetic maps 2D and 3D improved models simulating deep geological structures can be also constructed.

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