DEFINING STRUCTURAL CORRELATION USING OF TOTAL HORIZONTAL GRADIENT

Snežana Ignjatović[1], Ivana Vasiljević[1], Milanka Negovanović[1]

[1] Faculty of Mining and Geology, University of Belgrade, Đušina 7, 11000 Beograd, Serbia

Abstract *Gravity data can help to define the structural correlation along significant vertical shifts. The different procedures of mathematical transformations on gravity data are applied to define structural correlations. The paper presents the results obtained using the procedure total horizontal gradient on gravity data. The application of the total horizontal gradient helped to detect contacts with a large dip angle (vertical or subvertical contacts), which can be interpreted as faults. The study area is in the wider area of the Vranje basin was taken as field example. The positions of the main neotectonics faults detected during geological survey in the vicinity of the Vranje basin correspond to the contacts acquired by applying the total horizontal gradient.*

Gravity data can be used to define the structural correlation in the survey area. Vertical or subvertical contacts of two environments of different density may indicate abrupt changes in anomaly values, and these contacts may be interpreted as faults [1].

By applying certain procedures of mathematical transformations to gravity data, structural correlation can be identified in study area. A mathematical transformation that gives good results is the procedure total horizontal gradient, which is applied to the Bouguer anomaly data.

The paper presents the theoretical basis of the procedure total horizontal gradient, and its practical application. As practical example we used data from gravity measurements in the wider vicinity of the Vranje basin.

The procedure total horizontal gradient (THDR) is used to differentiate the boundaries of near-surface causes of gravity anomalies, as well as to identify the position of contacts with a large dip angle, which may correspond to a fault, the front of thrust, etc. On the map of total horizontal gradient, the contacts are detected as the elongated maximum [4,5].

By applying the procedure, the total horizontal gradient on the data of Bouguer anomalies can be detected by contacts, which have a large dip angle, and which can be interpreted as faults. The wider area around the Vranje basin was chosen as the test area. The boundaries of the exploration area in the Gauss-Krüger coordinate system are [7550 km - 7600 km] and [4700 km - 4730 km].

The positions of the main faults for the study area in this paper were taken from the neotectonics map [6]. The dominate directions of neotectonics faults in the study field are NE-SW and SE-NW.

To create the Bouguer anomaly map, which is the basis for further processing, gravity survey data from the former Yugoslavia were used [2]. To eliminate or reduce errors and disturbances in the measured signal, data filtering was performed. The filtered map of Bouguer anomaly is shown in Figure 1.

On the map of Bouguer anomaly (Figure 1), sudden changes in the values of anomaly are observed, which may indicate the existence of vertical or subvertical contacts of two environments of different densities.

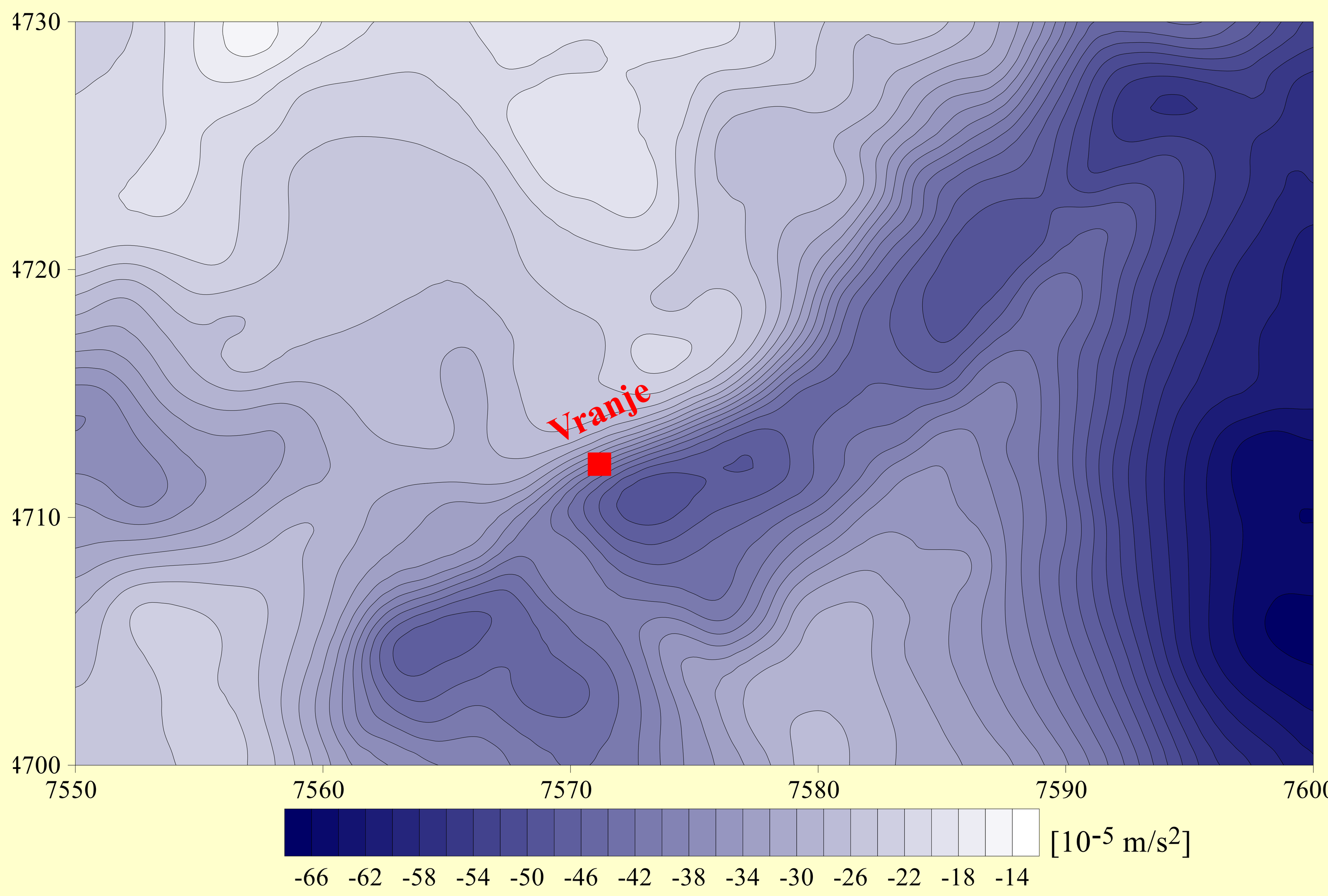

Figure 1. Filtered map of Bouguer anomaly

To detect contact with a large dip angle (vertical or subvertical contacts), the total horizontal gradient on Bouguer anomaly was applied (Figure 2). The contacts are identified as the elongated maximum on the map of total horizontal gradient [4.5]. The contacts in Figure 2 are drawn in black lines. These contacts have a dominant direction NE-SW and SE-NW.

To accomplish a detailed interpretation of the data it was necessary to compare the contacts detected based on the total horizontal gradient, with faults detected during geological surveys for a given exploration area. The positions of the main neotectonics faults are shown in Figure 3 and were obtained from the neotectonics map of Serbia [6].

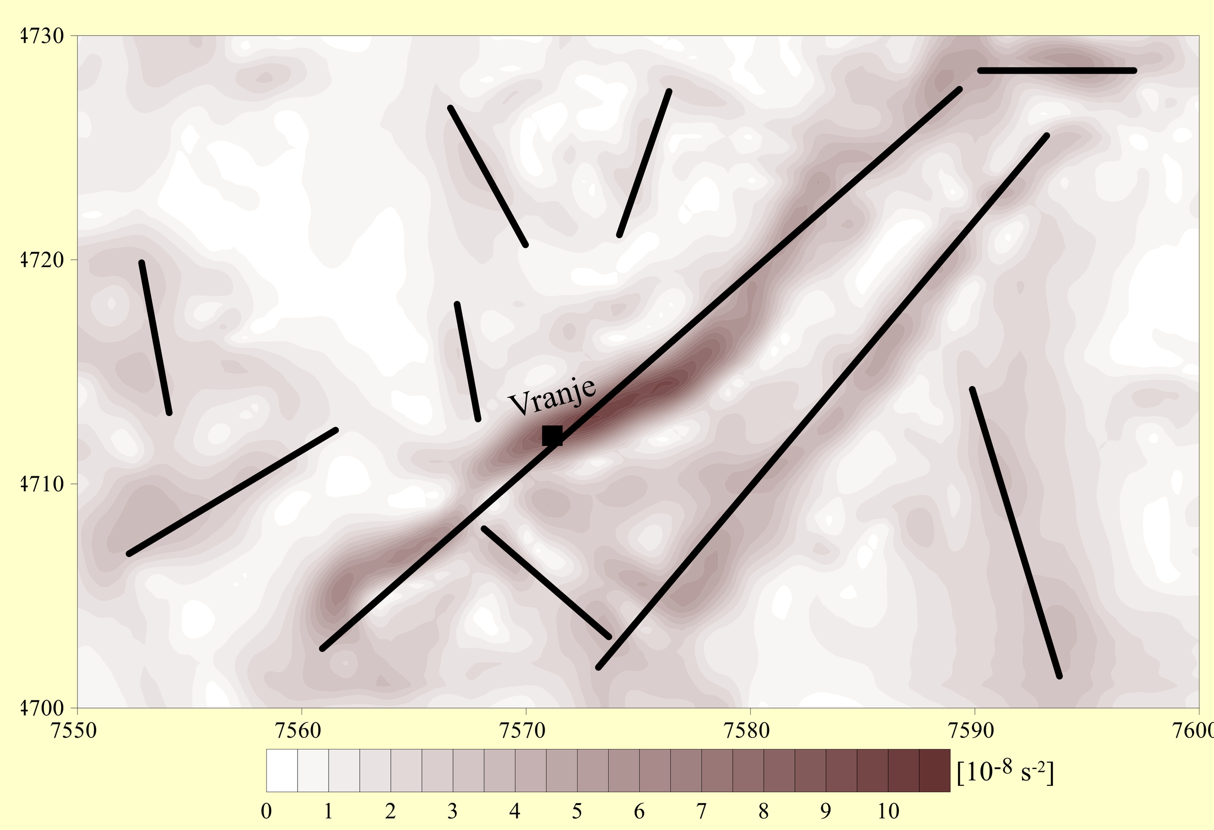

Figure 2. The map of total horizontal gradient

(black lines - interpretation contacts)

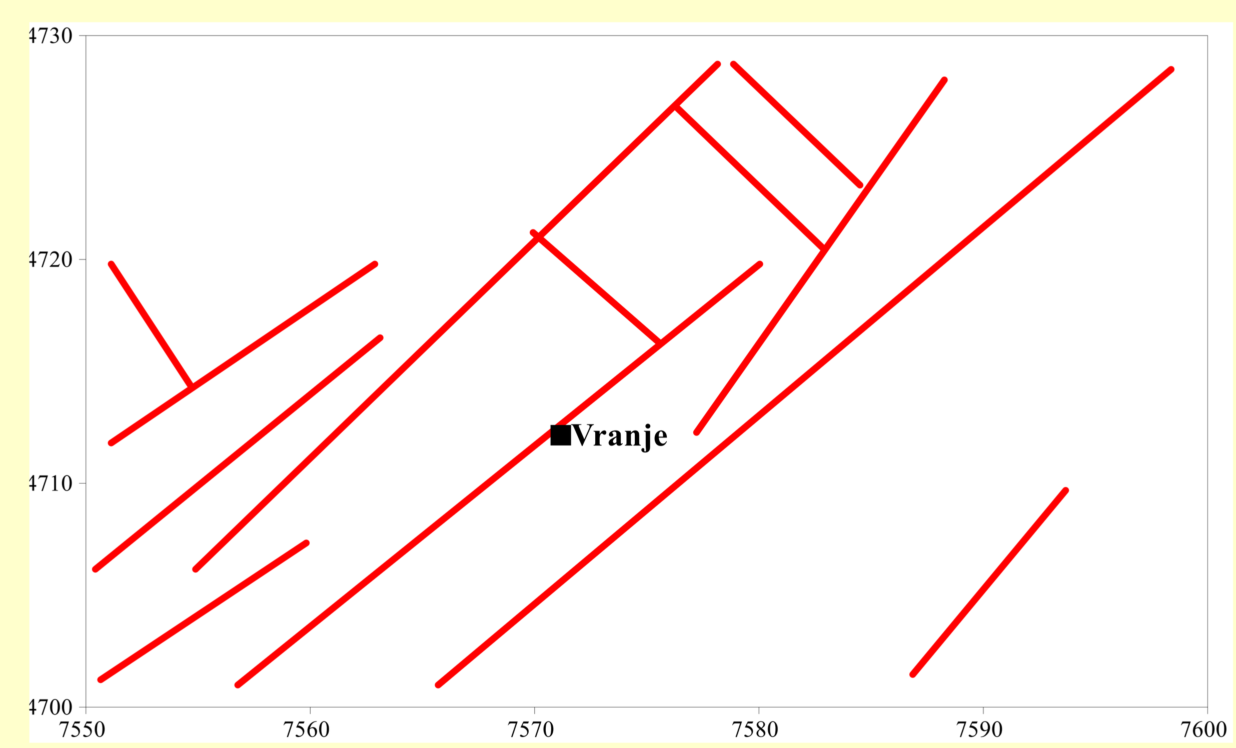

Figure 3. The positions of the main neotectonics faults

(faults – red lines)

Figure 4 shows the contacts defined by the total horizontal gradient (black lines) and faults defined during geological research (red lines), which were taken from the neotectonics map [6]. Contacts/faults general direction is NE-SW and SE-NW.

CONCLUSION

Different procedures of mathematical transformations on gravity data can help to successfully distinguish contacts in the exploration area, which can correspond to faults with a large dip angle. The paper shows that applying a mathematical transformation of the total horizontal gradient to gravity data, facilitate detection of vertical and subvertical contacts. These contacts can be interpretated as faults.

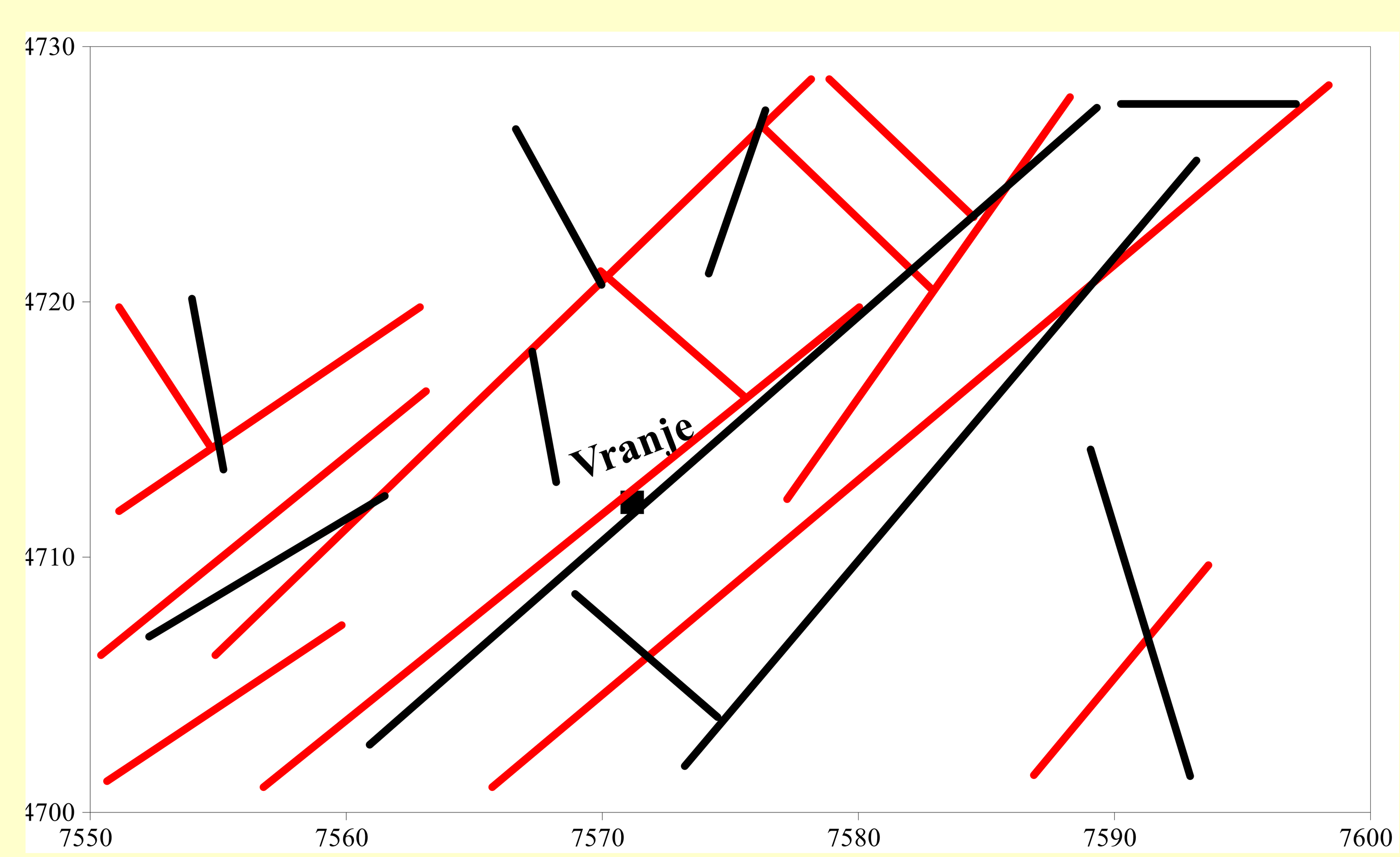

Figure 4. Map of contacts obtained using the total horizontal gradient (black lines) and faults defined during geological research (red lines)

REFERENCES

[1] Vasiljević I, Ignjatović S. *Osnovi gravimetrije - praktikum*, Univerzitet u Beogradu - Rudarsko-geološki fakultet, Beograd, 2016.

[2] Bilibajkić P, Mladenović M, Mujagić S, Rimac L. *Tumač za gravimetrijsku kartu SFR Jugoslavije – Bugeove anomalije 1:500 000*, Savezni geološki zavod, Beograd, 1979.

[3] Cooper GRJ, Cowan DRD. Edge enhancement of potential-field data using normalized statistics. *Geophysics*, 2008, Vol. 73, No. 3, pp. H1-H4.

[4] Miller GH, SinghV. Potential field tilt-a new concept for location of potential field sources, *Journal of Applied Geophysics* 32, 1994, pp. 213-217.

[5] GETECH. *Advanced Processing and Interpretation of Gravity and Magnetic Data*, Getech Kitson House Elmete Hall Leeds, UK, 2007.

[6] Marović M. Toljić M, Rundić Lj, Milivojević J, *Neoalpine Tectonics of Serbia*, Serbian Geological Society, Beograd, 2001.