

Geophysical investigations on regional geology profiles in the West Serbia Region

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Area of investigations

This paper represents an effort to define contact zones between large tectonic units in Western Serbia, with applied geophysical methods of investigations. The area of investigations comprises parts of the Jadar Block, Vardar Zone and Drina-Ivanjica Element. The figure below represents the geological map of the investigation area with positions of the surveyed sections.

Geomagnetic investigations

Lower anomalies of geophysical field that are registered on a smaller part of the investigation area are a

result of thick series of bedded limestone. Localities with high anomalies are in the southeast part of the investigation area and they coincide with serpentine rocks of different levels of metamorphism.

Map of vertical magnetic anomalies of the Earth's magnetic field is made on the basis of data of geomagnetic survey on 140 measurement points (0.19 points/km²). Because of low density of points, it is possible to determine only big units. In the figure below, we can see positive anomalies over peridotite, and they are less sharp over diabase and serpentine.

Gravity investigations

Map of Bouguer anomalies is made on the basis of data measurements from 398 gravity points (0.55 points/km²) and average density of 2.66 g/cm³. Maximum values of anomalies are above ultrabasic rocks and diabase. Minimum values of anomalies are

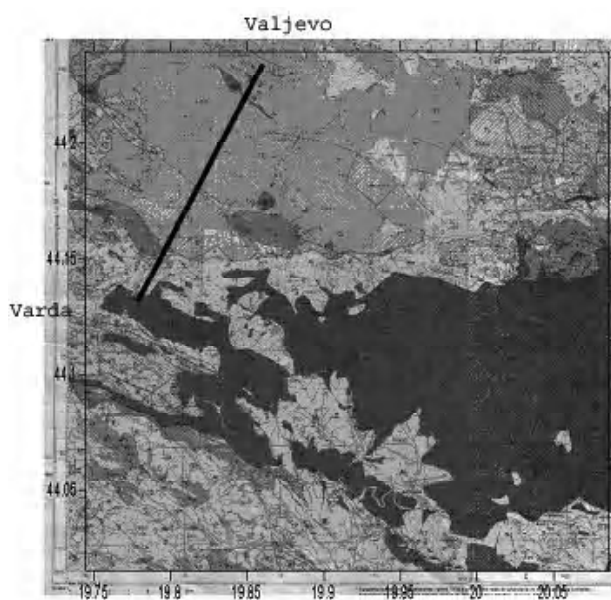


Fig. 1. Geological map of the investigation area with the position of the survey sections (Basic geological map Sheet 1:100 000 Valjevo and Sheet 1:100 000 Gornji Milanovac)

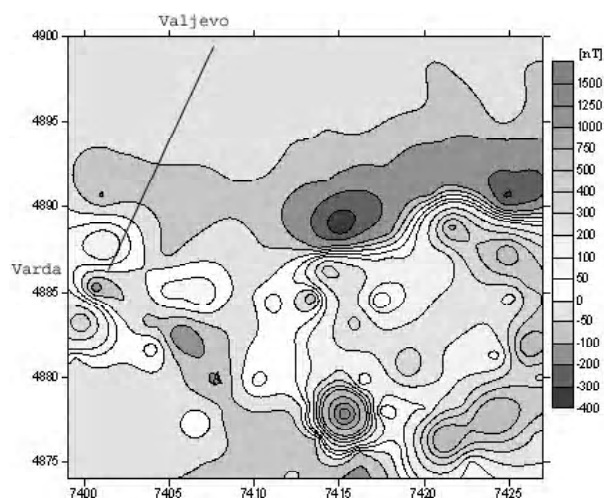


Fig. 2. Anomalies of vertical component of geomagnetic field and profile positions

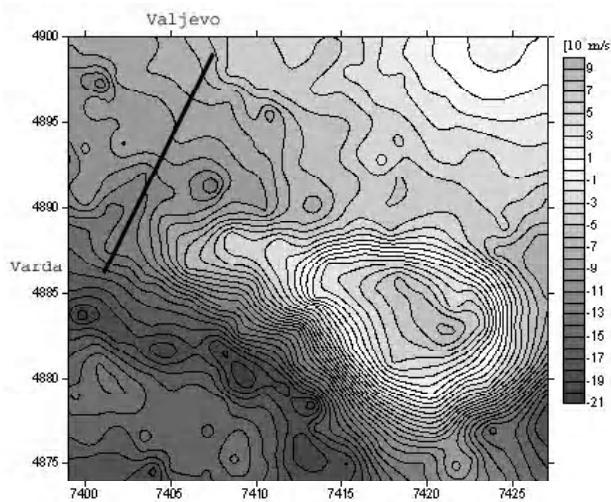


Fig. 3. Gravity anomalies and profile positions

above younger sediments (Miocene) and Cretaceous deposits and serpentinite west of Divcibare (samples are with low density 2.19 g/cm^3 , probably because of a higher level of serpentinization). Local minimums are in the northwest, near the acidic intrusives in the vicinity of Triassic limestone. Separating ophiolitic melange from Cretaceous sediments is obscure.

Interpretation of Varda-Valjevo profile

On the basis of gravity and geomagnetic field anomalies, it is necessary to define geometrical and physical parameters of the causes of the anomalies such

as position, depth and subsurface configuration of structures. These parameters can be defined if magnetic and gravity influences on the Earth's surface are calculated on the basis of an assumed geological configuration of causes of anomalies and probable values of magnetization intensity, magnetic susceptibility, density of rocks. Theoretically calculated results are compared with the measured ones. If these values mutually deviate more than the proposed data, the assumed model is modified till a satisfactory correspondence is obtained.

Sites for measurement of the vertical component of geomagnetic field are set up at every 750 m. Densities are determined on the basis of field samples and tabular data for certain types of rocks. Magnetic anomalies over serpentinite and diabase are noticeable. Lower values of gravity and magnetic anomalies over diabase indicate their small depth.

Sections along regional profiles

Detailed geomagnetic investigations were performed by measuring total intensity of the magnetic field by proton magnetometers. All the cross-sections are in the West Serbia Region, between Kosjerić and Valjevo, on the slopes of Maljen and Povlen Mts., and they were set perpendicular to the boundaries of different geological units (parts of the Jadar Block, Drina-Ivanjica Element, Vardar Zone ...). Average length of these cross-sections is 200 m.

Section 12

This section lies perpendicular to transgressive boundary between the Triassic and Paleozoic of the

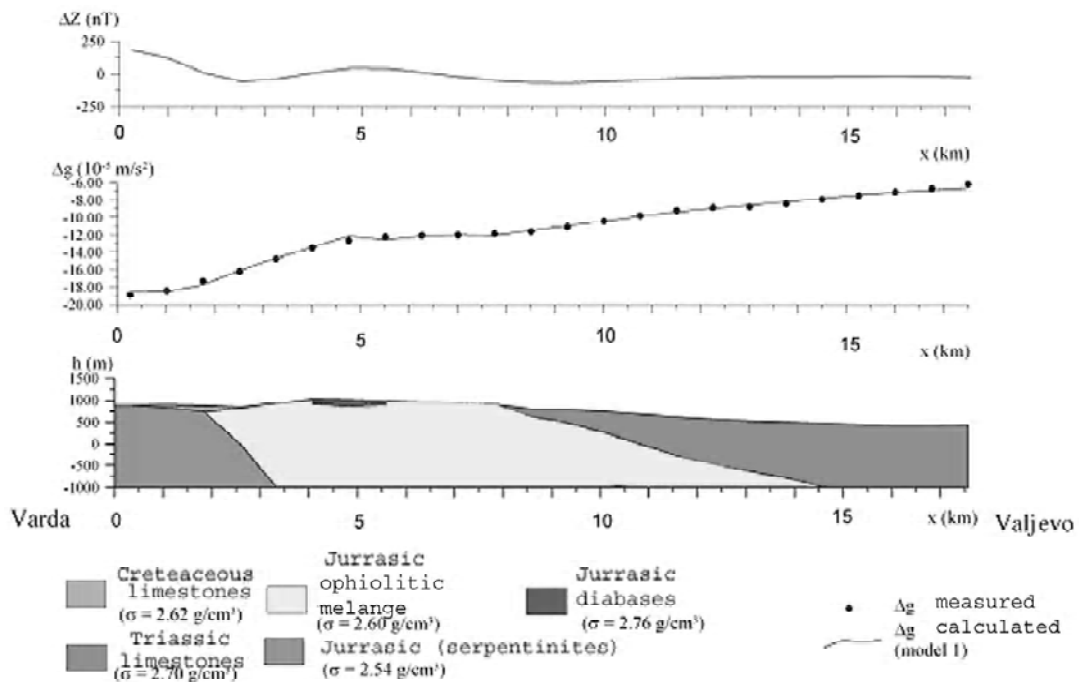


Fig. 4. Model of the profile Varda-Valjevo with the magnetic and gravity anomalies

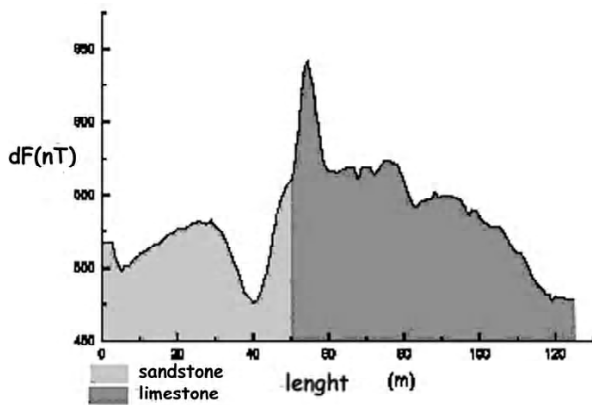


Fig. 5. Section 12

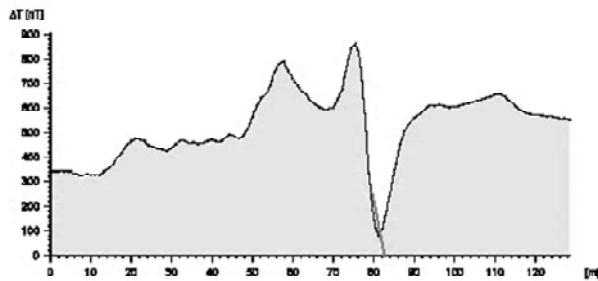


Fig. 6. Section 13

Drina-Ivanjica (fig 1). Azimuth of the section is about N 282° and length of the section is about 128 m.

Between 40th and 60th meters of this section, there is a relatively big anomaly with the amplitude of about 160 nT (fig 5). Position of that anomaly coincide with position of the lithological boundary and that anomaly is a result of different magnetic characteristics of limestone and sandstone. Level of magnetization of limestone is higher than that of sandstone. The anomaly is just an effect of the contact zone between sandstone and limestone.

Section 13

First 20 m of this section, whose total length is about 130 m, lies over serpentinite and the rest of it lies

over limestone. Theirs contact should be tectonic — an imbrication structure. Azimuth of the section is about 135°. At the contact zone, there is a noticeable anomaly with the amplitude of about 150 nT (fig 6). Much larger anomaly is about 80th m deep in carbonate with amplitude of about 800 nT. It is possible fault zone that is not noticeable at the Earth surface.

Conclusion

In this paper, a 2D interpretation of sections is given and it doesn't give unanimous and adequate geological explanation. Besides, we managed to separate large geological units within the investigation area by modelling of geomagnetic measurements and by gravity data.

On the current level of investigations and on the basis of current knowledge, we assumed the position of the north boundary of ophiolitic melange of the Vardar Zone. Below the Triassic rocks of the Jadar Block, the Ophiolitic Melange of the Vardar Zone extends northward to the line Lelic-Banja Vrujci. The obtained results does not give possibility of quantitative interpretation, because we need data of other geological and geophysical investigations (susceptibility measurements, detailed geological mapping...) for such interpretation. In that sense, these results stay in the domain of qualitative interpretation.

The results of measuring of changes in total intensity of the vector of the geomagnetic field along the cross-sections were reduced according to daily variations of geomagnetic field, which were registered in the base station set in the field. Daily variations in total intensity of the vector of the geomagnetic field in the base station were compared to the daily variations registered in the Geomagnetic Observatory Grocka (GCK).

Results show very good correlation between geomagnetic data and data of geological mapping and the measured elements of tectonic fabric. This paper represents introduction to the future investigations that will deal with correlation between different geophysical methods and tectonic and geological investigations. Only complex investigations can enable high-quality interpretation of the existing data.

This paper shows the possibility of using geophysical investigations for determination of different lithostratigraphic units and marking faults.