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IP ANOMALOUS EFFECT CONDITIONED BY RUGGED RELIEF AND ORIENTATION OF THE POLARIZING CURRENT VECTOR

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The largest part of the territory of Albania is mountainous. The deposits of solid polarizable minerals as copper, chromites etc. are located in the ophiolitic belt situated in mountain regions characterized by rugged relief. Such geomorphologic conditions and the morphology of ore bodies itself condition the configuration and the amplitude of IP anomalies.

The effect of these factors is studied using physical models, 2D and 3D mathematical finite element models, and the results are compared with the data from field surveys as well. In this paper there are analyzed some results of mathematical models for irregular shaped ore bodies under rugged relief. These results are presented in IP Real Sections.

The 3D mathematical models are based on the assumption that the polarizing currents are distributed in a homogeneous half-space. To take into account the contrast of resistivity between prismatic bodies and the environment we modify the polarizability of the body to include the effect of virtual currents generated because of the contrast of resistivities. Finite elements are used to calculate the effect on the surface of IP generated on the surface of the body by polarizing currents. In the case of 2D models there is supposed that the polarizability is distributed within the volume of the body. Finite elements are used to calculate the density of the polarizing gradient within the body. The environment may be heterogeneous, as well as the effect of the relief is included both for polarizing and polarized currents.

Modeling is carried to evaluate the effect of two factors deforming the IP anomalies:

1. Rugged relief - the target bodies are located under mountain crests, valleys and slopes.
2. Position of target bodies relative to current electrodes of gradient arrays.The rugged relief do influence in two ways. The relief creates variations in the distribution of the polarizing currents and its gradient on the surface of polarizable bodies, modifying the configuration of IP phenomena around the body. But at the same time the relief modifies the scattering of IP currents, influencing the values measured on the surface of the terrain. As result, the anomalies may have deformations both in amplitude and configuration.

For a vertical targets situated under a valley the anomalies have increased compared with case of the flat relief. Under crests the amplitude may decrease and, depending on the depth of the body, its configuration may change even to a bi-modal one. The sides of anomalies may be deformed as well, but generally they remain symmetric. In cases of non-vertical targets under valleys the anomalies are asymmetric with lower amplitudes, as result of the decrease of polarization current gradient on the surface of the body. In cases of targets with small cross-section under crests the negative sides of the anomalies have higher amplitudes, as result of the position of the body relative to the surface.

The orientation of the polarizing current vector do influence directly on the configuration of the IP phenomena around the body, and the typical case is when the target is situated near one of polarizing current electrodes. Even in a flat relief the anomalies may be strongly deformed. By putting the electrode near the body, the anomalies became asymmetric with lower amplitudes. The asymmetry increases until the electrode goes over the body, in which case the anomaly becomes bi-modal with a zero, value over the body having amplitude almost the half of the symmetrical case. The presence of rugged relief in such cases may cause even more strange deformations of the anomalies. The rugged relief itself may condition the position of the current electrode near the body.

In the paper there are presented a number of typical cases from numerous models. Understanding these models and related phenomena would help to assure a good interpretation of the field data, obtaining correct localization of ore bodies and their spatial position. The results of modeling are confirmed by physical models and field examples from IP geoelectrical surveys in Albania, as well as from the field works of the Canadian Company QUANTEC IP.