P9-2 A GEOTOMOGRAPHIC METHOD FOR STUDYING THE ROCK MASSES BETWEEN DRIFTS ACCORDING TO DATA FROM THE RADIOWAVE SOUNDING

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Introduction

From the sixties, the radiowave sounding has been applied effectively for studying the rock masses between drifts in Bulgarian deposits (Ivanova,V., Pistalov,St., 1972, and others). The method is aimed towards a detail mapping of known orebodies, or towards searching new orebodies during the process of underground geological investigation. The application of geotomography in the final stage of interpretation is giving optimum results.

The subject of the studies revealed in the present work is the possibility to apply the developed "ray-path" method (Dimovski,S., 1990, 1992) for obtaining geotomographic solutions, based on data from radiowave sounding. Results obtained for some Bulgarian ore deposits are illustrated. The obtained results for cases with different relative density and different rays distribution in the sounded area are of methodological and practical interest.

Basic information for the method of field investigations and the essence of the "alternative ray-path" geotomography

The field investigations were performed by a set of equipment for radiowave sounding, developed by the Department of Applied Geophysics in the University of Mining and Geology "St. Ivan Rilski", Sofia. The utilised frequencies were 0,468 , 1,00 and 8,00 MHz , and the sounding interval was respectively 150 - 80 m. The step between the points of measuring was 1 meter.

In the presented work is performed a reinterpretation of some of the data by applying the "alternative ray-path" geotomography. This method is aimed towards detection of objects (orebodies) with anomalous value of the coefficient of absorption ($\mathbf{b}_a$) of the electromagnetic energy in a host medium (background) with specific "background" value of this coefficient ($\mathbf{b}_f$). The "background" value of the coefficient $\mathbf{b}_f$ is determined by utilising all measurements. The ray with the maximum length of the ray-path $\mathbf{r}_b$, having a measured signal $\mathbf{E}_b$ is defined as a "basic" ray and is used for the calculation of the effective value of the coefficient of absorption $\mathbf{b}_{ef}$ for all the remaining rays according to the following expression:

$$b_{ef,j} = \frac{1}{r_j - r_b} \ln \frac{E_b r_b}{E_j r_j} \qquad (1)$$

where $\mathbf{E}_b$ and $\mathbf{E}_j$ are the signals measured on distances respectively $\mathbf{r}_b$ and $\mathbf{r}_j$ from the source of the radiowave field.

A statistical analysis of the obtained data is performed in order to determine the coefficient of absorption of the background (host) medium. On the basis of this value, the "background" rays are defined and a certain part of the background (host) medium is identified. This part depends on the angle of visibility of the anomalous object and on the rays density. The initial model is formed, where the anomalous zone is mapped by the peripheral "background" rays.

The initial anomalous values of the coefficient of absorption are determined on the basis of the initial model using the expression:

$$b_{a,j} = \frac{b_{ef,j}\, r_j - b_f\, r_{f,j}}{r_{a,j}} \qquad (2)$$

After performing a statistical analysis, the possible anomalous value of the coefficient of absorption $\mathbf{b}_a$ is defined. Using the obtained coefficients of absorption for each anomalous ray, the respective interval of the ray-path $\mathbf{r}_a$ through the anomalous object is calculated:

$$r_{a,j} = \frac{b_{ef,j} - b_f}{b_a - b_f}\, r_j \qquad (3)$$

The obtained anomalous intervals are used for mapping the anomalous object.

Detection of anomalous objects in the studied rock masses

The presented examples illustrate the approach towards the application of the ray-path geotomography and the obtained results for different ore deposits in Bulgaria.

The basic stages of the radiowave sounding data processing utilising the ray-path geotomography are shown for a part of the Tchiprovtsi ore deposit.

Final results are shown for parts of the ore deposits of Krumovo, Martinovo and Elshitsa.

Conclusions

- The radiowave sounding is a highly effective geophysical method for remote studying of the rock masses between drifts during the process of geological investigation in the stage of production.

- The developed method of ray-path tomography allows the optimum utilisation of all the measured data.

- For the obtaining of a well detailed map of the sounded area, the situation of the stations and the measuring points has to provide the maximum rays density and the widest possible angle of visibility for the present specific conditions.

References

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