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INTERPRETATION AND CREATION OF THE BLOCK MODEL OF THE Zn, Pb DEPOSIT RIBNIK-ŠUPLJA STIJENA

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Abstract

Interpretation of the deposit and its immediate surroundings through the corresponding block-model implies their division into blocks of regular dimensions. The size of a block depends on numerous factors of the mathematical-statistical nature, degree of complexity of the deposit geological structure, etc. In general, the blocks must not be too small, because in this way the errors and calculations of the total volume of mined space, and quality of useful and accompanying components ("estimates") increase, but they must not be too large either, because they must be adapted to the characteristics of the planned exploitation method.

***Keywords**: variogram, kriging, deposit, blocks*

1. INTRODUCTION

Calculation the reserves of mineral raw materials is carried out applying the optimal methods of reserve calculation that ensure sufficient accuracy and rationality of the calculation. Particular attention must be paid to the shape and size of the deposit, that is, the ore body, the nature of the variability of quantitative and qualitative indicators, as well as how the ore body is covered by exploration works (schedule, density, type of exploration works, etc.) [1].

The interpretation of the deposit and its immediate surroundings through the corresponding block-model implies their division into blocks of regular dimensions. The size of a block depends on numerous factors of a mathematical-statistical nature, degree of complexity the geological structure of the deposit, etc. In general, the blocks must not be too small, because in this way the errors and calculations of the total volume of mined space, and the quality of useful and accompanying components ("estimates") increase, but they must not be too large either, because they must be adapted to the characteristics of the planned exploitation method [2, 3]. Bearing the above in mind, the block size of 2x2x2 m was adopted for the Ribnik deposit

2. INTERPRETATION OF A BLOCK MODEL

The space in which the block model is located is limited by the points with the following coordinates. (T1: 6.586.000, 4.803.287; T2: 6.586.288, 4.803.030; T3: 6.586.130, 4.803.428 and T4: 6.586.415, 4.803.171), approximate dimensions 385x190 m.

A block model was formed with:

- 192 rows
- 95 columns
- 100 levels (from +1.300 m to +1.100 m).

By creating the block model, the following values were defined for each block:

- A type of rock;
- Density;
- Content of useful and harmful components: Zn (%), Pb (%), Ag (g/t), Cu (%) i Fe (%).

The economic value of the block, i.e., the amount of useful components in the block or profit, which is realized by mining of that block.

Determination the content of specified components (Zn, Pb, Ag, Cu i Fe) in the blocks, it started with creation the variograms, which represent the basis for calculation ("estimation") the content (Figures 1 to 5) and Table 1 [3].

Variograms can be made from all or selected individual or composite samples. The "extract files" were created for the Zn, Pb deposit Ribnik, which contain data on the exact location of data in a space, as well as the values on quality of the mineral raw material. The extract files were created for composite samples (Zn, Pb, Ag, Cu and Fe). As reference points of all extract files, either individual or composite samples, the middle of samples were taken, in order to perform the three-dimensional interpretation of the relevant mined spaces as correctly as possible [2, 3].

Table 1. *Basic data of displayed variograms*

Variogram figure	Ele-ment	Direction	Nagit	Type var. 1	The threshold	Range (m)	Type vari. 2	The threshold	Range (m)	Type var. 3	The threshold	Range (m)
1	Zn	OMNI	0.3169	spherical	0.3807	7.5	spherical	0.1573	15	spherical	0.1478	27
2	Pb	OMNI	0.3329	spherical	0.3010	5	spherical	0.2276	20	spherical	0.1414	45
3	Ag	OMNI	0.1254	spherical	0.1542	10	spherical	0.2914	20	spherical	0.4318	42,5
4	Cu	OMNI	0.2307	spherical	0.4095	10	spherical	0.2084	25	spherical	0.1510	40
5	Fe	OMNI	0.2850	spherical	0.1446	7.5	spherical	0.1382	20	spherical	0.4350	45

2.1 Display of Semi-Variogram for the Ribnik Deposit

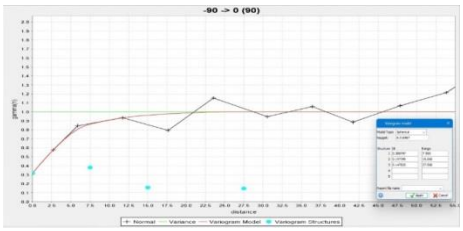

Figure 1. *Variogram for Zn*

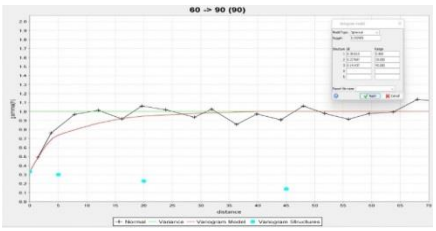

Figure 2. *Variogram for Pb*

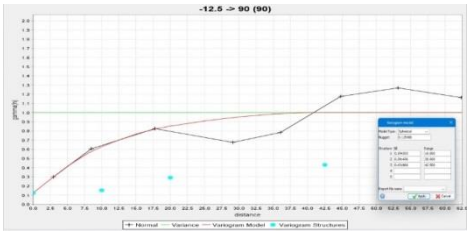

Figure 3. *Variogram for Ag*

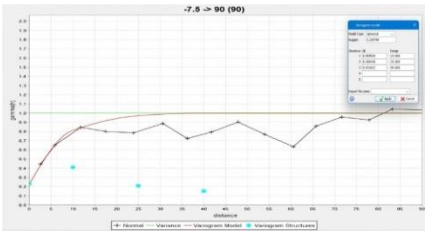

Figure 4. *Variogram for Cu*

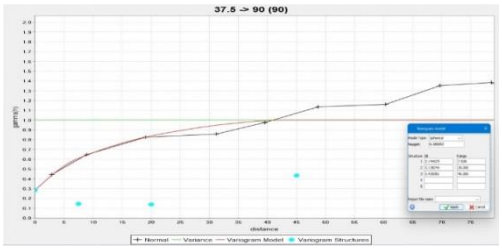

Figure 5. *Variogram for Fe*

Legend:

- variogram from the data

- theoretical variogram

1) spherical – variogram type; - Spherical, variogram range; variogram threshold;

2) "nugget effect" - nagit (grouping of data - compactness as a function of distance between samples); Gamma (H) – variogram value.

2.2 Kriging

The evaluation of the block model can be done in several ways, depending on the method that is judged to be adequate for determined type of mineralization. The methods that can be used are: true kriging, simplified indicator-kriging, complex indicator-kriging for a simplified model, complex indicator-kriging for a complex model, inverse distances and inverse distances with anisotropy. In the previous work, the most commonly used methods of assessment for such deposits are the true kriging and inverse distance method [2, 3].

For the interpretation method, the true kriging method was adopted for the following reasons:

- high correlation coefficients;
- the best results.

Before the kriging was performed, the processing (profile) had to be defined, i.e., in what way and with what parameters kriging is performed. The selection of the best profile for kriging was made with the help of the cross-validation method, which was programmed specifically for that purpose. The principle of this method is to estimate the

known values of useful component in a certain block, based on the surrounding values. In this way, the estimated values in that block are obtained, which can be correlated with the real values, that is, the contents of useful components, obtained by the chemical analysis of taken samples. Practically, the procedure is performed for all samples from the drillholes. This procedure was performed for all obtained variograms and defined kriging profiles. As a final result, the correlation between the real and calculated values, i.e., correlation coefficients, is obtained. The methods for which the highest correlation coefficient is determined, are considered as the most reliable for the assessment (interpretation) of deposits [2, 3].

2.3 Limits of Interpretation and Evaluation of Blocks in the Deposit

During the interpretation and evaluation of the block model, the following conditions are set for the system which blocks can be evaluated:

- That the minimum points for kriging should be 3 (three);
- That the minimum octant for assessment is 3 (three);
- Maximum number of data per octant to be 6 (six);
- That the search range is defined for each component.

Blocks that did not meet this condition were not evaluated. In this way, the possibility of evaluating blocks of low confidence (accuracy) was avoided. In the area covered by the Ribnik deposit, there were no blocks that remained unassessed.

3. CONCLUSION

The main purpose of the block model is to show the distribution of content of the analyzed chemical elements within the mineralized space (deposit, i.e., ore body), as a necessary basis for designing their exploitation, but also to enable a more precise assessment of metal reserves taking into account their spatial distribution.

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