INTERCOMMUNICATION OF CONTENT OF QUALITATIVELY-TECHNOLOGICAL INDEXES OF MINERALS IS WITH DEVELOPMENT OF MOUNTAIN WORKS

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Summary

Object of research. The estimation of mean value of the naturally-spatial placing of changeability of content of quality indexes in the bowels of the earth is based on research of changeability of description of signs, analysis of ore-mining geometrical parameters of blocks, areas of ore body and bed of deposit of ferrous quartzites and network of reconnaissance mining holes. For the regular networks of assay of the naturally-spatial placing of changeability of content of quality indexes of minerals in the array of balance-industrial supplies the calculations of coefficients are conducted in good time for the most tyFigal configurations of mutual location of block and tests that participate in an estimation.

Methodology of researches. Taking into account the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass in un magnetic mineral forms, four technological groups are distinguished ferrous quartzites that differ on content of qualitatively-technological indexes of minerals.

Purpose and research problems. This estimation of annual and perspective plans of development of mountain works taking into account the dynamics of changeability of qualitatively-technological descriptions of signs of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass at moving of mountain works both on reaching and on the depth of quarry. The methods of the automated geometrizing of content of quality indexes of minerals of areas of ore body and bed of deposit of ferrous quartzites are considered.

Keywords: ferrous quartzites, content of qualitatively technological indexes, mountain works.

Introduction

A problem and her connection are with scientific and practical tasks. Within the framework of general conception of management of the prepared products qualitatively technological indexes from positions of approach of the systems construction of the system of surveyor-geological management naturally-spatial placing of change-

ability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass is based on principles [1]:

- to the management unbreak naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass and by volume of producing of the prepared products;
- to the management complexity on functions, tasks and informative providing;
- to unity of management process on all cycle of forming of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass from planning to the consumption;
- standardizations of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass as to the means of management.

At development of annual and perspective plans of development of mountain works the dynamics of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals is taken into account in an array and loosening iron-ore mass at moving of mountain works on reaching and on the depth of quarry.

Analysis of researches and publications. Establishment of conformities to law of changeability of content of qualitatively-technological indexes of minerals in iron-ore mass and determination of limits of oscillation on the different areas of ore body and bed of iron-ore deposit on a career will allow clearly and reasonably to plan direction of development of mountain works, stabilize content of qualitatively-technological indexes of minerals in iron-ore mass and improve the technical-economical indexes of work of ore mining and processing combine [2].

Rising of task. Coming from the requirements of mountain production and functions of surveyor-geological departments on the content management of qualitatively-technological indexes of minerals in iron-ore mass embrace practically all complex of tasks, have connection with planning and planning of mountain works, directly with the booty of balance-industrial supplies in the process of development of areas of ore body and bed of iron-ore deposit up to shipping of commodity iron-ore mass on an ore mining and processing factory [3].

To planning and calculation of the average systems of content of quality indexes of minerals in iron-ore mass on an ore mining and processing combine research of statistical descriptions of content of qualitatively-technological indexes of minerals in an array and iron-ore mass on the areas of ore body and bed of iron-ore deposit and transformation is preceded in the process of booty of balance-industrial supplies and exception of content of quality indexes useful to the component, related to magnetite [4].

Exposition of material and results. From data of operating assay of blast holes of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array on the career of ПрАТ «South ГЗК» the built graphic arts of oscillation of content of quality indexes of minerals in iron-ore mass on a general and magnetite useful component (Fig. 1) [5].

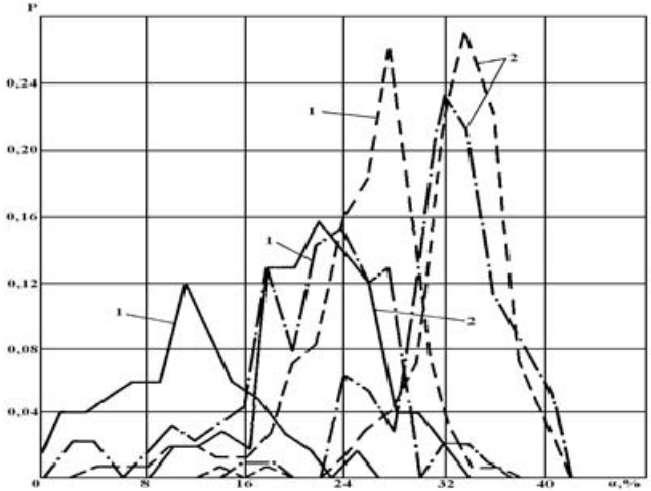

Fig. 1 - Naturally-spatial placing of changeability of content of quality indexes of minerals in the array of balance-industrial supplies on the career of ПрАТ «South ГЗК»: *1* - α_{mg}; 2 - $\alpha_{заг}$; (----) - horizon is minus a 15 m; (-- --) - it is horizon minus a 30 m; (-- · --) - horizon is minus 45 м

It is shown on graphic arts that for to all considered horizons distribution of content of quality indexes of minerals in iron-ore mass is near to the normal law [6].

Statistical data about distribution of content of qualitatively-technological indexes of minerals in iron-ore mass on extractive ho-

rizons of quarry testify to the considerable vibrations of content of qualitatively-technological indexes of minerals to iron-ore mass: $\alpha_{заг}$=3,8-4,6 %; σ_{mg}=5,4-6,9 % [6].

For research of changeability of content of qualitatively-technological indexes of minerals at the component quartzites of IV of ferrous horizon of quarry of ПрАТ «South ГЗК» on the chemical and phase analyses of mining holes of operating secret service distribution of different components curves are built.

Analyses are used here equipartition for areas deposits of ferrous quartzite on the quarry. On correlation of minerals, to the chemically-analytical and texture criteria on Skelewativske deposits distinguish three groups of basic varieties of ferrous quartzite: to magnetite, silicat-carbonat-magnetit and to gematit-magnetit. An additional group is presented by the poorly-oxidized and semi oxidized varieties [7].

They got histograms certify the wide range of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass on Skelewativske deposit of ferrous quartzite.

Distribution of content of qualitatively technological indexes useful to the component of general iron and related to magnetite near to the normal law. They change accordingly within the limits of 20-48 %; 10-42 %.

Interval of changeability of content of qualitatively-technological indexes useful to the component, related to magnetite in carbonate and silicate and gemmated far fewer and folds 1-17 %; 1-13 %.

The analysis of distribution of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass on a career shows that on ore mining and processing combines takes place considerable oscillation of content of qualitatively-technological indexes of minerals in iron-ore mass (σ=4,8-15,4) (Fig. 2.) [8].

The necessary condition of effective organization of mountain works in the mode of stabilizing of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass are an analysis and taking into account of changeability of content of the useful component related to magnetite crises-cross and on reaching of ore body.

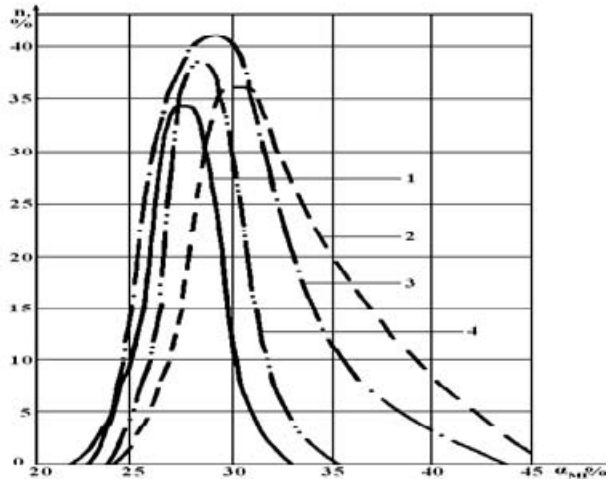

Fig. 2 - Naturally-spatial placing of changeability of content of quality indexes useful to the component, related to magnetite in the mineral varieties of Skelewativske of deposit on the career of ПрАТ «South ГЗК»: *1* is magnetite; *2* is an anhydroferrite; *3* - silicate; 4 - carbonates

Yes, changeability and coefficient of variation on content of qualitatively-technological indexes of the useful component, related to magnetite crises-cross reaching considerably higher than on reaching. For the ground of optimal places and volumes of average of content of qualitatively technological indexes of minerals in iron-ore mass on an ore mining and processing combine determined statistical descriptions and transformation of content of qualitatively technological indexes of minerals in iron-ore mass from one technological stage to other. Commodity iron-ore mass that is shipped from career is characterized [5]:

- by large heterogeneity of content of qualitatively-technological indexes of minerals in commodity iron-ore mass (coefficient of variation of V=5,0 %);

- on an exit from the factories of oscillation goes down approximately twice (V=2,2-4,3 %);

- in the process of growing and magnetic separation shallow there is further substantial reduction of oscillation to content of qualitatively-technological indexes of minerals in iron-ore mass (of V=0,94 %).

Oscillation of quality indexes of concentrate on compositions of ore mining and processing factories (σ=0,45) considerably exceeds norms (0,2 %) what recommended by normative documents [9].

Thus, oscillation of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass has considerable amplitudes that diminish in the process of booty of balance-industrial supplies exception of content of qualitatively-technological indexes of the useful component related to magnetite in 4-6 times.

The vibrations of qualitatively technological indexes of concentrate on compositions considerably exceed norms that need to the metallurgical enterprises that testify to the unsatisfactory process of average nation of content of qualitatively-technological indexes of minerals state in iron-ore mass on ore mining and processing combines. For the terms of working off the quarry of ПрАТ «South ГЗК», at development of annual and perspective plans of development of mountain works the dynamics of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals is taken into account in an array and loosening iron-ore mass at moving of mountain works on reaching and on and on the depth of quarry.

Methodology of establishing a connection is examined between deepening of mountain works and naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass. Establishment of conformities to law of changeability of content of qualitatively-technological indexes of minerals in iron-ore mass with deepening of works on a career, at taking into account of properties and useful to the component, related to magnetite, will allow to define the limits of oscillation of content of qualitatively-technological indexes of minerals on different horizons and in every obtaining coalface.

By a necessary condition for the decision of one of tasks of mountain production - planning and process control of booty of balance-industrial supplies. It allows clearly and reasonably to plan direction of development of mountain works, stabilizes content of qualitatively-technological indexes of minerals in iron-ore mass that is given on the entrance of ore mining and processing factory and to improve the technical-economical indexes of work of ore mining and

processing combine. Content of qualitatively-technological indexes of the useful component related to magnetite the varieties of ferrous quartzites of deposit have much general. Magnetite, in the packs of these varieties of minerals, up-diffused evenly, means values hesitate in an interval 28-30 %.

On content of qualitatively-technological indexes of useful component of iron general, the basic varieties of ferrous quartzites differ through different content of unmagnetic mineral forms of bivalent ore triple valent iron (silicats, carbonates and hematite). Correlation of unmagnetic mineral forms testifies that they have characteristic for every variety mean values that interrelate with content of qualitatively-technological indexes of useful component, iron general in dump tails (Fig. 3.) [5].

Analyzing the methods of count [10], what are used in surveyor practice come to the conclusion, that majority from them is oriented to simplification of calculations. By the aim of the use of them at the hand method of calculations of volumes of mountain works and balance-industrial supplies. The question of creation or modernization of existent methods appears for the use in programmatic foods of the computer providing of the surveyor measuring and calculations.

Concentration of production and continuous increase of volumes of booty of balance-industrial supplies and exception of content of qualitatively-technological indexes useful to the component, related to magnetite in iron-ore mass on an ore mining and processing combine, stipulates, necessity of development of new and perfection of existent methods and technical equipments of assay and control of content of qualitatively-technological indexes of minerals for iron-ore mass.

If necessary, hand corrections are entered, or fully repeat a decision with the use of computer technologies. By such method, conduct planning of mountain works taking into accounts the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass.

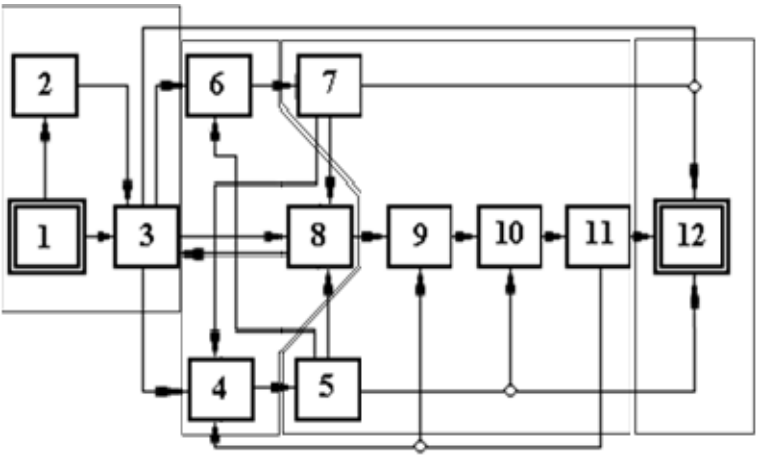

Fig. 3 - Chart of transformation of the naturally-spatial placing of changeability of content of quality indexes of minerals in the array of balance-industrial supplies and loosening iron-ore mass: *1*; *2*; *3* is the naturally-spatial placing of changeability of content of quality indexes of minerals in an array and loosening iron-ore mass, accordingly from the array (natural quality) removed (by loosening drilling and blasting works), in transport capacities; *4*; *6*; *8*; *10* is the naturally-spatial placing of changeability of content of quality indexes of minerals in an array and loosening iron-ore mass accordingly on an entrance at capacity of grading ore mining and processing and sintering factories; *5*; *7*; *9*; *11* is the naturally-spatial placing of changeability of content of quality indexes of minerals in an array and loosening iron-ore mass accordingly on an exit from capacities, grading and sintering factories; *12* - content of quality indexes useful to the component in the prepared products (concentrate, agglomerate, pellets)

The perspective and operative planning assists the rational booty of high-quality and balanced on maintenance qualitatively-technological indexes minerals of supplies in a career and averegenation of content of qualitatively-technological indexes of minerals in loosening iron-ore mass for the separate intervals of time.

Thus, coming from content of qualitatively-technological indexes of useful component, iron general in unmagnetic mineral forms; four technological groups of ferrous quartzites are distinguished. They differ on naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass. An estimation of varieties of minerals is in iron-ore mass on content of qualitatively-technological indexes of the useful component related to magnetite and is acquired by a value at the

annual and perspective planning of correlation of varieties of minerals in iron-ore mass. From commodity iron-ore mass content of qualitatively-technological indexes of the useful component related to magnetite and power of ore mining and processing factory is determined is withdrawn.

This estimation is executed at Sunday-day's planning of average nation of content of qualitatively-technological indexes of minerals in iron-ore mass. Aim of estimation of receipt at withdrawn on the ore mining and processing factory of the content of qualitatively-technological indexes of the useful component related to magnetite in dump tails with the possible interval of vibrations set by a plan.

In this connection, there is a necessity, research of intercommunication of geological properties of useful minerals in iron-ore mass with direction of development and deepening of mountain works on careers.

2. Methods of the automated geometrizing of the naturally-spatial placing of changeability of content of qualitatively-technological minerals of areas of ore body and bed of deposit of ferrous quartzites

Without regard to intensive development of mathematical methods of analytical and digital design of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit, wide use of computer technologies, presence serially published of graphic recording devices, the problem of automation of construction of ore-mining geometrical graphic arts is yet distant to the successful decision.

It is conditioned by a large volume and variety of graphic documents that is used for the decision of surveyor-geological tasks on the different stages of mastering of areas of ore body and bed of iron-ore deposit. Also complete developments of the mathematical providing of modern devices are absent, that is oriented to the use in the conditions of ore-mining enterprises.

Experience of the executed developments shows that the most successful application of facilities of computer technique and technology is for the decision of tasks ore-mining geometrical maybe at the use of ideas and methods of the classic geometrizing, formaliza-

tion of basic heuristic procedures and creation of the standard programmatic modules. Exactly these principles are fixed in basis of methods of the automated geometrizing that is worked out in the Kryvyi Rih national university [11].

The structure of the mathematical providing is determined by the analysis of logical, calculable and graphic procedures that is used for geometrizing of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit by traditional methods. Economic feasibilities of modern graphic -builders are taken into account here.

The existent methods of geometrizing are based on an idea about placing of indexes in the balance-industrial supplies of areas of ore body and bed of iron-ore deposit in the bowels of the earth as geochemical field. The geochemical field is described by the function of coordinates of point of space of $P=f(X, Y, Z)$, or $P=f(X, Y, Z, t)$ depending on that it is an index - structural or quality. Coming from supposition, that the function of P satisfies to the terms of completeness, unambiguity, continuity and smoothness, in geometry of bowels of the earth the method of isoclines' as one is worked out of basic methods of image of surfaces of topographical order naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals is in the array of areas of ore body.

Depending on the degree of studied of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals the method of isoclines' is used in the array of areas of ore body and bed of iron-ore deposit, form of presentation of weekend of data (regular, irregular, continuous assay), quantitative descriptions of changeability of index.

The method of isoclines' will be realized to one of five methods: invariant lines and devil-fishes, polyhedron, profiles, statistical and indirect. A logic analysis with the aim of formalization allowed to distinguish the calculable, graphic and heuristic following of the automated geometrizing [12]:

- a ore-mining geometrical analysis of weekend of data and choice of method of graphic design or combination of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals are in the array of areas of ore body;

- transformation of weekend of data is on the induced network;
- construction of isoclines' of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array at the linear approaching with the next smoothing;
- registration graphic of the document.

Because of an ore-mining geometrical analysis of geological data general conformities to law of placing of index are set in the balance-industrial supplies of areas of ore body and bed of iron-ore deposit in the bowels (Fig. 4.) of the earth [5].

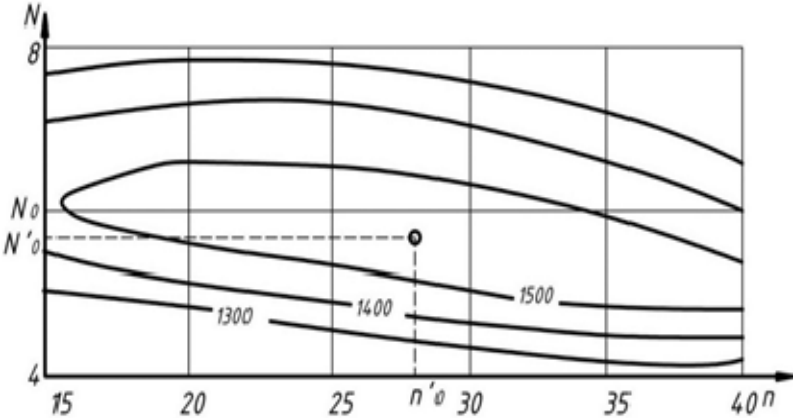

Fig. 4 - A surface $\Delta T=F$ (N, n, m=15) is in the isoclines' of values of commodity products in a money equivalent. Ferrous quartzites are on the career of ПрАТ «Inhuletskyi ГЗКа»

On this stage invariant lines and devil-fishes of the represented surface are set, the borders of areas of geometrizing are determined. Exactly this stage is difficult formalized for the use of computer technologies.

The results of study of changeability of index give additional data for a ore-mining geometrical analysis. If invariant lines are near to the lines, then at research of changeability main directions of anisotropy approximately gather or perpendicular to the invariant lines.

Quantitative estimations of parameters of changeability are the heights of cut of isoclines' used for determination. The choice of method of construction of isoclines' is determined by the results of ore-mining geometrical analysis and researches changeabilities.

The methods of polygons, invariant lines and devil-fishes are used for the construction of structural plans at an irregular reconnaissance network. So as qualitatively-technological indexes contain considerable part of casual constituent, then for the reflection of properties the method of statistical window is used. Window that smoothes out extent, certainly coming from the height of cut of isoclines'. Transformation of weekend of data on a regular rectangular or square network comes true by means of analytical models of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit by smoothing methods, including the methods of optimal statistical interpolations.

Regardless of that is used the network of data (three-cornered or rectangular), determination of coordinates of isoclines on the first stage comes true by means of linear interpolation on the «ribs» of network on two adherent knots. After it the broken isoclines' are smoothed out. Nonlinear approximation of the represented surface of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals comes true in an array.

The enumerated operations at the graphic design of areas of ore body and bed of iron-ore deposit are formalized, except for the row of heuristic procedures. For the selection of invariant lines and devil-fishes and for triangulation of reconnaissance networks the additional surveyor-geological is used information.

The analysis of logical connections between the graphic and heuristic procedures calculated, determines principle of construction of the mathematical providing of tasks of graphic design of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit.

The mathematical providing of the automated geometrizing contains the programs of three levels: base, functional and applied. Of the mathematical providing at level answers the degree of working out in detail of the shown out graphic information [13].

The base programs worked out by the plant-manufacturer of graphic buildings allow carrying out the construction of the simplest geometrical elements (alphabetical and digital symbols, segments of lines, arc of circumference, polylines and so on.).

The functional programs are developed taking into account content of the applied tasks. In the complement of the functional mathematical providing of tasks of graphic design of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit enter [14]:

- a construction of coordinate scales (continuous, dotted, stroke of dotted) is with coordinates on the perimeter of net;
- a construction of plans of assay of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals is in the array of areas of ore body (with causing of mining holes, names, content of qualitatively-technological indexes of minerals in an array and so on.);
- construction of basic elements of plans of mountain works; twisting of coordinates (affine, functional and other);
- processing of graphic documents (causing of scopes, accompanying text and so on);
- draft of charts of functions, that is set analytically in an obvious kind and self-reactance;
- draft of charts of functions, that is set tabular, with the use of different methods of interpolation.

Application programs of graphic design of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array, areas of ore body and bed of iron-ore deposit provide plotting of isoclines' different methods [15]:

- geological cuts with the isoclines' of quality indexes;
- plans of mountain works;
- block of diagrams;
- models of mining-and-geological objects in axonometric projections and so on;
- by volume images of surfaces of topographical order.

The methods of graphic design of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit contain identical procedures of interpolation (twisting of coordinates, smoothing of isoclines', subscription of isoclines' and so on.). The most rational principle of packet of the application programs assembly is module.

The algorithm of construction of mathematical model of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit consists of chain of procedures, each of that appears an independent task. The decision of separate from them differs in a substantial mathematical novelty.

To basic procedures belong:

- construction of border of zone of mineralization; choice of model parameters;
- smoothing of results of primary assay of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals is in the array of areas of ore body;
- Kriging histograms;
- realization of switch control statement is to the new system of assay of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array.

The linear sizes of blocks excel AV distance between tests in a few times, and the volumes of blocks are far less to the volume of areas of ore body and bed of iron-ore deposit, in that they are, then an estimation can be simplified [16].

Number of tests that get n equals in the estimated block of volume v, and the number of all tests within the limits of the field of V equals N. Then as an estimation of integral expression is used

$$\tilde{C} = \lambda C_n + (1-\lambda)\overline{C}_N \qquad (1)$$

where $\overline{C}_n = \frac{1}{n}\sum_{k=1}^{n} C_k$ is a middle arithmetic estimation of index on tests in the middle of block v; $\overline{C}_N = \frac{1}{N} = \sum_{m=1}^{N} C_m$ it is a middle arithmetic estimation of index on the tests of all field of V.

Assuming that tests within the limits of block υ are located by chance and a block is located by chance in the field of V (hypothesis of casual Kriging), then expressions for λ and dispersions will have a comfortable for calculations view [17]

$$\lambda = \frac{\sigma_v^2}{\sigma_n^2 + \frac{n}{N-n}\sigma_v^2};$$

$$\sigma_k^2 = (\sigma_n^2 - \sigma_v^2)\left[1 - \frac{\sigma_n^2 - \sigma_v^2}{\frac{N}{N-n}\left(\sigma_n^2 + \frac{n}{N-n}\right)\sigma_v^2}\right], \qquad (2)$$

where $\sigma_n^2 = \frac{1}{n^2}\sum_{k=1}^{n}\sum_{m=1}^{n} K\left(\left|\bar{r}_k - \bar{r}_m\right|\right)$, if the number of tests of N on all field of V considerably excels the number of tests of n in a middle a block υ, that is estimated, then close formulas are used

$$\lambda \approx \frac{\sigma_\upsilon^2}{\sigma_n^2}; \qquad \sigma_k^2 = \left(1 - \frac{\sigma_\upsilon^2}{\sigma_n^2}\right)\sigma_\upsilon^2 \qquad (3)$$

The parameters of estimation and dispersion of Kriging block υ depend on the number of tests, and also from descriptions of autocorrelation or structural naturally-spatial hashing of changeability of content of qualitatively-technological indexes of minerals functions in the array of areas of ore body.

Thus, at the estimation of large and small blocks bulky equalizations of Kriging are considerably simplified. Calculations are conducted quickly in default of appropriate constituent in placing of sign of C (X, Y, Z, t). At presence of trends', all considered approaching become incompetent. In this case it is necessary to distinguish a trend, using a least-squares method [18].

Coefficients of equalization of trends', conditioned on it method not displaced, however they minimize dispersion, if deviations of values of sign from trends' are auto correlated. At determination of trends' a rejection is investigated on autocorrelation.

At presence of estimation of coefficients of autocorrelation that is calculated on differences will be displaced. Geostatistical calculations are for deviations from trends' that is conditioned by a least-squares method, appear ineffective. The autocorrelation of rejections is taken into account at the selection of equalizations of trends. There is not a necessity in such account, if number of points of assay more than 100. In opposite case it costs to modify approach to the problem of estimation that results in equalizations of craining [19].

At the construction of mathematical model of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit there is the field of concentrations of the useful compo-

nent, related to magnetite occupies the local volume of bowels of the earth, limited to the that area of space, the process of mineralogenesis took place in that. Objectives are the limits of the mineralized zone, built from data of geological supervisions and by the results of assay of geological survey mining holes.

Smoothing of results of primary assay comes true by middle weight of averagination of data of assay of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array on the segments of mining holes between the surfaces of separate ledges [20].

Successful increase of rates of booty of balance-industrial supplies from the areas of ore body and bed of iron-ore deposit by open, underground or combined methods, the use of the newest measuring devices, high-performance equipment and computer providing on the ore-mining enterprises of Ukraine begins to dictate certain requirements and to change out-of-date methodologies. Availability and development to the proper level of the computer providing it is allowed to use them in a sufficient amount by every worker in a surveyor department. It gave possibility to automatize workaday tasks that is executed by the workers of surveyor department at cameral treatment of the field measuring. Among main problems that must be decided there is a question of count and account of volumes of mountain works balance-industrial supplies subject to condition the use of the geographic information systems, namely, what methods of count to use for providing of necessary exactness, comfort of the use and reduction to time on implementation of works.

Analyzing the methods of count [21], what are used in surveyor practice come to the conclusion, that majority from them is oriented to simplification of calculations. By the aim of the use of them at the hand method of calculations of volumes of mountain works and balance-industrial supplies. The question of creation or modernization of existent methods appears for the use in programmatic foods of the computer providing of the surveyor measuring and calculations.

Thus, it is possible to assert on the basis of the stated, that at application of computer technique and technology for the decision of mining-geometrical tasks, high results it maybe to get using ideas and methods of the classic geometrizing, formalization of basic heuristic procedures and creation of the standard programmatic modules.

At the construction of mathematical model of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in the array of areas of ore body and bed of iron-ore deposit there is the field of concentrations of the useful component, related to magnetite occupies the local volume of bowels of the earth, limited to the that area of space, the process of mineralogenesis took place in that [22].

The model of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals built after this algorithm in the array of areas of ore body and bed of iron-ore deposit is used for the count of balance-industrial supplies, optimal planning, and corporate strategic and medium-term planning of mountain works on operating enterprise.

Conclusion

1. Oscillation of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass has considerable amplitudes that diminish in the process of booty of balance-industrial supplies exception of content of qualitatively-technological indexes of the useful component related to magnetite in 4-6 times.

2. The model of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals built after this algorithm in the array of areas of ore body and bed of iron-ore deposit is used for the count of balance and industrial supplies, optimal planning of mining enterprise, and also corporate strategic and medium-term planning of mountain works on an operating enterprise.

3. This estimation of annual and perspective plans of development of mountain works taking into account the dynamics of changeability of qualitatively-technological descriptions of signs of the naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass at moving of mountain works both on reaching and on the depth of quarry. The methods of the automated geometrizing of content of quality indexes of minerals of areas of ore body and bed of deposit of ferrous quartzites are considered.

4. Automated control system of management is on a career, allows to do the optimal forming and management naturally-spatial placing of changeability of content of qualitatively-technological indexes of minerals in an array and loosening iron-ore mass on all stages of planning of mountain production and his management in a career.

References

1. Temporary methodology for determining the economic efficiency of costs and environmental protection measures. (1987). - in the book: Methods and practice of determining the effectiveness of investments and new technology. M., Science, pp. 108–114.

2. Uniform rules for the protection of mineral resources in the development of solid mineral deposits. (1987). M., Nedra.

3. Collection of guidelines on the protection of mineral resources (1973). - M., Nedra.

4. Adigamov Y.M., Mining C.3. (1987). Rationing of loss of minerals in the extraction of ores. M., Nedra.

5. Sholokh M.V. (2016). Methods of assigning i normuvvnya to the side of the alleged shows of copalin at industrial and balance reserves - Kryvyi Rig: DVNZ «KNU» Vidavnichy center. - 160 p. Іл.

6. Sholokh M.V. (2018). Determination and research of norms of the ferrous quartzites prepared to booty. - pp. 25-52. / Development of scientific foundations of resource-saving technologies of mineral mining and processing. Multi-authored monograph. – Sofia: Publishing House «St. Ivan Rilski». – 264 p. ISBN 978-954-353-355-8.

7. Sholokh M.V. (2018). Estimation of content of quality indexes of minerals in array of rogitinums of magnetite and in stream of iron-ore mass. - pp. 180–208. / Resources and resource-saving technologies in mineral mining and processing. Multi-authored monograph. – Petroşani. Romania: UNIVERSITAS Rublishing, 2018. – 363 p. 180–208. ISBN 978-973-741-592-9.

8. Sholokh M.V. (2018). Optimization of preparedness for extraction of balance industrial mineral reserves. - pp. 133-165. / To Figal issues of resource-saving technologies in mineral mining and processing. Multi-authored monograph. – Petrosani, Romania: UNIVERSITAS Publishing. - 270 p. ISBN 978-973-741-585-1.

9. Sholokh M.V., Sergieieva M.P. (2019). Mine surveying support of controlling losses of balance industrial reserves. – pp. 343–363. / Sustainable development of resource-saving technologies in mineral mining and processing. Multi-authored monograph. – Petroşani, Romania: UNIVERSITAS Publishing. – 400 p. ISBN 978-973-741-622-3.

10. Sholokh M.V., Sholokh S.M., Sergieieva M.P. (2018). An analysis of surveyor control of losses of balance-industrial supplies is at mastering of bowels of the Earth. – pp. 415–438. / Innovative development of resource-saving technologies for mining. Multi-authored monograph. – Sofia: Publishing House «St. Ivan Rilski». – 439 p.

11. Sholokh M.V. (1999). Aspects of geometrizatsiya zalizodernyh ancestors / Vidomosti AGN Ukraine. - Mineral. Kryvyi Rig. - Vip. 1. - pp. 104–106.

12. Sholokh M.V. (2018). Having drawn into the balance of the commercial reserves and the reserves of the alleged showers in the procession averaging / Zb. Naukovich prats DVNZ «KNU» «Girnichny Visnik»: – Kryvyi Rig. - Vip. 103. - pp. 50–55.

13. Sholokh M.V. (2018). Marksheiderske prediction and forecast management with demonstrators in the development of important ancestors. - pp. 160–168. / Forum girnikiv - 2018: Materiali mizhnar. Conf., 10–13 Zhovtnya 2018 p. - Dnipro: Serednyak T.K. - 307 p. ISBN 978-617-7696-55-0.

14. Sholokh M.V., Sergieieva M.P. (2018). Simulation of characteristics of volumetric-qualitative parameters of flows of iron ore in quarries and mines / Zb. scientific works of the State University «KNU» «Mining Bulletin» Scientific and Technical Collection: Kryvyi Rih, 2018. - Vip. 103. - pp. 17-22.

15. Sholokh N.V. (1999). Mining and geometric monitoring of forecasting quality indicators of iron ore deposits. / Sat. scientific Proceedings of the Second International Symposium / July 12-17, 1999. / Operational control and management of the quality of mineral raw materials during mining and processing. - Yalta. - pp. 151–153.

16. Sholokh N.V. (2002). Optimal algorithms and programs for automating the construction of mining and geometric graphs. / Development of ore deposits. - Issue number 78. - Krivoy Rog. - pp. 179-182.

17. Sholokh N.V. (2005). Prediction of indicators of the geochemical field deposits of ferriginous hornfelses Krivbass. / Development of ore deposits. - Issue number 89. - Krivoy Rog. - pp. 144–147.

18. Sholokh N.V. (2007). Optimization of the discovered ore reserves and the direction of mining in the quarry. / Bulletin KTU, - Vipusk number 16. - Kryvyi Rig. - KTU. - pp. 42–44.

19. Sholokh M.V. (2015). Modeluvuvnya processes in the formation of dough and cinnamon from the ore sirovini ore flow / Naukovo-tech. Zbirnik «Girnichiy Visnik» DVNZ «KNU». - Kryvyi Rig. - Vip. 100. - pp. 111–116.

20. Sholokh M.V. (2017). The normuvannya balance and industrial reserves of saline quartzite on the level prepared by the way up to the type of vydkritim way / Naukovo-tech. Zbirnik «Girnichiy Visnik» DVNZ «KNU». - Kryvyi Rig. - Vip. 45. - pp. 172–178.

21. Sholokh M.V. (2018). Models and Criteria of Optimized Identity Indicators in the Magnetitic Horn backs Vidobutka. - pp. 65–78. / The 6th International conference Science and society - (August 3, 2018) Accent Graphics Communications & Publishing, Hamilton, Canada. 2018. 250 p. ISBN 978-1-77192-360-6.

22. Sholokh M.V. (2018). A model of forecasting predictions for the world of allegedly shown cops. pp. 274–287. / The 3rd International Youth Conference - Perspectives of Science and Education - (July 6, 2018) SLOVO \ WORD, New York, USA. 2018. 524 p. ISBN 978-1-77192-403-0.