LLC Miramine
A.N. Nikandrov
A.A. Roschin
A.V. Korsakov

REPORT
RESOURCE MODELING AND ESTIMATION IN MICROMINE

FOR THE KRASNOYE GOLD ORE OCCURRENCE

Krasnoye Ore Occurrence, Bodaibo District of the Irkutsk Region

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

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4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

1. Purpose of Work

The work was conducted under Contract No 001/12 dated October 10, 2012, between LLC. Miramine ("Executor") and LLC. Krasny ("Customer").

The goals of the work under contract included:

- Resource modeling and estimation for the Krasnoye ore occurrence in Micromine.
- Modeling of ore bodies of the deposit, grade interpolation and resource categorization with regard to geological information and exploration data.
- Detail description of the methodology of deposit modeling in the corresponding methodological section of the report which shall comply with international standards and the JORC Code.
- Building of optimal pit shells and resource estimation within the contour of the pit.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

2. Tasks Solved

- Information collection and analysis.
- Agreement and correction of errors detected, data specification and replenishment.
- Interpretation of gold mineralization on the basis of the statistically identified natural cutoff grades.
- Building of 3D wireframe models of ore bodies.
- Statistic and geostatistic analyses of mineralization distribution.
- Building of a block model.
- Grade interpolation from the analytical database to the block model.
- Mineral resource estimation.
- Building of a 3D model of the topographic surface.
- Confirmation of computer models of ore bodies locally and globally;
- Comparison of the received resource figures with previous estimates.
- Building of an optimal pit shell.
- Mineral resource estimation within the optimal pit contour.

The work was conducted with the use of Micromine software, Licenses Nos. MM1163 and MM1164.

4-2, Aptekarsky per., Moscow, Russia 105005
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e-mail: info@miramine.ru

3. Qualification of Consultants

LLC. Miramine is an independent Russian company which includes more than 20 processional consultants providing expert services in a wide spectrum of technical disciplines associated with the mining and geological industry.

LLC. Miramine has experience in independent auditing and mineral resource and reserve estimation.

LLC. Miramine also has significant experience in review of resource estimation reports prepared in Russia and CIS countries in compliance with the conditions and instructions used in these countries.

3.1. Working Program and Team Members

LLC. Miramine used the following specialists:

- Alexey Nikolayevich Nikandrov – geologist and Competent Person, project manager;
- Alexey Alexeyevich Roschin – leading mining engineer;
- Yelena Sergeyevna Shmakova – geologist;
- Alexandra Vyacheslavovna Korsakova – geologist.

Yevgeny Nikolayevich Bozhko was the contact person of the Company. He provided the input data for work. He also presented all the information required afterwards.

The results of work conducted by the team were summarized in the report by the project manager and were examined by internal reviewers. Mr. Alexey Nikolayevich Nikandrov acted as a Competent Person.

4. Disclaimer

Opinions and estimates given in this report are based on the information provided by the Customer to LLC. Miramine. LLC. Miramine accurately examined the information provided. Although LLC. Miramine compared the key data provided with the expected figures, the accuracy of the results and conclusions of this work wholly depend on the accuracy and fullness of the data

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

provided. LLC. Miramine does not accept responsibility for any errors or omissions in the information provided and does not bear any further responsibility associated with the commercial decisions made or actions taken on their basis.

All observations, comments and results of technical analyses stated in this report are the conclusion of LLC. Miramine specialists as of October 2012 and are based on the completed work as specified in the report. Despite the fact that the LLC. Miramine site is sure that all provided conclusions are correct, most of the data provided was assumed as reliable and was not verified. LLC. Miramine did not carry out any verification of data or sampling with the purpose of quality control. Therefore, LLC. Miramine disclaims all responsibility, both direct and indirect, for reliability of the data provided by the Customer.

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

5. Data Reliability

LLC. Miramine thinks that its opinion shall be assumed in whole, and that individual parts of the report, with no regard to all factors and analyses in whole, can give a misguiding pattern of processes serving as the basis for the opinions given in the report. Preparation of a review report is a complex process and is not related to any specific analysis or generalization.

Furthermore, LLC. Miramine is not obliged to and did not assume any responsibility to notify any person on any changes in the circumstances which become evident after preparation of this report, or edit, review and update the report or the opinion.

All reviews, comments and conclusions given in this report reflect the opinion of LLC. Miramine as of October 2012 and are based on the review of information and materials provided by the Company and discussions with Russian specialists.

LLC. Miramine does not bear any responsibility, either direct or indirect, in relation to information reliability.

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6. Declaration

Neither LLC. Miramine as a company, nor its director, employees or associates, own the securities of the Customer, its subsidiary companies or offices, and

- do not have any rights to receive Customer's securities either now or in the future;
- do not have any right fixed by the law for the property or participation in the concession belonging to the Customer; and
- were not promised or were not assumed to be given any such rights.

LLC. Miramine will receive the payment for preparation of this report in accordance with the regular practice of professional consulting. This payment does not depend on the outcome of any activity for raising funds, and LLC. Miramine will not receive any other profit from preparing this report. LLC. Miramine does not have any material or other interest which could be reasonably considered to be capable of influencing its ability to give neutral opinion in relation to the Mineral Resource estimate of the Company.

Therefore, LLC. Miramine, the Competent Persons and the Director of LLC. Miramine consider themselves independent from the Company.

This report includes the technical information which requires further calculations for making subtotals, totals and weighted average values. Such calculations can include some specific degree of roundoff and, thus, can lead to error. If such errors occur, LLC. Miramine does not consider them significant.

LLC. Miramine is responsible for this report and declares that it took all reasonable measures to provide correspondence of the information contained in this report to the facts, as far as they known, and no other significant facts known to the Customer, that could influence the conclusions, were omitted.

The **Competent Person** Alexey Nikolayevich Nikandrov, MSc, MAIG, LLC. Miramine full-time employee, is an independent Competent Person as defined by the JORC Code (2004). As a Competent Person, he has at least five years of experience in exploration of deposits of such type and assumes all responsibility for the information given below.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru


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Данное свидетельство выдано

Nikandrov Alexey Nikolaevich

Никандрову Алексею Николаевичу

of JSC “Pokrovsky Mine”
Из ОАО “Покровский Рудник”
Has successfully completed the
В том, что он успешно закончил курс

Advanced Tailored Training
MICROMINE Version 9
Специализированного обучения
Майкромайн 9

Training Course, held in p. Tygda, Amur region
Курс проводился в пос. Тыгда Амурской области

Dmitry Pertel, Course Coordinator
Дмитрий Пертель, Координатор курса
Certificate No: MM.04.45

August 2004

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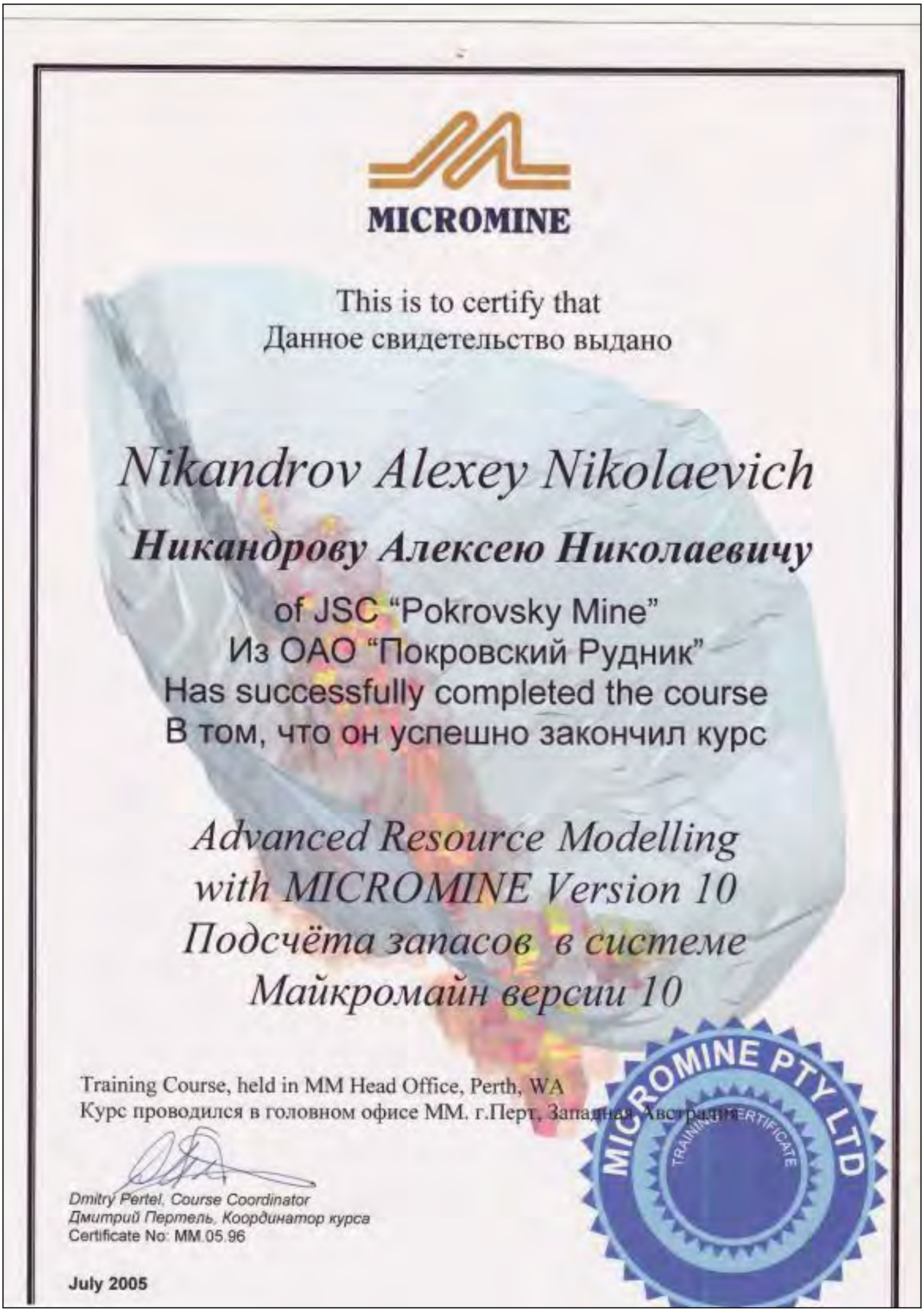

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Из ОАО "Покровский Рудник"
Has successfully completed the course
В том, что он успешно закончил курс

Advanced Resource Modelling with MICROMINE Version 10
Подсчёта запасов в системе Майкромайн версии 10

Training Course, held in MM Head Office, Perth, WA
Курс проводился в головном офисе ММ. г.Перт, Западная Австралия

Dmitry Pertel, Course Coordinator
Дмитрий Пертель, Координатор курса
Certificate No: MM.05.96

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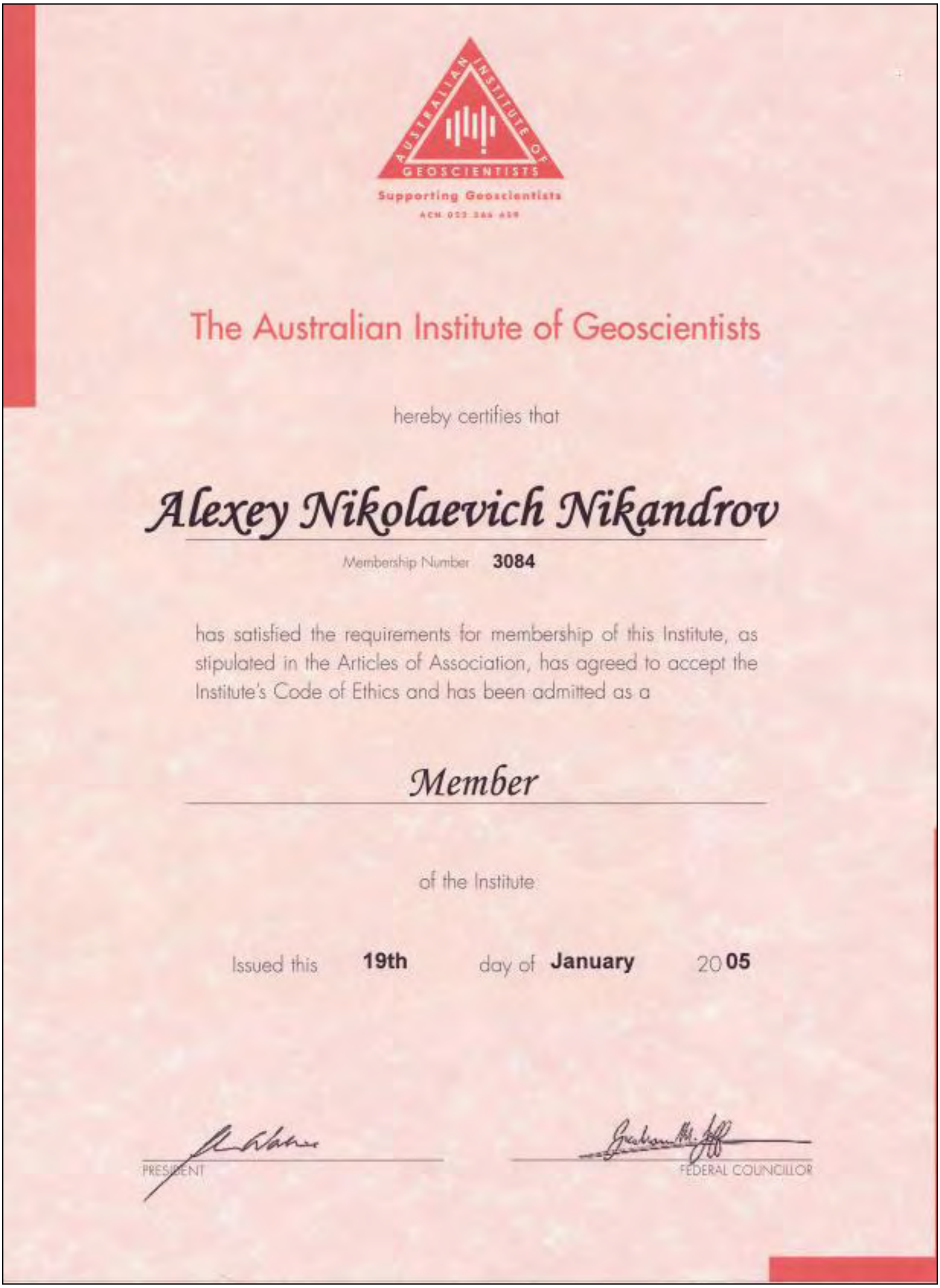

Australian Institute of Geoscientists

Supporting Geoscientists

The Australian Institute of Geoscientists

hereby certifies that

Alexey Nikolaevich Nikandrov

Membership Number **3084**

has satisfied the requirements for membership of this Institute, as stipulated in the Articles of Association, has agreed to accept the Institute's Code of Ethics and has been admitted as a

Member

of the Institute

Issued this **19th** day of **January** 20**05**

PRESIDENT

FEDERAL COUNCILLOR

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8. Location and Geological Understanding of the Krasnoye Gold Ore Occurrence

8.1. Landscape-Geographical, Climatic and Hydrological Conditions

The Krasny site license area is located at the right bank of the Bodaibo River, in its upper reaches.

The climate of the district is extreme continental. The average annual air temperature is 6˚C. The average temperature variations are from 54˚C in January to +34˚C in July. The average annual amount of precipitation is 350 mm, most of it falling during a warm period. Snow falls in the mid or the end of September and thaws out completely in the end of June. The thickness of the snow cover in valleys reaches 2-4 m.

In the orographic relation the district is located within the Patom uplands with typical middle-mountain topography. The elevation varies between 800 and 1,200 m, with the local difference in elevation making 500-600 m The topography is characterized by flattened watershed tops and steep, up to 30^{o} (10-15^{o} on average), slopes covered with a slope deposits talus cone several meters thick. The degree of outcropping of the area is low. Bedrock outcrops are local. Glacial deposit residuals tens of meters thick are noted on watershed anticlinal folds and slope bottoms. River valleys are wide, frequently bogged. Most of valleys are complicated by technogenic deposits as a result of placer mining. The alluvium thickness reaches 50 meters. Technogenic dumps tens of meters thick, especially in the Teply creek, significantly complicate the exploration process.

The river network of the work area is presented by minor watercourses freezing out almost completely in winter. The Bodaibo River with the following tributaries is the main watercourse: Krasny, Teply and Mokry Creeks. Short springs drying out in summer after the end of the permafrost thawing period are found in minor creek valleys. The highest water rate falls on May-June – the periods of intensive snow thawing and rains. Permafrost is generally developed on slopes and watersheds, especially of the northern aspect. Thawed zones are noted under river beds. The seasonal thawing depth by the end of summer does not exceed 2 m on southern slopes and up to one meter on northern ones.

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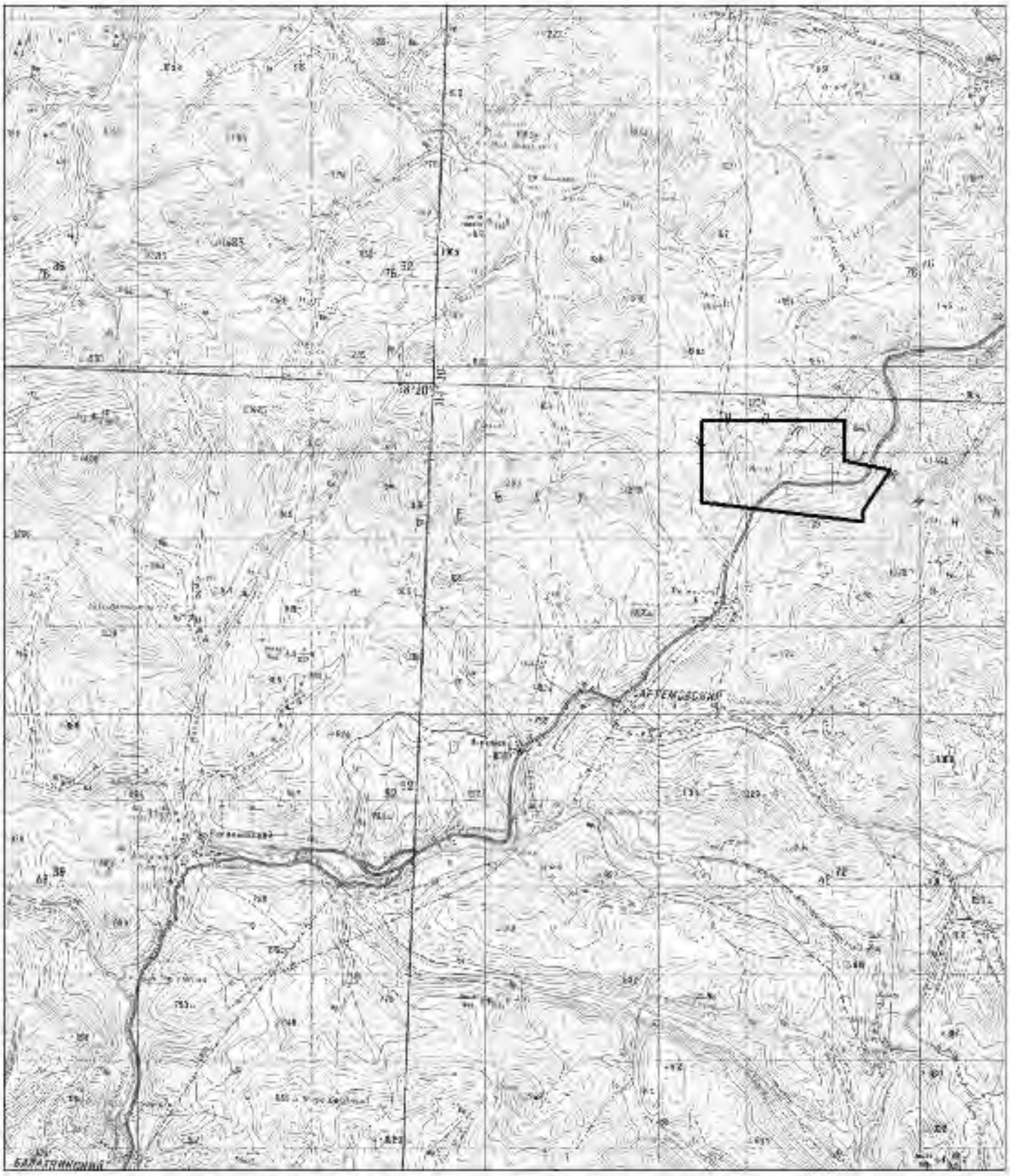
Figure 8-1 Review map of the work area. **Scale 1:250,000**



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8.2. Level of Economic Development of the Area and Infrastructure Characteristic

The district is economically developed quite well and is located 70-80km away from explored ore deposits Sukhoy Log, Verninskoye and Vysochayshy. Gold is mined in the surroundings from placers of various types. The project is administratively subordinated by the Artemovsky municipal settlement of the Bodaibo District of the Irkutsk Region (Figure 8.1).

The nearest village - Artemovsky is located 15 km away. The distance to Bodaibo is 75 km. There is a motor road Bodaibo-Kropotkin-Perevoz passing across the site. There are gravel and dirt motor roads within the site in the lower reaches of creeks. They are currently used by placer miners. Roads require snow removal within the site in winter. Cargo deliver to the Krasny site from LLC. Kopylovskoye base (Bodaibo) is executed by cross-country vehicles. Most of cargos are delivered to the base from the nearest railway station Taximo (Baikal-Amur Railway) by motor road 220 km long. Water transportation along the Lena and the Vitim Rivers from the Osetrovo river port (Ust-Kut) to Bodaibo (750 km) is possible during the navigation period. In Bodaibo there is an operating airport which accepts cargo and passenger planes with medium capacity from Irkutsk (1200 km), Bratsk, Mirny, Kirensk and Ust-Kut.

The area enterprises are supplied with energy from the Mamakan hydro-electric power station and thermal plant by means of 110kV and 220kV overhead power lines Taximo-Bodaibo. 110kV and 36kV overhead power lines pass in proximate vicinity to the work area.

Telephone communication on site with the base and company's management is provided with the help of a satellite telephone.

8.3. Geological structure

8.3.1. Stratigraphy

The central part of the Lenskaya gold-bearing province (Artemovsky ore cluster), within which the Krasny site is located, is positioned in the miogeosyncline baikalid belt in the northern limb of the Bodaibo complex syncline – one of the main structures in the central part of the Bodaibo synclinorium.

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The Bodaibo complex syncline is composed of sedimentary-metamorphic rocks of the Bodaibo series of the Upper Proterozoic complex and is covered by loose deposits of the Quaternary system.

The data on the geological structure of the area is given on the basis of the GDP-50 data (Yablokovsky A.G. et al., 1981) (graphical appendix 1).

The Bodaibo Upper Riphean series is divided into two parts on the basis of its lithological and facial particularities. The lower one presented by Aunakit and Vacha suites is composed of carboniferous monomictic quartz sand-slate deposits. The upper one including the Anangr, the Dogaldyn and the Iligir suites, is characterized by the development of mainly sandy and terrigenic carbonate formations.

The rocks of the Aunakit, the Vacha and the Anagr suites crop out to the day surface within the Krasny site.

The **Aunakit suite (R_3au)** is the most ancient subdivision within the area under study. The suite deposits within the design area are developed in the northwest and compose the core parts of the Verkhne-Bodaibinskaya and the Rudnaya anticlines complicating a larger Bodaibo syncline. The suite is divided into three subsuites on the basis of lithological particularities. It should be noted that the lithological composition of sandstone varies from quartz-sericitic in the southeast of the area to carbonate in the northwest.

The lower subsuite ($R_3\,au_1$) is mainly composed (by 90%) of quartz sandstone with single carboniferous phyllite and calcareous sandstone interbeds. The thickness of the subsuite is 100-120 m. The lower subsuite rocks within the site do not crop out but are intersected in boreholes only.

The middle subsuite (R_3au_2) is presented by dark-grey, grey calcareous phyllites with thin quartz sandstone and siltstone interbeds. The thickness of the subsuite is 400 m.

The upper subsuite ($R_3\,au_3$) is most widely developed. The lower part of the section is presented by grey, dark-grey quartz metasandstone with dark-grey carboniferous aleurite slate interbeds which become dominating over carboniferous metasandstone in the middle part of the section. The upper part of the section is characterized by prevailing quartz metasandstone (70-75%) with carboniferous chlorite-sericite slate interbeds and rare calcareous metasandstone interbeds. The thickness of the subsuite is 400-500 m.

Therefore, the rocks of two lithological groups participate in the suite structure: metasandstone and slate. Sandstone with calcareous cement is subordinated.

The total thickness of the Aunakit suite is 1000 m.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Vacha suite (R_3vc). The Vacha deposits occupy the central part of the area. In the structural relation they compose the limbs of anticline folds and the core of the Lozhkovaya syncline.

The suite is composed of black high-carbon and cericite-quartz slates (80-95%) with thin interbeds of carboniferous quartz sandstone. Coarse alternation of rocks with interbed thickness 0.5 m and above is typical for the section bottom. The thickness of the suite varies from 400 m to 600 m depending on the structural position.

The Vacha suite is clearly expressed in the section and is a reference stratigraphic unit of the region on the basis of lithological rock particularities (homogeneous composition, black colour, and high content of carboniferous substance).

The Vacha suite is divided into two subsuites: Upper and Lower.

The Lower Subsuite (R_3vc_1), first horizon ($R_3vc_1^1$) is characterized by high-carbon siliceous slates with dark-grey quartzitoid sandstone interbeds. *The second horizon ($R_3vc_1^2$)* is composed of black high-carbon phyllites and sericite-quartz slate with rare quartz-sericite sandstone interbeds.

Two horizons are also defined within the *Upper Subsuite (R_3vc_2)*: *the first horizon ($R_3vc_2^1$)* mainly presented by alternation of dark-grey quartzite and high-carbon phyllite, and *the second horizon ($R_3vc_2^2$)* composed of black high-carbon phyllites and sericite-quartz slates.

Anangr suite (R_3 an). The deposits of the Anangr suite are noted in the south of the area, composing the southern limb of the Rudnaya anticline, and in the northeast bedding conformably on the Vacha rocks. Two subsuites are defined on the basis of the particularities of the lithological rock composition: Lower – black-slate and Upper – light sandstone.

The *Lower Subsuite ($R_3\,an_1$)* is presented by two-component rhythmic alternation of dark-grey carboniferous aleurite slates and grey small-grained metasandstone. The thickness of the subsuite is 150 m.

The *Upper Subsuite ($R_3\,an_2$)* unites a complex of coarse-alternating light unequigranular metasandstone, carboniferous slates and metasiltstone, and rare polymictic metagravelite lenses. The thickness of the subsuite reaches 200-300 m.

According to the electric exploration data, the formations of the Vacha and the Anangr suites are characterized by a differentiated field of apparent resistance from units to 100 Ohm and natural field anomalies with the intensity -500 to 750 mA. Magnetic fields are calm, negative with the intensity 0.25-0.75 mOe, Typical for low metamorphism zones.

As for potential ore content, it is assumed that the rocks of the Aunakit and the Vacha suites are potential for mineralization localizing. According to their lithological composition, they are

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

favourable for formation of sulfide-veinlet gold-ore projects. Quartz-vein mineralization (thickness and number of veins) generally grows with increase of the rock competency and is mainly subordinated to structural control.

Quaternary deposits covering Upper Riphean formations occupy almost the whole day surface. Upper Pleistocene (Q_{III}) and Holocene (Q_{IV}) deposits of the Quaternary system are identified within the work area.

Upper Pleistocene glacial deposits are presented by boulders, crushed stone, debris, rare lumps and pebble of local, rarely exotic rocks with aleurite, silt-clay and sand filling. The sizes of lumps and boulders reach 4 m. The total amount of crushed-stone-boulder and pebble-lump material makes about 30%.

Water-glacial deposits differ from glacial ones with belt-stratified structure due to prevailing silt-clay component and unequigranular sand and clay sand in the total mass. The upper parts of the section are frequently composed of pebble stone.

The total thickness of the complex of glacial and water-glacial deposits (Q_{III}) reaches 15-20m and locally falls till 4-6 m under terraces.

The current deposits (Q_{IV}) of the exogeodynamic series are presented by the following genetic types: bed alluvium, alluvium of lower above-floodplain terraces of 3-15 m and 20-40 m levels, and diluvium-solifluction and proluvium formations. Eluvium deposits of weathering crusts of mainly physical series are developed on watersheds.

A two-member structure is typical for alluvial deposits of the area: there are boulder-pebble formations and pebble stone of bed facies in the bottom section, covered by sand, clay sand and silt from the surface.

Differently rounded fragments of Upper Riphean metamorphic rocks dominate in the modern alluvium composition. Well rounded pebbles of granitoids of the Konkudero-Mamakan complex are present in an insignificant quantity.

Slope formations are presented by boulder streams, rockslides, temporary flow alluvial cones, deluvial talus cones in the bottoms. These are unrounded fragments of local rocks in the clay-silt matrix. The amount of the latter grows in the lower part of the section.

Eluvium of watersheds and flat slopes represents a fragmented cliff covered by poorly bound bedrock cryoclastites. These are debris-crushed stone-boulder fragments in the cryopelitic matrix formed on local substratum. Eluvium covers the above-mentioned geomorphologic taxonomic units blanketlike, obscuring the primary bedding of rocks and complicating observations.

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The fragmented material is frequently intensively weathered. The amount of the latter grows towards the bottom of the loose horizon where it transfers to the structural bedrock eluvium.

8.3.2. Intrusive, Metamorphic and Hydrothermal-Metasomatic Formations

Intrusive igneous rocks in the work area are not detected, although widely developed along the periphery of the Bodaibo zone. Thus, granitic massifs of the Konkudero-Mamakan complex limit the basin of the Bodaibo River from the south (Engazhimino-Vitim massif), the northeast (Dzhekdokarsky) and the northwest (Chumarkoysky). Granites are located at the distance of 40-50 km from the work area. The isometric boron anomaly covering also the work area and, as a result of acidic metasomatosis, presence of tourmaline in metamorphosed rocks of the area serve as one of indirect indicators for the granitic intrusives nearness.

Metamorphism. The Riphean deposits of the Bodaibo structural-facial zone generally suffer progressive zonal regional metamorphism with contact impact and regressive metamorphism indicators near granitoids of the Konkudero-Mamakan complex. Dislocation metamorphism formations are also developed within the area under study.

Zonal regional metamorphism. Mineral parageneses of regionally metamorphosed rocks correspond to the greenschist and the disthene-muscovite slate facies, formed in the middle-pressure conditions (Dobretsov et al., 1980). The greenschist facies is widely developed in the zone of near-latitudinal folds of the Bodaibo synclinorium. It is subdivided into low-temperature (chlorite) and high-temperature (biotite) zones located amidst the rocks of the Anangr, the Dogaldyn and the Aunakit, the Vacha, the Anangr, and the Dogaldyn suites respectively. The identified zones coincide with the strike of folded structures.

The zone of chlorite subfacies of the greenschist facies is characterized by:

- presence of the following minerals in the rocks of various lithological groups: actinolite, epidote, chlorite, quartz, albite, pyrite, pyrrhotite and other sulphides;
- a combination of folded and fault dislocations;
- a good degree of preservation of structural and textural particularities of sedimentary rock.

Dislocation metamorphism in the rocks of the site occurred in several stages on the rock and the mineral levels and led to cleavage and schistocity formation. Cleavage is widely developed in the limbs of folds of various orders, found in the rock area. Intensive cleavage is typical for more pelitic rocks and, to a lesser extent, for psammitic rocks. The rocks in the cleavage zone are

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

dissected by near-parallel or crosscutting at an angle fractures into strips 1-5 m long and lenses 0.1-1 mm thick.

Dislocation metamorphism in the work area is characterized by:

- zoning reflecting temperature conditions of metamorphism (for the low-temperature process – cleavage; for a higher temperature one – schistocity);
- a complex configuration of zones depending on the nature of rock strata;
- conformity of tectonic structures;
- impact of the grain-size composition of rocks.

Hydrothermal-metasomatic formations. Hydrothermal-metasomatic rock alterations were expressed in general recrystallization of the rock cement, re-distribution of the carboniferous substance, intensive occurrence of brown feldsparization and sulphidization. These transformations are most evident in anticlinal structures, the zones of intensified fracturing and are widely developed in the area.

Calcite replacement with ankerite and siderite with simultaneous transportation and concentration of ferriferous-magnesial carbonates and sulphides into lithologically and geochemically favourable bands (carboniferous strata) occurred in the process of metamorphism. This led to the formation of veinlet-disseminated sulphide and carbonate mineralization zones. In addition to these metasomatosis occurrences, general rock silicification and formation of quartz vein fields extended in the near-latitudinal direction in the core parts of folds is observed. The development of shear deformations, schistosity and ore-metasomatic processes could occur in parallel. The formation of quartz veinlets is associated with the process of silica squeezing-out from compression sites to opening cleavage fractions.

The local re-distribution of "embryonal" gold in host rocks with its further concentration on polygenetic geochemical barriers could be associated with the metasomatosis process. The sites with increased gold grades are currently characterized by all metasomatic and hydrothermal processing indicators: increased content of sulphides, silicification, sulphide, quartz, and quartz-sulphide veinleting.

Metasomatically altered rocks within the Bodaibo syncline are localized mainly in the Bodaibo River basin, where their share is approximately 87% of the area. Most of previous researchers identify the following types metasomatites: beresites (according to researchers – listvenites), pyritized and pyrrhotitized rocks, silicification zones.

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The beresite development halo includes the area of the Nakatami River basin adjoining from the west. In the east beresites are quite quickly replaced by the zones of pyrite-altered rocks. This is explained by the metasomatosis zoning. Beresites are localized in the hinge parts of anticlines of various orders, in contact zones of unequigranular layers. The Aunakit suite and the Lower subsuite of the Anangr suite are the most favourable stratigraphic levels for beresites in the region.

The gold grade in beresites usually makes thousandth fractions of g/t, an order higher in single cases. In the cases when the gold grade is higher in beresites, the latter always contain veinlet quartz and increased content of pyrite bearing most of gold-ore mineralization.

Pyrite- and pyrrhotite-altered rocks occupy limited spaces as compared to beresites, localizing in cleavage and schhistosity zones. They are typical for the deposits of the Aunakit, the Vacha suites and the lower subsuite of the Anangr suite. They are widely developed within the work area. Rock pyritization is irregular and there area sites where the degree of saturation with pyrite reaches 3% and above. The gold grade in these rocks usually makes thousandth fractions of g/t, and increase of the gold grade up to industrial values is observed on local sites only.

Quartz veins, the formation of which is associated with local substance differentiation during metamorphism and the development of folding structures of the region, are widely developed.

As the results of previous works conducted within the ore fields of the district showed, the varieties of quartz-vein formations can be divided into the following types in the morphological relation: saddle-shaped veins; plate-shaped veins, lens-shaped veins; stockwork-like zones of adjacent quartz veins and veinlets (including zones of veinlet-disseminated quartz-sulphide mineralization); zones of ladder-type veins, lens-shaped and beaded veinlets and their zones, and folding veinlets.

The formation of quartz veins mainly occurred in tense dynamic conditions. Intensified schistosity and crushing of contact parts of veins, presence of tectonic hatch and fault polishes, frequent beaded vein shapes, presence of pseudo-boudines, deformation of veinlets, presence of several quartz generations testify to that.

The ore mineralization of quartz veins is quite poor (below 1%) and is presented mainly by sulphides: pyrite, pyrrhotite, rarely galena, sphalerite, chalcopyrite and silver. Veins concentrated in the lower-temperature zone of regional metamorphism have increase gold grades.

Precipitation beds of ironstone in the bed parts in the middle reaches of the Teply and the Krasny Creeks are one of the specific formations of the work area. The floodplain deposits of

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

creeks are red-brown, ochreous due to “cold” metasomatosis. In addition to the bed parts of above-mentioned creeks, limonitization is observed in the form of local spots in local gullies of the topography.

8.3.3. Tectonics

The Bodaibo synclinorium is the largest structural unit of the district. It occurred at the place of the same-name Ruphean paleodepression.

The Bodaibo synclinorium, as the structure of the first-order, is divided into a number of minor structures (Kazakevich Yu.P. et al., 1971).The Bodaibo complex syncline is one of them. It joins the Kropotkin complex antiform in the north and the Tamarkan complex antiform in the south and hosts the research area.

Near-latitudinal fold strike is typical for the basin of the Bodaibo River in general. Anticlinal folds are frequently asymmetric with larger southern limbs. Synclines are mostly flatter, with wide hinges. The structural paragenesis is presented by cleavage and schistosity, minor folds, boudinage, mineral linearity, co-folding longitudinal faults, low-amplitude diaclases and fracturing. Deep faults played a significant role in the formation of area structures. Their activation preconditioned complication of earlier formed structures and formation of new ones.

Most intensive formations are typical for the axial zone of the Bodaibo syncline and, to a lesser extent, - for adjoining complex anticlines which evidently predetermined their various productivity in relation to gold. The folding stage of deformations, caused by general meridianal compression, led to the formation of linear folding of the Verkhne-Bodaibinskaya folding zone and associated co-folding upthrusts. Sublatitudinal fracturing zones formed during this period and zones of layer-by-layer movements were filled with metamorphogenic quartz-vein and sulfide mineralization. The formation of gold mineralization is associated with the final stage of folding. Spatial-genetic relation of the gold quartz-sulfide and vein-quartz mineralization with the zones of intensive occurrence of hydrothermal metasomatic processes (carbon dioxide and sulphuric metasomatosis) is established.

It shall be noted that the processes of metasomatic processing were most evident in steep limbs and the axial parts of anticlines of the 4^{th}-5^{th} order, where quartz-vein and sulphide mineralization were formed. Here, increase of intensity and sizes of ferriferous-magnesial carbonates a well as intensified sericite alteration of rocks is observed.

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The Krasnsy site is located in the zone of impact of the Verkhne-Bodaibinskaya deep intra-block fault expressed in the form of linear folding of the regional folding zone at the surface. Tense different-scale folding is typical for the area. It is complicated by multiple faults, microfolding zones, boudinage and tectonic mélange.

Plicative structures identified within the site include the Verkhne-Bodaibinskaya (in the north) and the Rudnaya anticlines (in the south) and the Lozhkovaya syncline separating them.

The Verkhne-Bodaibinskaya anticline has the strike of the axial surface 285-290^0, with dipping to the north at 70-75^0, dipping of a hinge to ENE at 5-10^0. The fold is asymmetric, with dipping of the southern limb to the SW at 60-85^0 and the northern limb to the NW at 20-55^0. Limbs are complicated by additional folds of higher orders, and contrast gold halos are confined to them. As the most recent data of previous researchers shows (Melnik, 2006), folds of higher orders have isoclinal morphology in the area of periclinal closure of the anticline (area of the Mokry Creek). It shall be noted that the quartz-vein zone and the zones of dispersed sulphide mineralization are confined to the periclinal closure of the fold.

The Rudnaya anticline has a complex structure due to a dislocated northern limb. A wide development of folds varying in morphology and sizes, frequently located en echelon in relation to each other, is typical for it. The northern limb of the Rudnaya anticline is more compressed and steep (60-80^0) and is characterized by undulating alteration of the dipping of layers from 45^0 to 90^0. Additional folds are also found there with the amplitude from first meters to 50-100 m. The anticline hinge generally dips to the ENE at 10-5^0, but it beds near-horizontally at the watershed of the Teply and the Krasny creeks. The most intensive mineralization with increased gold content is confined to this part of the fold.

The Lozhkovaya syncline is characterized by an intensively dislocated core complicated by en echelon upthrust. Regular reduction of the width of the syncline from west to east is another particularity.

Disjunctive dislocations are presented by near-latitudinal upthrusts and downthrusts, near-longitudinal downthrusts-shifts and zones of increased fracturing and crushing.

Near-latitudinal faults are most widely developed. They are concentrated in the flat limb of the Rudnaya anticline and in the central parts of the Verkhne-Bodaibinskaya anticline. They are a part of the folding zone. The length of individual faults is 10-100 m to 4-5 km, rarely more. Their location is en echelon in relation to each other. Tectonic joints are usually presented by grinded fractures or fracturing zones filled with quartz, quartz-sulphide veinlets and quartz veins.

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The orientation of near-latitudinal faults is conformable to the direction of main structures. The dipping is usually steep at 60-80^0. The amplitude of displacement along tectonic joints is low, making approximately first cm to first tens of meters.

Near-longitudinal downthrust-shifts are expressed in the form of series of adjacent steeply dipping shear fractures with fault polishes and channels. The displacement amplitude is insignificant – 0.5-1.0 m, rarely up to 5 m. The length of such faults does not exceed first hundreds of meters.

Minor structural forms include microfolding, boudinage, tectonic crushing and fracturing zones. The degree of occurrence of this or other type of minor folding forms depends on the lithological composition of intersected horizons. The zones of microfolding first cm to tens of meters thick are developed in thin rock alternation horizons. Boudinage is typical for coarse rock alternation; the boudine orientation is in all cases with their long axis along axial cleavage.

Zones of intensified fracturing and crushing have near-latitudinal and near-longitudinal orientation and form single zones. Rock fracturing is very intensive. Main fracture systems are defined within the Krasnoye ore field, similar to all studied ore occurrences and deposits of the Bodaibo ore-bearing district: cleavage 1 (dip azimuth 10-20^0, dip angle – 0-75^0); cleavage 2 (dip azimuth 90-100^0 and 280^0, dip angle – 70-80^0).

Moreover, there are fractures of NW orientation (dip azimuth 235^0-245^0, dip angle 80^0) and an insignificant number of flat ruptures (dip azimuth 110-120^0, dip angle 20^0).

Axial cleavage is generally developed and coincides at the areas of monoclinal bedding, with layer-by-layer cleavage developed at contacts of lithological varieties.

Near-latitudinal fracturing zones and zones of layer-by-layer shifts were formed during linear folding formation. These tectonically weakened zones were used by ore-bearing fluids for ore localization. At the ore occurrence the fracture tectonics controls the location of veinlet quartz-sulphide and quartz-vein mineralization.

8.3.4. Placer Gold Content

The gold placers of the Nearest Taiga (Blizhayshaya Taiga) unique in the grade have been developed, explored and studied for more than 100 years. The placers of the Bodaibo River and its tributaries are the richest. An exceptionally wide development of buried alluvial placers is typical for them. The placers of deep valley bottoms are dominating. Terraces of the low (up to 15 m), the middle (15-30 m) and the high (above 30 m) levels and bed placers are rarer.

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Deep valley bottom placers are characterized by long extension, continuity and a high degree of saturation with metal (2-3 t/km). Low-level terrace placers are developed most widely and have the same degree of saturation as deep valley bottom placers. The placers of middle-level terraces are not very rich. High-level terrace placers are developed poorly.

River bed placers are most widely developed and are completely mined out to date.

Narrow placers are small in size and reserves and are characterized by irregular metal grades. Weak development of narrow placers is associated (Tischenko E.I.) with wide occurrence of solifluction processes in narrows.

Eluvial and deluvial-solifluction placers are unknown in the Bodaibo complex syncline, although concentrate gold halos are identified within all ore fields.

The placer gold content is known in the valleys of the Teply and the Krasny Creeks within the designed work area. These are river bed placers of minor watercourses. In this case the upper, head parts of placers are located orographically above the known ore occurrences. Previous researchers did not reveal any significant placer god resources in slope deposits of the territory.

8.3.5. Gold Mineralization

Two types of gold-ore mineralization are identified within the Krasny ore field: veinlet-disseminated quartz-sulphide type of mineralization with lithological and structural control, and quartz-vein type with limited development. These two types frequently spatially coincide.

The ***quartz-sulphide mineralization*** forms veinlet-disseminated zones amidst metamorphogenic dispersed zones of sulphide mineralization within the sites of structural complications. The internal structure of the zones is complex and represents a thick grid of veinlets, lenses and pockets oriented in different directions and found together with intensive (above 1-3%) dispersed dissemination (pyrite) in schistose and cleavaged host rocks. In general, increase of the number of veinlet-lens-shaped ore mineral association inclusions occurs in parallel with increase of disseminated sulphide mineralization.

A wide development of sulphide mineralization presented primarily by pyrite is a typical feature of the whole ore field. Pyrrhotite, chalcopyrite, sphalerite and galena are is subordinated quantities. Pyrite is presented by the following morphologic varieties: 1) dusty pyrite (pre-ore), 2) in the form of unclearly expressed inclusions; 3) porphyroblastic cubic pyrite, 4) lens-shaped pyrite, and 5) pyrite in quartz veinlets.

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e-mail: info@miramine.ru

The gold grade in pyrite varieties is different. Lens-shaped aggregate cubic and cubic porphyroblastic pyrite has the highest gold grade.

Pyrite in quartz veinlets is most frequently observed within the ore field and is considered low-grade, with the gold grades 0.002-0.8 g/t. The thickness of quartz-pyrite veinlets is from fractions of mm to 2 cm and above; the degree of their saturation of host rocks varies and makes from 1 per 1 m^2 to 5-6 per 1 m^2. Quartz in veinlets is white, semi-transparent, amorphic.

Gold in veinlets is noted in the form of irregular grains 0.02 x 0.01 mm to 0.06 x 0.12 mm in size, present at the quartz contact with pyrite.

The axial part of the Rudnaya anticline (where the Krasnoye ore occurrence is located) and the axial part of the Verkhne-Bodaibinskaya anticline (Verkhne-Bodaibinskaya mineralized zone) are most mineralized. These are referred to as Southern and Northern mineralization zones below.

The ***quartz mineralization*** is localized in veins and veinlets, usually with lens-shaped morphology: thickness 0.2 cm to 0.5 m and length from first centimeters to tens of meters. Quartz-vein fields and zones are confined to the core and to the southern limb of the Verkhne-Bodaibinskaya anticline and the southern limb of the Rudnaya anticline. They are located within near-latitudinal zones (belts) of dispersed quartz and quartz-sulphide mineralization. The distribution of quartz-vein material in these belts is irregular and the sites with increased concentration alternate with barren ones. It is assumed that the ones which suffered additional hydrothermal processing are the only potential ones. The following vein and veinlet systems are defined: stratal near-latitudinal continuous in size and strike near-horizontal and near-longitudinal discontinuous in size.

The northern belt of quartz veins is confined to the core and the southern limb of the Verkhne-Bodaibinskaya anticline and stretches across the whole area with the width 0.8-1.0 km. The maximum degree of saturation with quartz is registered within the license area by previous researchers in the upper reaches of the Teply and the Krasny Creeks and at the watershed of the Krasny and the Mokry Creeks. Moreover, a zone of quartz vein development is noted, confined to the southern limb of the Rudnaya anticline. The most evident occurrences are defined at the Teply and the Krasny watershed and at the Teply and the Topky watershed.

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9. Basic Data

9.1. Analysis of Borehole and Trench Databases

The Customer provided databases on boreholes and channels in .mdb and .dat formats. The files contains in bases were renamed in accordance with LLC. Miramine internal standards, with preservation of field names in files. The input files, their content and renamed files are given in the table below.

Borehole database (DH_NEW.dhdb):

Original File	File Content	Renamed File
KRA_Ustia_core.DAT	Collar file	DH_collar_new.DAT
KRA_Inklin_core.DAT	Directional survey file	DH_survey_new.DAT
KRA_Proba_core.DAT	Borehole sampling file	DH_assay_new.DAT
KRA_Geoldat_core.DAT	Lithology file	DH_geo_new.DAT

Channel database (TR_NEW.dhdb):

Original File	File Content	Renamed File
KRA_Channel_MarkPiket.DAT	Trench coordinates file	TR_collar_new.DAT
KRA_Channel_proba.DAT	Channel sampling file	TR_assay_new.DAT
KRA_Channel_GeoldatDAT	Lithology file	TR_Geo_new.DAT

The database DH_NEW.dhdb **contains the following fields in files:**

Collar file: DH_collar_new.DAT

Field	Field Content
BHID	Borehole No
X,Y,Z	Borehole collar coordinates
EOH	Borehole depth (m from collar)

Directional survey file: DH_survey_new.DAT

Field	Field Content
DHID	Borehole No
FROM	Measurement depth from, m
TO	Measurement depth to, m
AZ	Borehole inclination azimuth
DIP	Borehole dip angle

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Sampling file: DH_assay_new.DAT

Field	Field Content
BHID	Borehole No
SAMPLE	Sample No.
FROM	Beginning of the sampling interval (m from collar)
TO	Ending of the sampling interval (m from collar)
LENGTH	Interval length (m)
CONTROL	
AU	Grade field, g/t

Lithology file: DH_geo_new.DAT

Field	Field Content
BHID	Borehole No
FROM	Beginning of the sampling interval (m from collar)
TO	Ending of the sampling interval (m from collar)
NAME SOSTAV COLOR STRUKTURA TEXTURA METASOM PROJGILK TRESCH VIVETR OKISL TXT_CTS TXT_SOSTAV ROCK-FORM TXT_ORE TXT_PROJGI SUPERGENE TXT_TRESCH TXT_METASO TXT_TEKTON CONTACT COMMENT	Lithological description

The database TR_NEW.dhdb **contains the following fields in files:**

Collar file: TR_collar_new.DAT

Field	Field Content
BHID	Trench No.
X,Y,Z	Channel stake coordinates
meter	Distance between channel stakes

Sampling file: TR_assay_new.DAT

Field	Field Content
BHID	Trench No.
SAMPLE	Sample No.
FROM	Beginning of the sampling interval (m from zero stake)
TO	Ending of the sampling interval (m from zero stake)
LENGTH	Interval length (m)
CONTROL	
AU	Grade field, g/t

Lithology file: DH_geo_new.DAT

Field	Field Content
BHID	Trench No.
FROM	Beginning of the sampling interval (m from zero stake)
TO	Ending of the sampling interval (m from zero stake)
NAME SOSTAV COLOR STRUKTURA TEXTURA METASOM PROJGILK TRESCH VIVETR OKISL TXT_CTS TXT_SOSTAV ROCK-FORM TXT_ORE TXT_PROJGI SUPERGENE TXT_TRESCH TXT_METASO TXT_TEKTON CONTACT COMMENT	Lithological description

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The Customer also provided graphical materials (geological sections along drilling profiles) and a topographic surface file Krasniy_topo.dwg, which was converted to the wireframe file DTM.TDB.

9.2. Verification of Borehole and Trench Databases

The received borehole coordinates and sampling files were verified in GGIS Micromine with the help of special processes for presence of the following possible errors:

- The working number is absent in the coordinates file but is present in the analytical results file.
- The working number is absent in the analytical results file but is present in the coordinates file.
- The working number is present more than once in the analytical results or the coordinates files.
- One or more coordinates of the working collar is omitted or wrong in the coordinates file.
- FROM or TO is missing in the analytical results file.
- FROM is more or equals to TO in the analytical results file.
- Sampling intervals are not adjacent in the analytical results file (there is a gap between analyses).
- Sample intervals overlap in the analytical results file.
- The total depth of the borehole is less than the depth of the last sample.

No errors were detected as a result of verification in the DH_NEW.dhdb database.

Verification of the TR_NEW.dhdb database revealed the following errors:

File	Working No.	Error
TR_collar_new.DAT	143501	Total length of the trajectory < total length of intervals
TR_collar_new.DAT	143502	Total length of the trajectory < total length of intervals
TR_collar_new.DAT	143505	Total length of the trajectory < total length of intervals
TR_collar_new.DAT	143506	Total length of the trajectory < total length of intervals
TR_collar_new.DAT	143507	Total length of the trajectory < total length of intervals

Errors were corrected by means of extension of the channel trajectory in the general direction to the total sampling length.

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A repeated check detected no errors.

Moreover, a united sampling file was created for boreholes and trenches all_assay_new.dat. The structure of the file was preserved, a field AU_correct was added, and zero gold grades detected in the Au grade field were replaced in the field AU_correct with 0.01 (half of the detection limit of the device).

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10. Statistic Analysis of Sampling Data

The statistic analysis was conducted several times, both for the whole sampling database and the selection in the wireframe.

The purposes of the analysis were:

- determination of the natural cutoff grade of the mineralization for further interpretation;
- determination of the type of distribution in ores.

The processes *Statistics/distribution, Statistics/Normal/Log* were used in ***Micromine*** for statistic analysis.

Figure 10-1 Data on classic statistics *Normal/Log* for Au grades in all samples

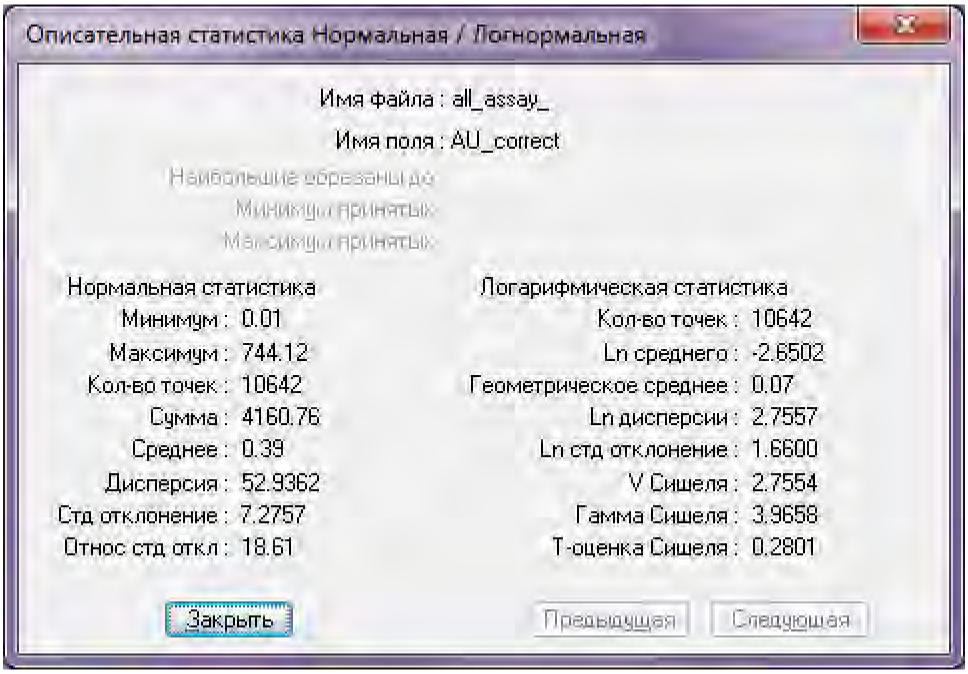

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Figure 10-2 Data on classic statistics (Median/Moda)
for Au grades in all samples

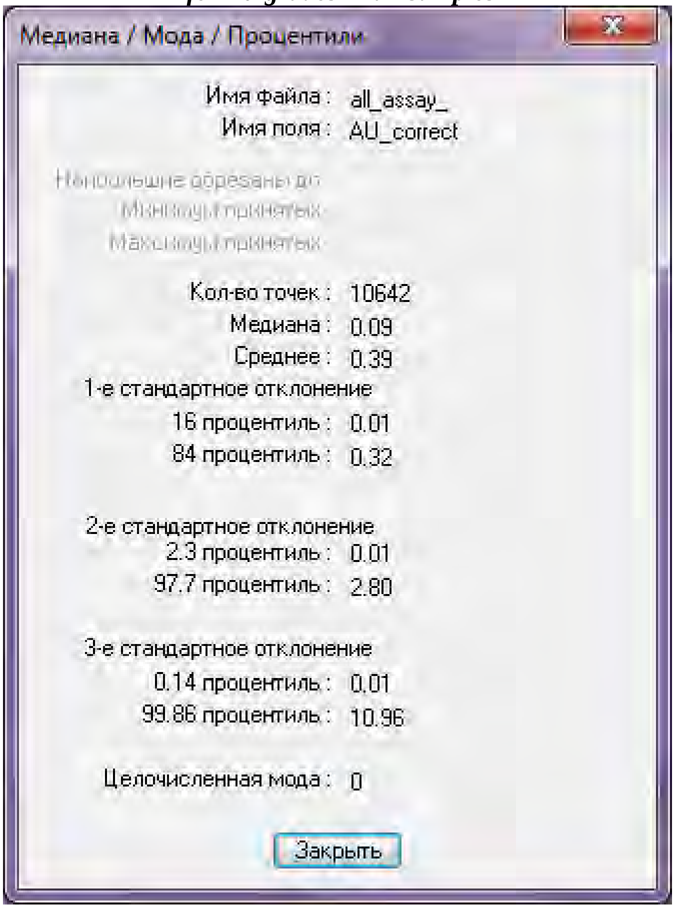

Figure 10-3 Histogram for all samples of the deposit *for Au grades*

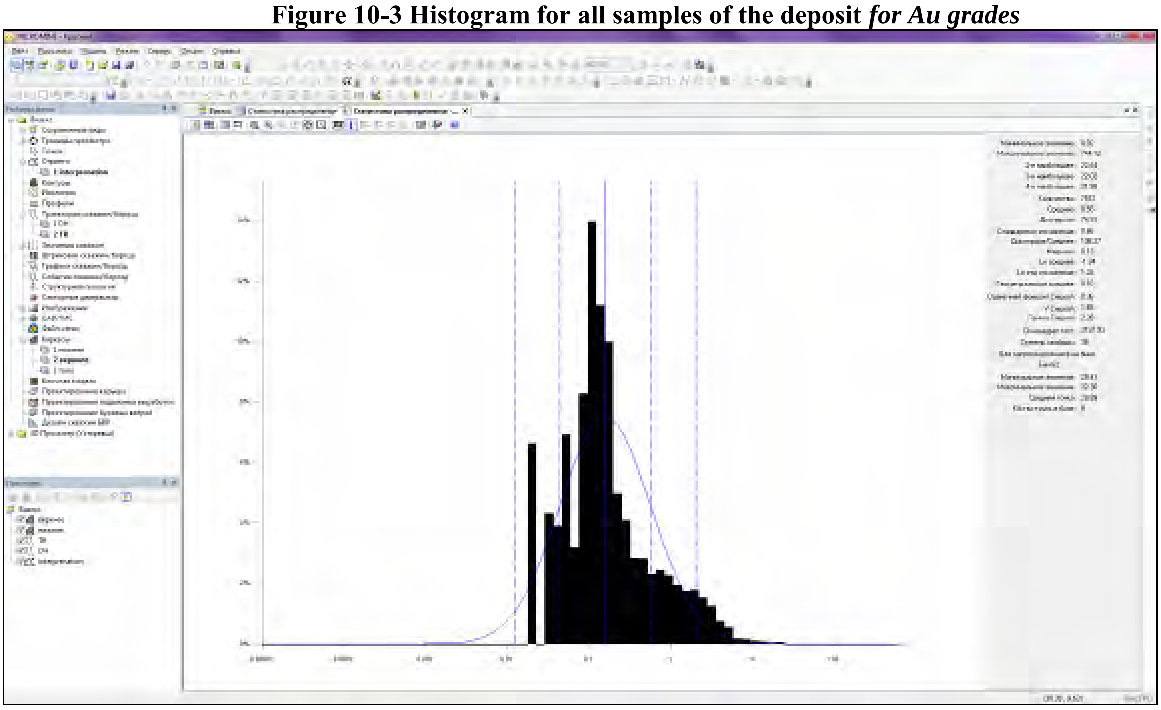

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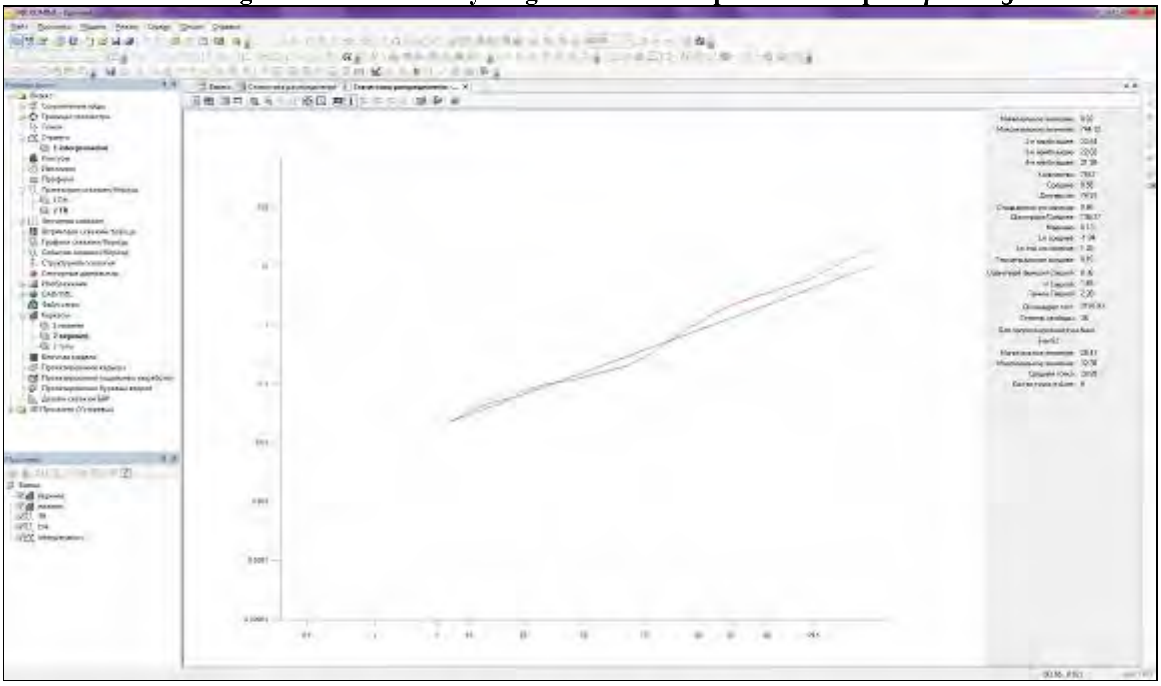
Figure 10-4 Probability diagram for all samples of the deposit *for Au grades*



The histogram and the cumulative probability diagram show lognormal gold distribution and presence of one population. A natural cutoff grade equal to 0.2 g/t was used for Au mineralization interpretation. It is seen at the bend of the cumulative probability curve.

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

10.1. Statistical Analysis for Different Workings

Figure 10-5 Data on classic statistics *Normal/Log for Au grades in boreholes*

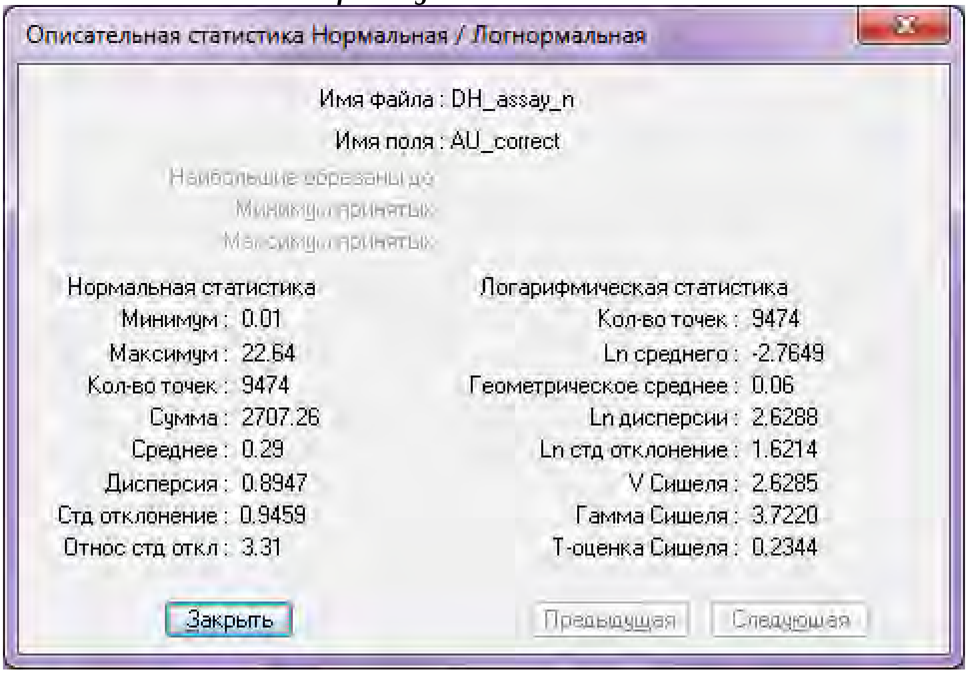

Figure 10-6 Data on classic statistics *Normal/Log for Au grades in trenches*

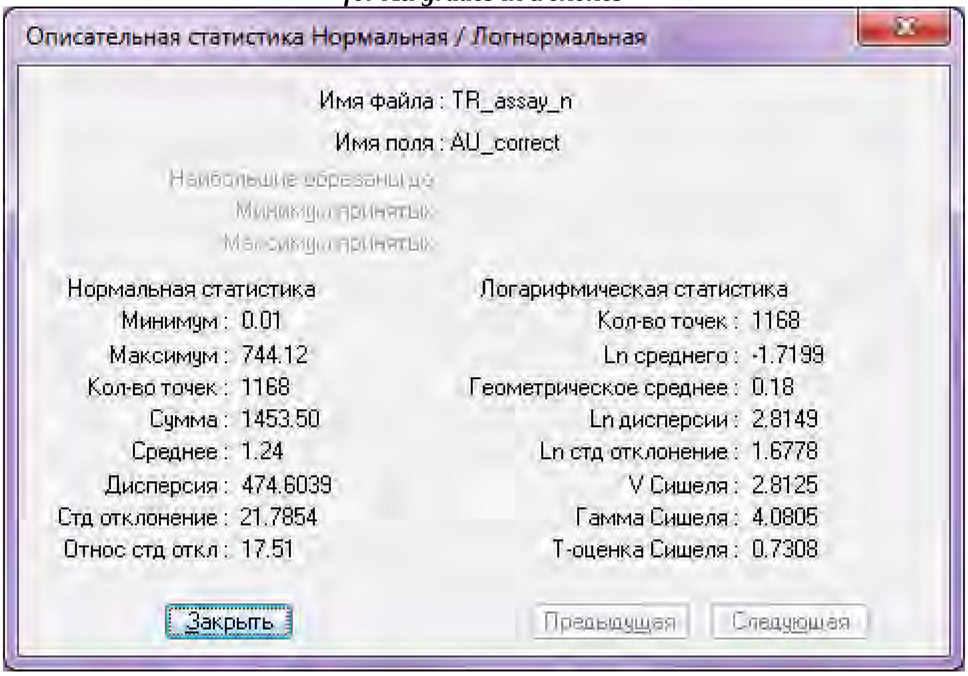

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Figure 10-7 Data on classic statistics (Median/Moda)
for Au grades in boreholes


Медиана / Мода / Процентили

Имя файла :	DH_assay_n
Имя поля :	AU_correct
Наибольшие обрезаны до	
Минимумы принятых	
Максимумы принятых	
Кол-во точек :	9474
Медиана :	0.08
Среднее :	0.29
1-е стандартное отклонение	
16 процентиль :	0.01
84 процентиль :	0.08
2-е стандартное отклонение	
2.3 процентиль :	0.01
97.7 процентиль :	2.48
3-е стандартное отклонение	
0.14 процентиль :	0.01
99.86 процентиль :	10.53
Целочисленная мода :	0

Закрыть

Figure 10-8 Data on classic statistics (Median/Moda)
for Au grades in trenches


Медиана / Мода / Процентили

Имя файла :	TR_assay_n
Имя поля :	AU_correct
Наибольшие обрезаны до	
Минимумы принятых	
Максимумы принятых	
Кол-во точек :	1168
Медиана :	0.18
Среднее :	1.24
1-е стандартное отклонение	
16 процентиль :	0.03
84 процентиль :	1.08
2-е стандартное отклонение	
2.3 процентиль :	0.01
97.7 процентиль :	4.15
3-е стандартное отклонение	
0.14 процентиль :	0.01
99.86 процентиль :	9.21
Целочисленная мода :	0

Закрыть

Figure 10-9 Histogram for boreholes *for Au grades*

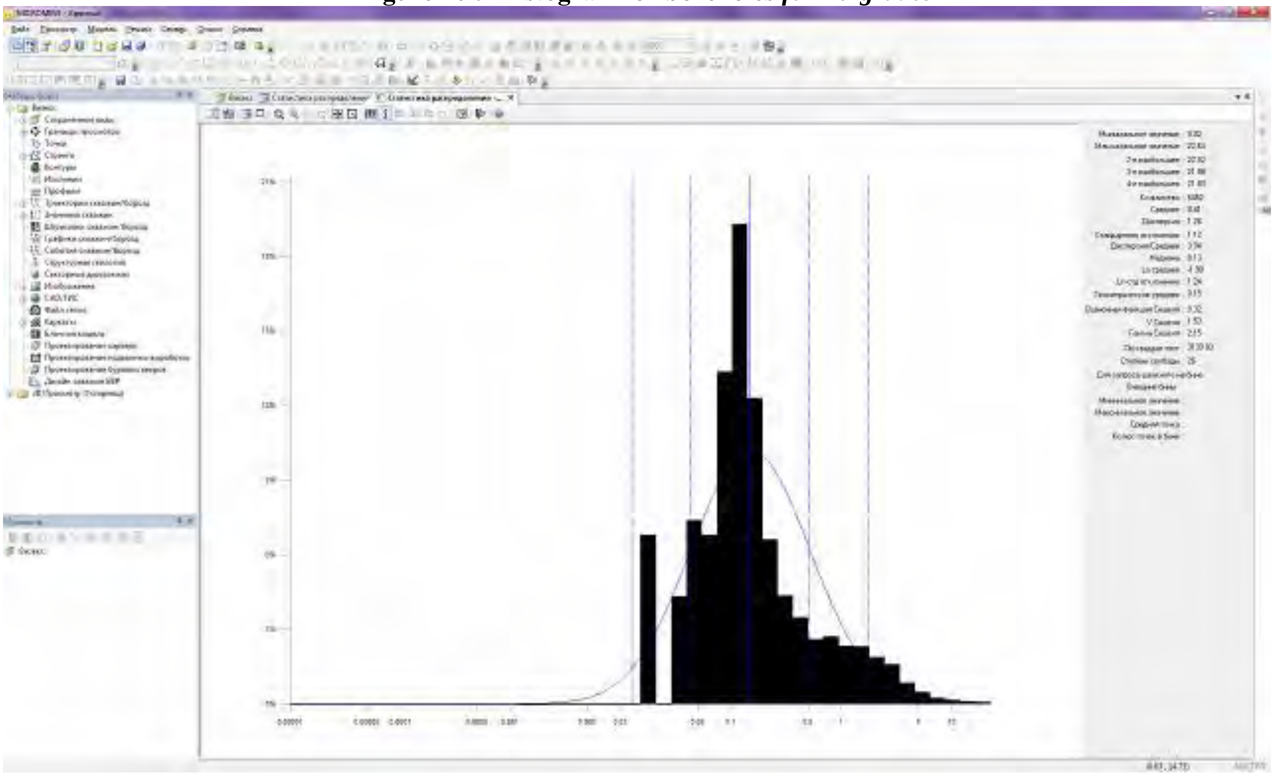

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Figure 10-10 Probability diagram for boreholes *for Au grades*

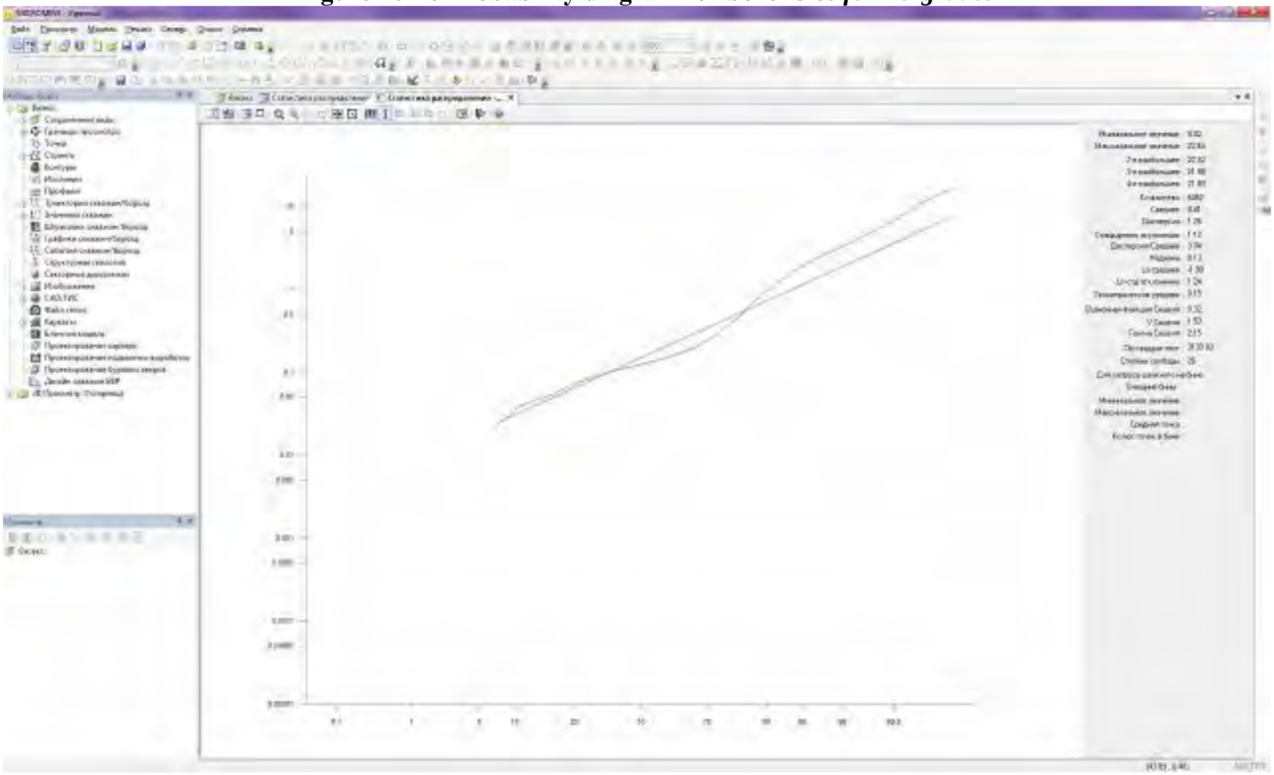

Figure 10-11 Histogram for trenches *for Au grades*

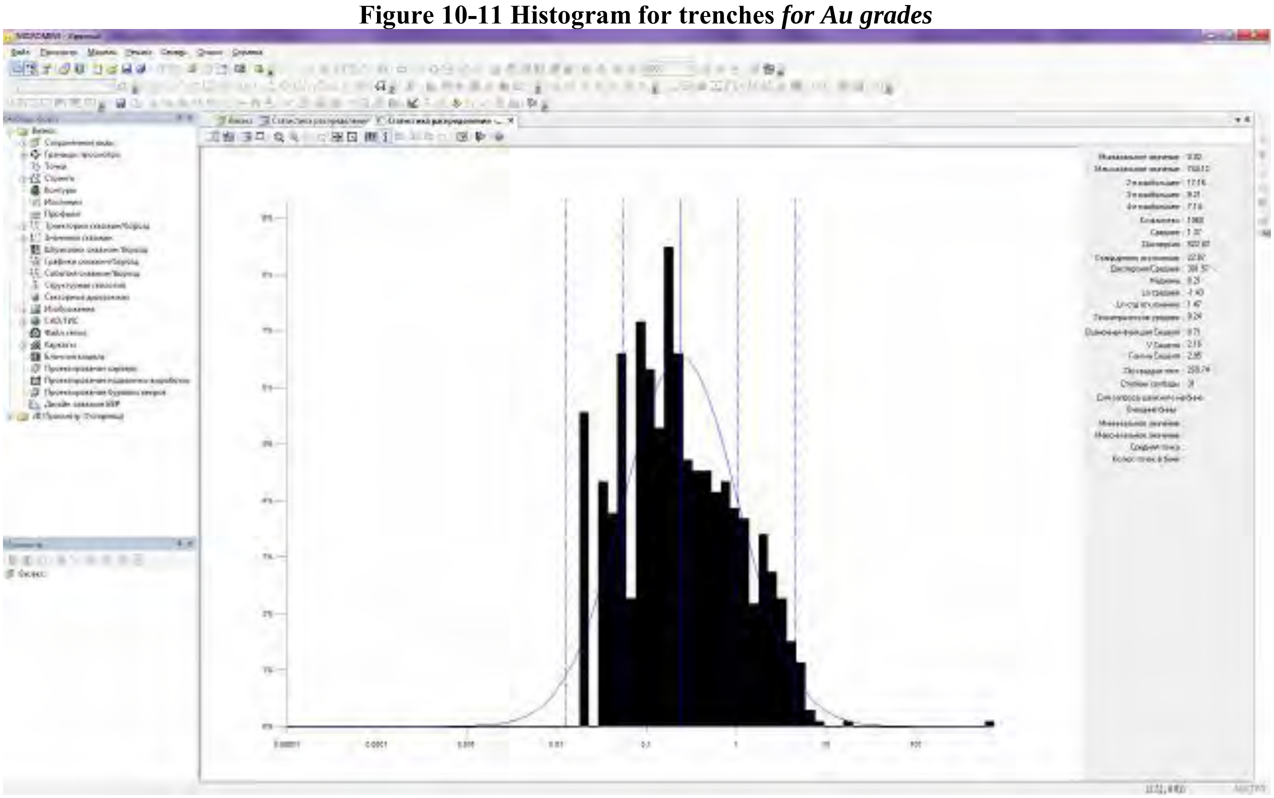

Figure 10-12 Probability diagram for trenches *for Au grades*

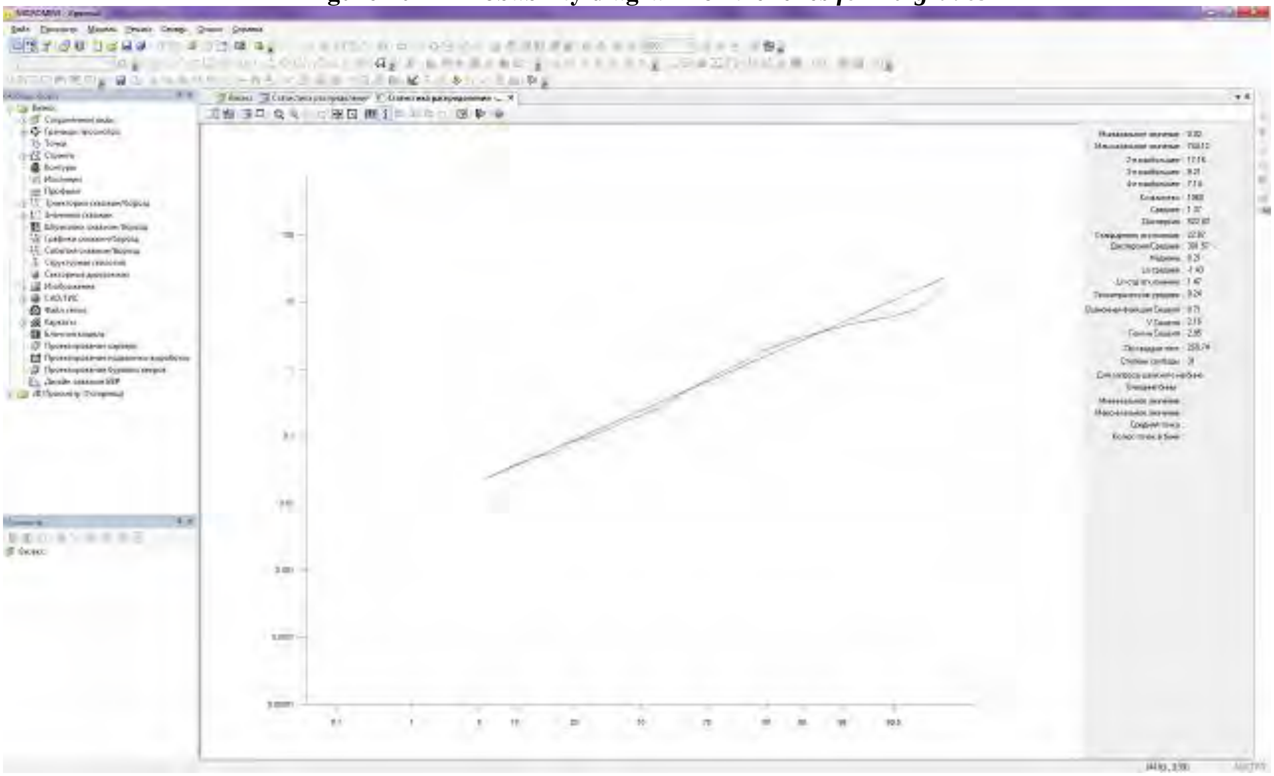

Table 10-1 Summary table of Au grade classic statistics data

Statistics Data	Number of samples	Minimum	Maximum	Mean	Coefficient of Variation	Median	Variation	Standard Deviation
For all workings	10642	0.01	744.12	0.39	18.61	0.09	52.9362	7.2757
For boreholes	9474	0.01	22.64	0.29	3.31	0.08	0.8947	0.9459
For trenches	1168	0.01	744.12	1.24	17.51	0.18	474.6039	21.7854

The table shows that the grades according to channel sampling are higher than those according to core sampling.

Channel sampling is also characterized by high variability.

11. Mineralization Interpretation

Geological modeling of mineralization is commonly conducted on the basis of natural indicators, such as natural cutoff grade of the mineralization and geological boundaries. In this case the received model will reflect natural distribution of mineralization which remains unchanged until the analytical base is replenished or the geologist's idea on the mineralization morphology is changed. Such mineralization model will be independent from any economic parameters and the latter can be applied to the model at any moment. For example, if the deposit is modeled on the basis of the natural gold cutoff grade 0.2 g/t, the model received can be used for reserve estimation with any Au cutoff grade above 0.2 g/t.

Natural Au cutoff grades 0.2 g/t identified by means of classic statistic analysis were used for ore body modeling.

Digital interpretation of the Krasnoye occurrence ore bodies was conducted in the following way:

Prior to the beginning of interpretation, new string files were created for the contours of mineralization of corresponding bodies (process *File* | *New*). The string file for the interpreted body was uploaded to *Vizex (Vizex/Strings*), and a corresponding section was opened, using one of the forms of *Display Contours.* Interpretation was conducted by means of reference of the interpreted contour points to borehole or trench sampling intervals, i.e. the created string of the ore body contour was not in the section plane but connected corresponding boreholes and/or trenches.

The orientation of sections for interpretation was chosen mainly across the strike of the main ore bodies.

The general methodology of interpretation (digitization) of ore bodies looks as follows:

1. A new string file is created in *Vizex*: an upload form *Strings* was opened, the string window was right-clicked and the option *New* was selected. The structure of the new file is standard, containing point and string coordinate fields. A separate string file was created for each ore body.
2. Prior to interpretation, it is recommended to install an *Edit Request* for a new string upload: *Options/Vizex/Request editing prior to new string upload?* In this case the sequence of interpretation can be controlled while creating new strings and string

parameters can be entered to the file created. It is recommended to enter values for each new string.

3. Strings were initially referenced to sampling intervals, and then additional points were added to them.
4. All digitized strings were closed.
5. If the ore body was not continued, the string was closed at a half of the distance between boreholes (ore trenches).

Mineralization interpretation was conducted separately on the basis of sections, for each available profile with boreholes (trenches). A string file interprenation_NEW.STR was created for interpretation lines (strings). Intervals with insignificant length with the grade below the cutoff grade inside the ore body were also included into this contour. These intervals were assumed with KP equal to zero (field KP_NEW).

While choosing the orientation of the strike (dipping angle) of the ore body, graphical materials provided by the Customer (geological sections) were taken into consideration.

According to the Customer's requirements, the results for boreholes on Profiles 16 and 22 were not included into the resource estimation. Moreover, Borehole 141450 was excluded from resource estimation. It was drilled in the east of the ore occurrence in Profile 43, and the Customer thinks that the driven profiles do not reflect the actual location of the zones of mineralization intersected in the central part of the deposit because they were driven to the north from mineralized zones. Mineralization intersected in Profile 16 reflects the ore bodies not related to the main deposit.

Therefore, in accordance with the customer's requirements, the resource estimation of the Krasny ore occurrence was limited by Profiles 26 and 35, with extrapolation of modeling results to a half of the distance between profiles.

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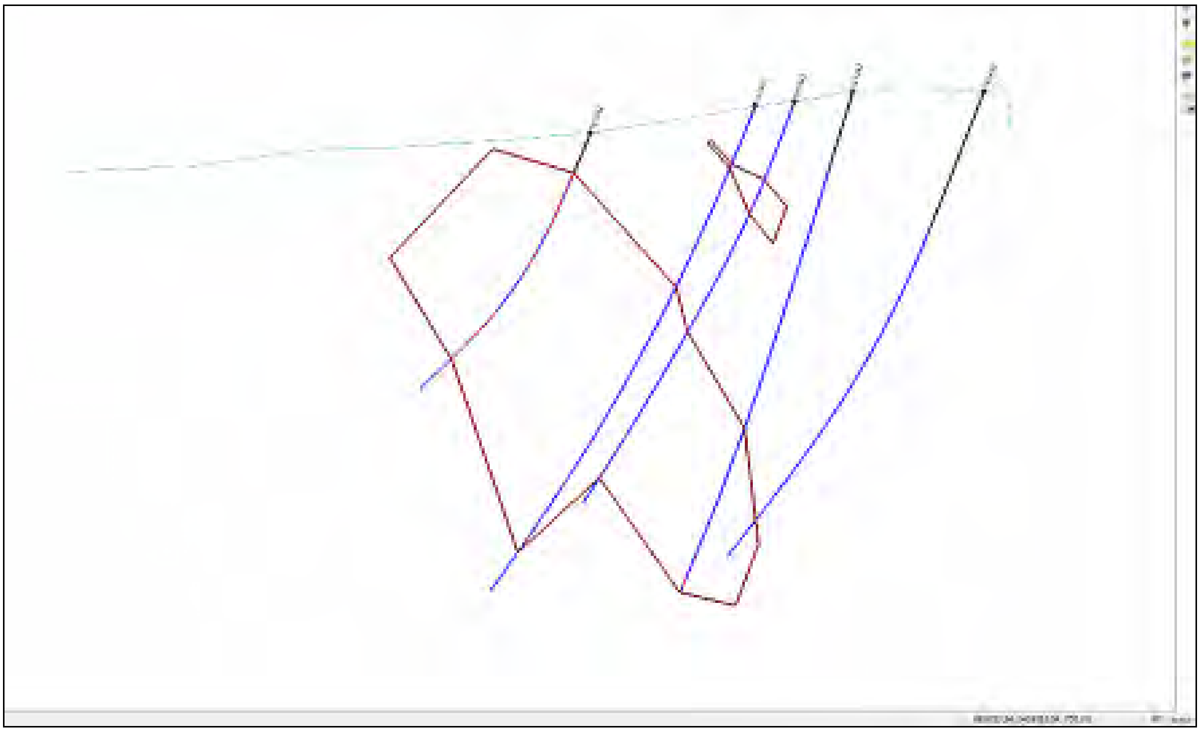
Figure 11-1 Example of mineralization interpretation



12. Wireframing

Closed wireframe models (solids) of ore bodies and cavities were built using digitized strings. Therefore, the following wireframe models were built:

Table 12-1 Wireframes of ore bodies

Type of Wireframe	Name of Wireframe	Volume, m^3
Ore_NEW	upper	57905153.32
Ore_NEW	lower	3903248.41
ALL	TOTAL	61808401.73

A standard MICROMINE methodology was used for creating digital wireframes. Wireframes are technically built in the following way:

- Start Vizex.
- Upload the string file: Upload | Strings.
- Start building a digital wireframe: Wireframe/New.
- Edit binding lines: Add.
- Build a wireframe: Build a wireframe.
- Validate the wireframe for continuity, intersections and open sites: Right-click/Validate. Validation colours as well as optimization options are chosen in options: Compress points and/or Compress triangles.

Closed wireframe models of ore bodies were built by means of successive creation of a continuous surface between strings, from section to section. Boreholes and trenches were uploaded to a 3D environment for building wireframe models. This allowed to check which borehole intervals fall into the wireframe model. The last string in a row was projected to a half of the distance between sections for creation of the ore body pinch-out. Then this string was closed.

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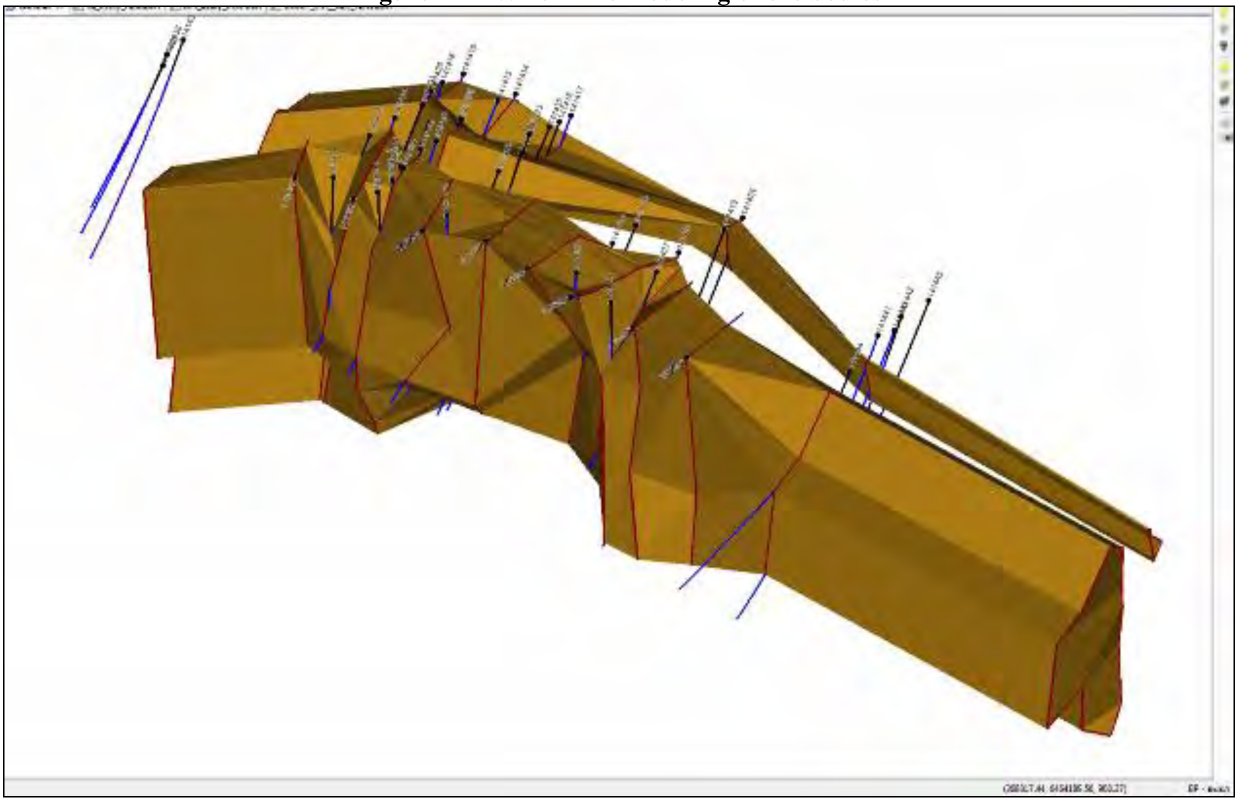
Figure 12-1 Wireframe modeling of ore bodies



In some cases the ore body could be interpreted for only a half of the section. In such cases adjoining sections were used for full interpretation of these sections. This means that in Vizex the view window was enlarged so that the ore intervals could be seen in adjoining sections. After that strings in the interpreted section were digitized but without reference to boreholes in adjoining sections.

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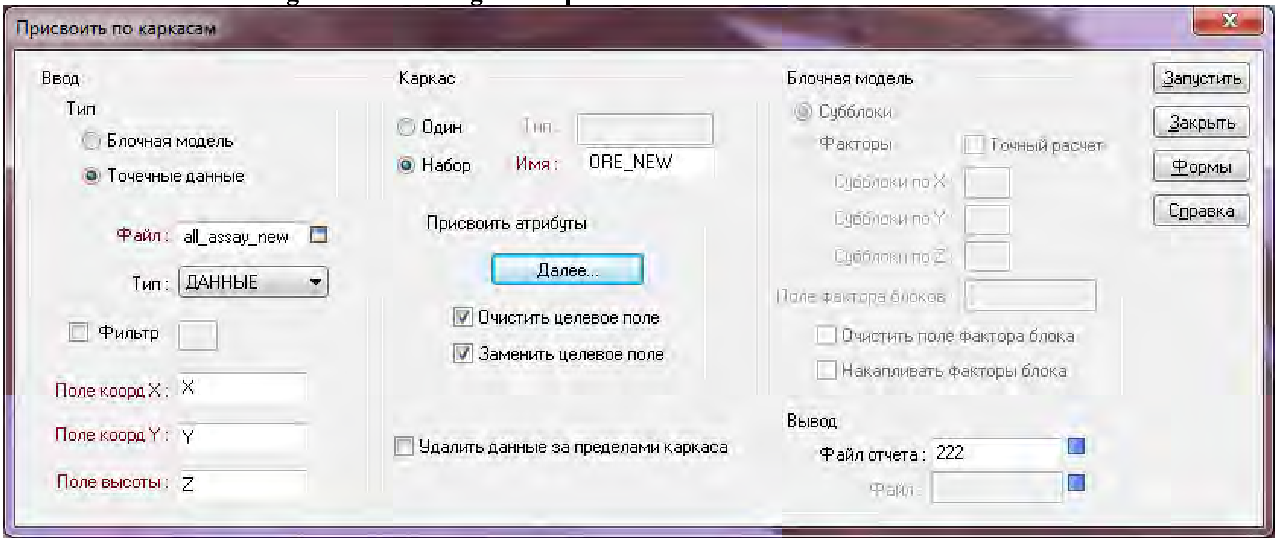
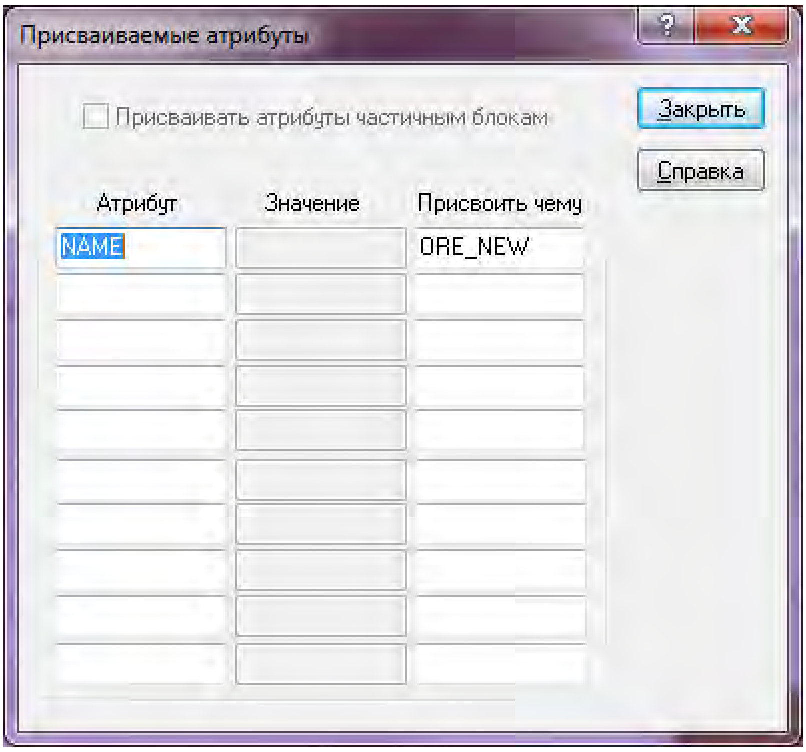
13. Sample Selection

Data selection for wireframes is a standard procedure guaranteeing usage of correct samples for classic statistic and geostatistic analyses, and for the grade interpolation process. Samples were selected on the basis of closed wireframes of mineralized zones. At that, the names of wireframes (ore bodies) coded were entered to the field ORE_NEW.

Figure 13-1 Coding of samples with wireframe models of ore bodies





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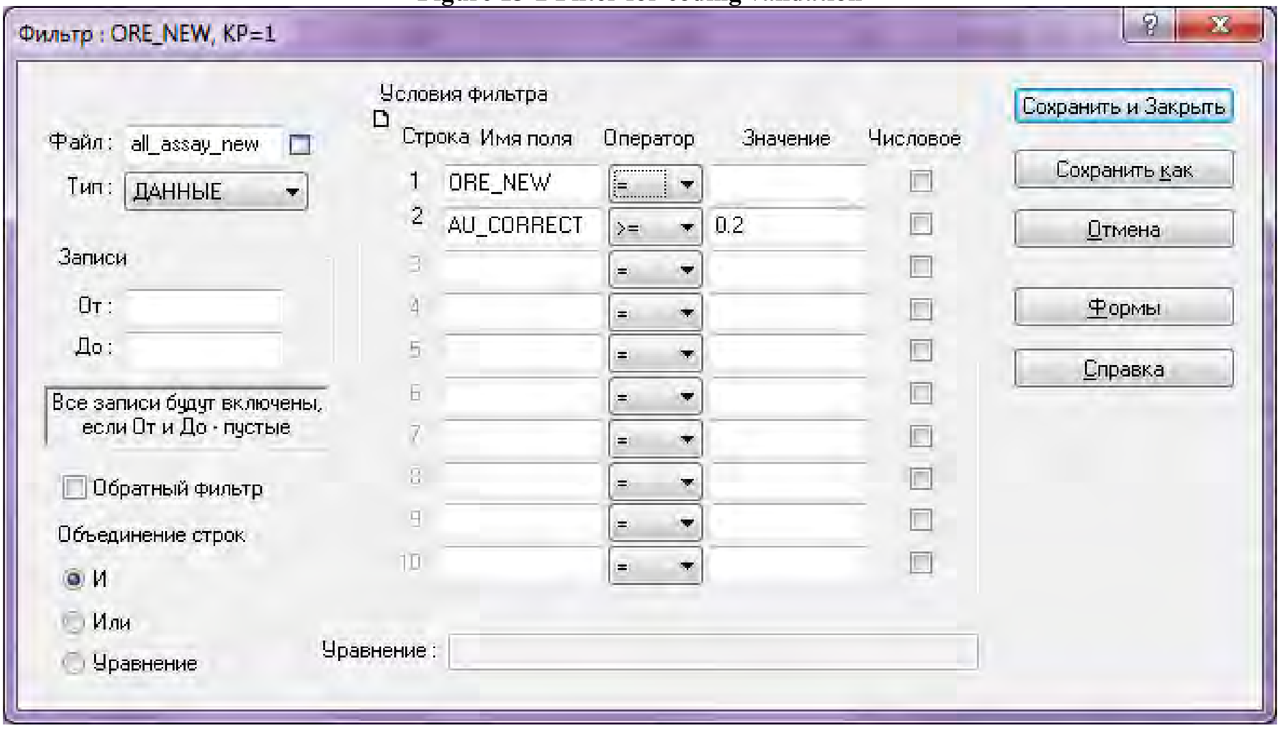
After all borehole and trench samples were coded, all samples and strings were uploaded for validation to Vizex; visual check as well as check with the help of filters were conducted. No errors were detected.

Figure 13-2 Filter for coding validation



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14. Statistic Analysis of Sampling Data Selected

Repeated statistic analysis was conducted with the purpose of evaluation of statistic parameters for useful component grades. This data was later used for validation of interpolated average grades in block models.

The processes described in Chapter 10 were used for reception of statistic data (Statistics | Descriptive | Normal/Log and Statistics | Descriptive | Median/Moda).

Samples which fell into wireframes of the ore bodies of the deposit were statistically analyzed.

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Figure 14-1 Data on classic statistics Normal/Log for all workings within ore body wireframes

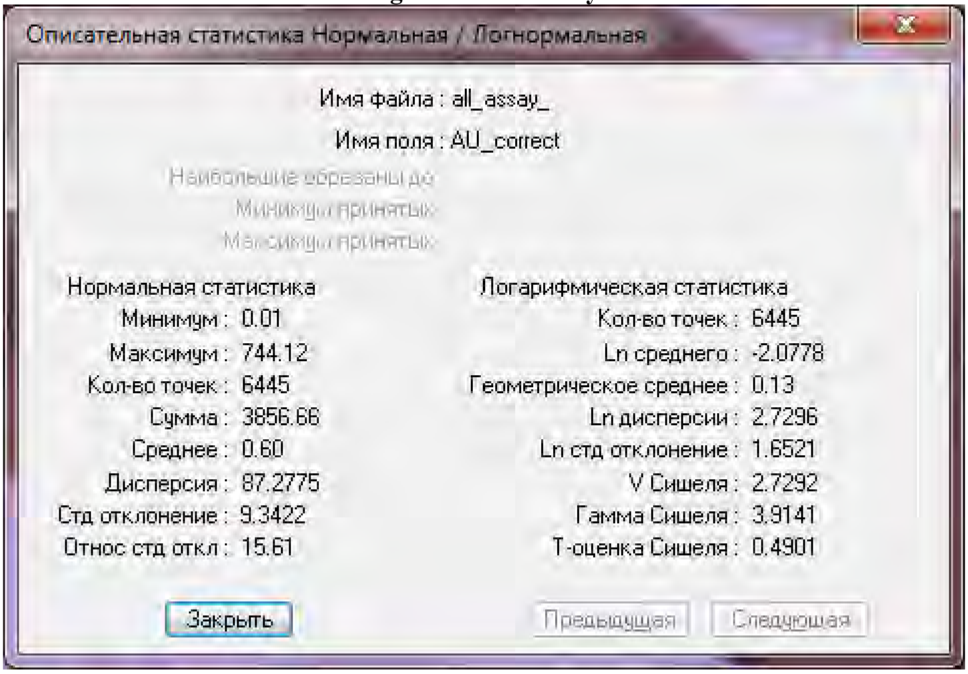

Figure 14-2 Data on classic statistics Median/Moda for all workings within ore body wireframes

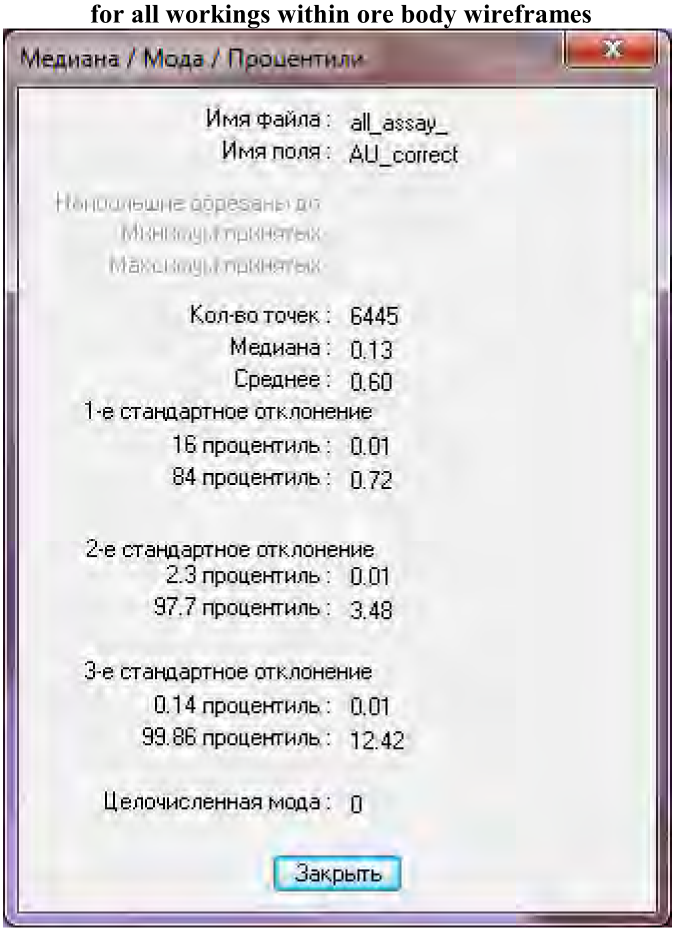

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Figure 14-3 Histogram of Au grade distribution for all workings within ore body wireframes

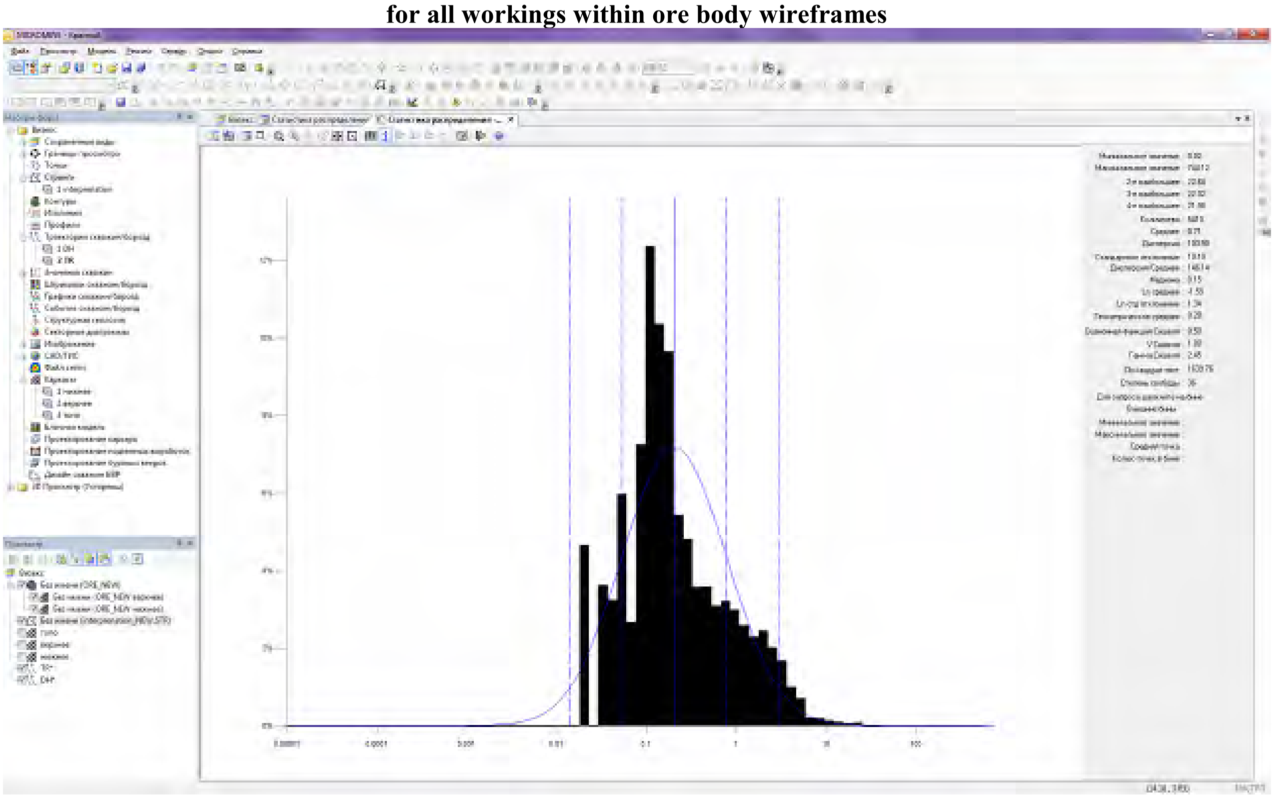

Figure 14-4 Probability diagram for all workings for Au grades within ore body wireframes

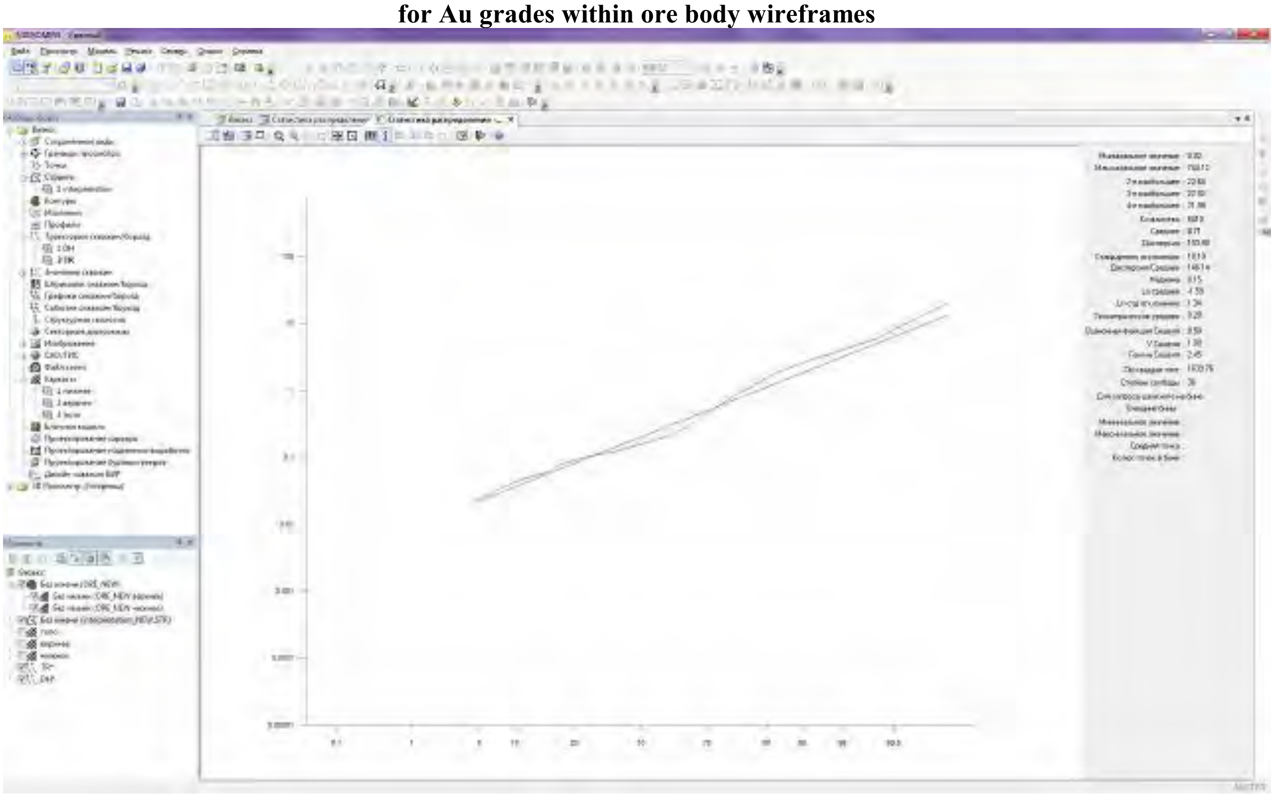

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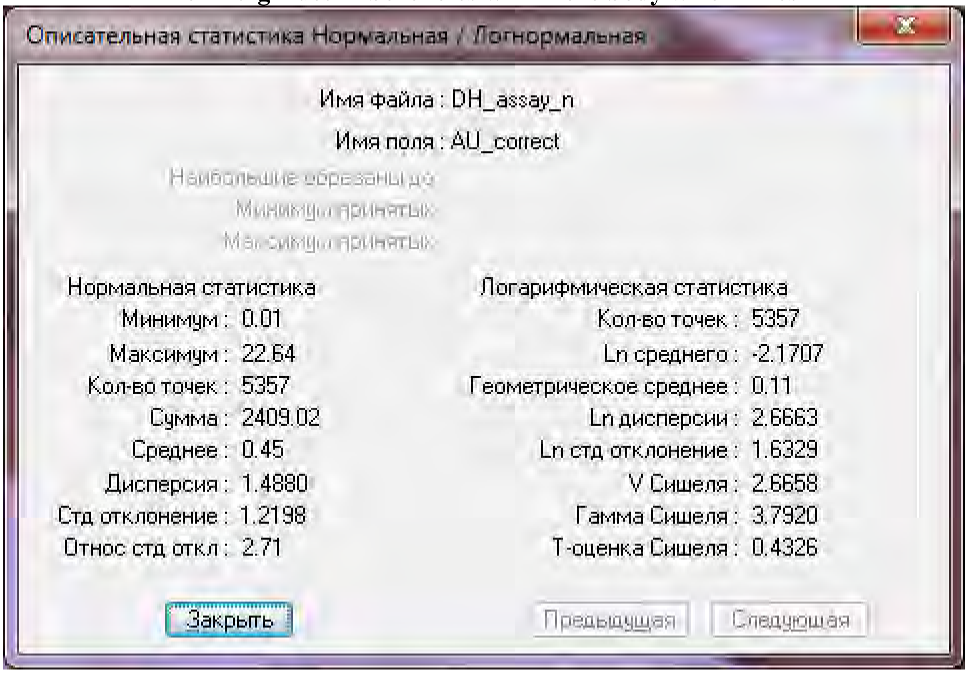
Figure 14-5 Data on classic statistics Normal/Log for Au grades in boreholes within ore body wireframes

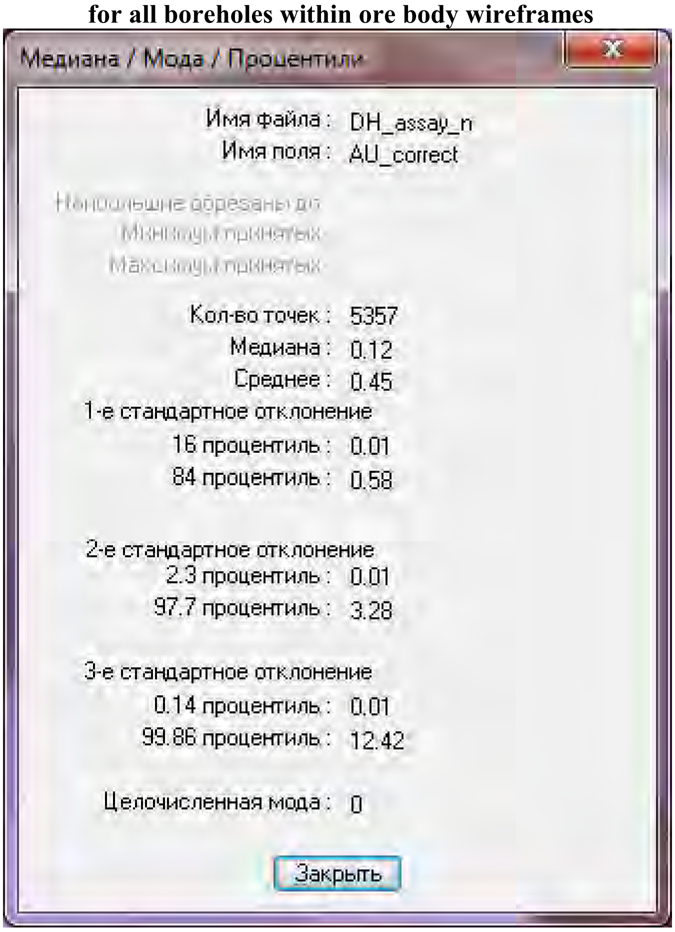

Описательная статистика Нормальная / Логнормальная

Имя файла : DH_assay_n
Имя поля : AU_correct
Наибольшие обрезаны до
Минимумы принятых
Максимумы принятых

Нормальная статистика		Логарифмическая статистика	
Минимум :	0.01	Кол-во точек :	5357
Максимум :	22.64	Ln среднего :	-2.1707
Кол-во точек :	5357	Геометрическое среднее :	0.11
Сумма :	2409.02	Ln дисперсии :	2.6663
Среднее :	0.45	Ln стд отклонение :	1.6329
Дисперсия :	1.4880	V Сишеля :	2.6658
Стд отклонение :	1.2198	Гамма Сишеля :	3.7920
Относ стд откл :	2.71	Т-оценка Сишеля :	0.4326

Закрыть | Предыдущая | Следующая

Figure 14-6 Data on classic statistics Median/Moda for all boreholes within ore body wireframes


Медиана / Мода / Процентили

Имя файла : DH_assay_n
Имя поля : AU_correct

Наибольшие обрезаны до
Минимумы принятых
Максимумы принятых

Кол-во точек : 5357
Медиана : 0.12
Среднее : 0.45
1-е стандартное отклонение
16 процентиль : 0.01
84 процентиль : 0.58

2-е стандартное отклонение
2.3 процентиль : 0.01
97.7 процентиль : 3.28

3-е стандартное отклонение
0.14 процентиль : 0.01
99.86 процентиль : 12.42

Целочисленная мода : 0

Закрыть

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Figure 14-7 Histogram of Au grade distribution for boreholes within ore body wireframes

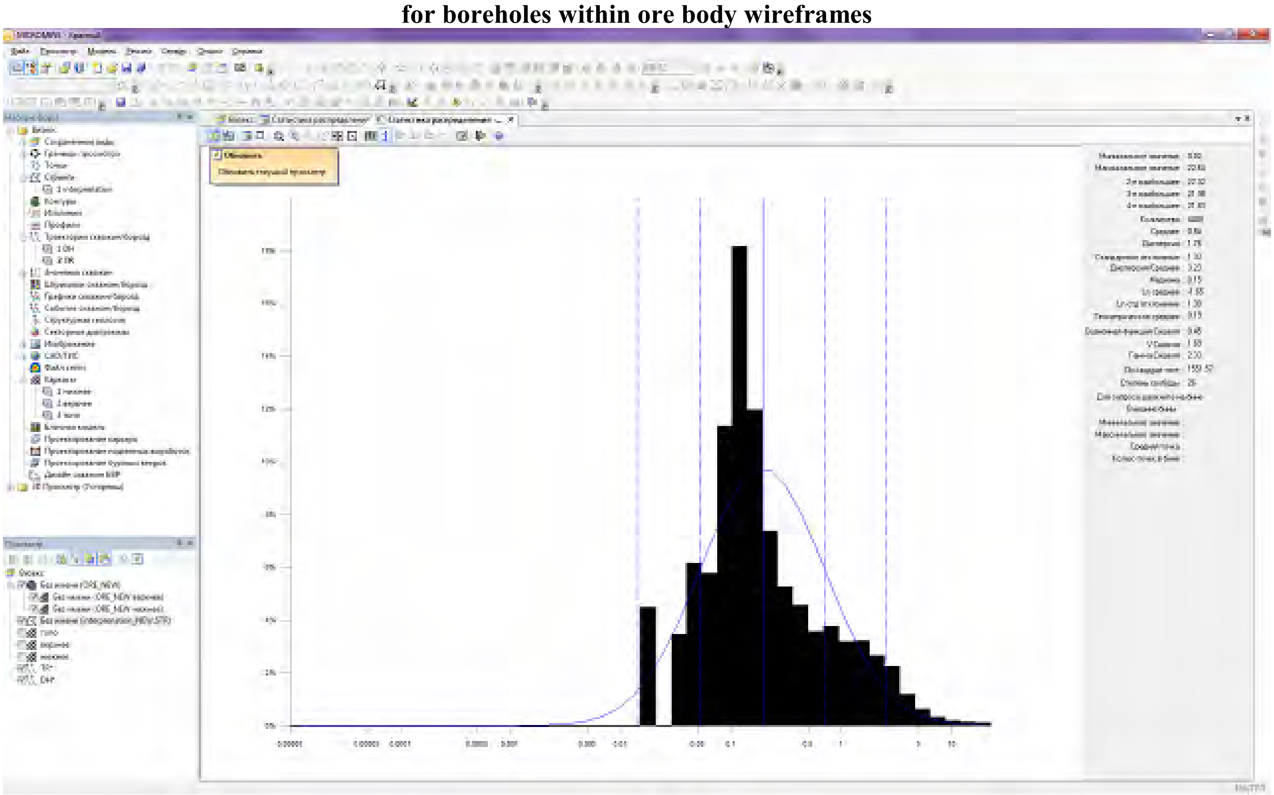

Figure 14-8 Probability diagram for boreholes *for Au grades* within ore body wireframes

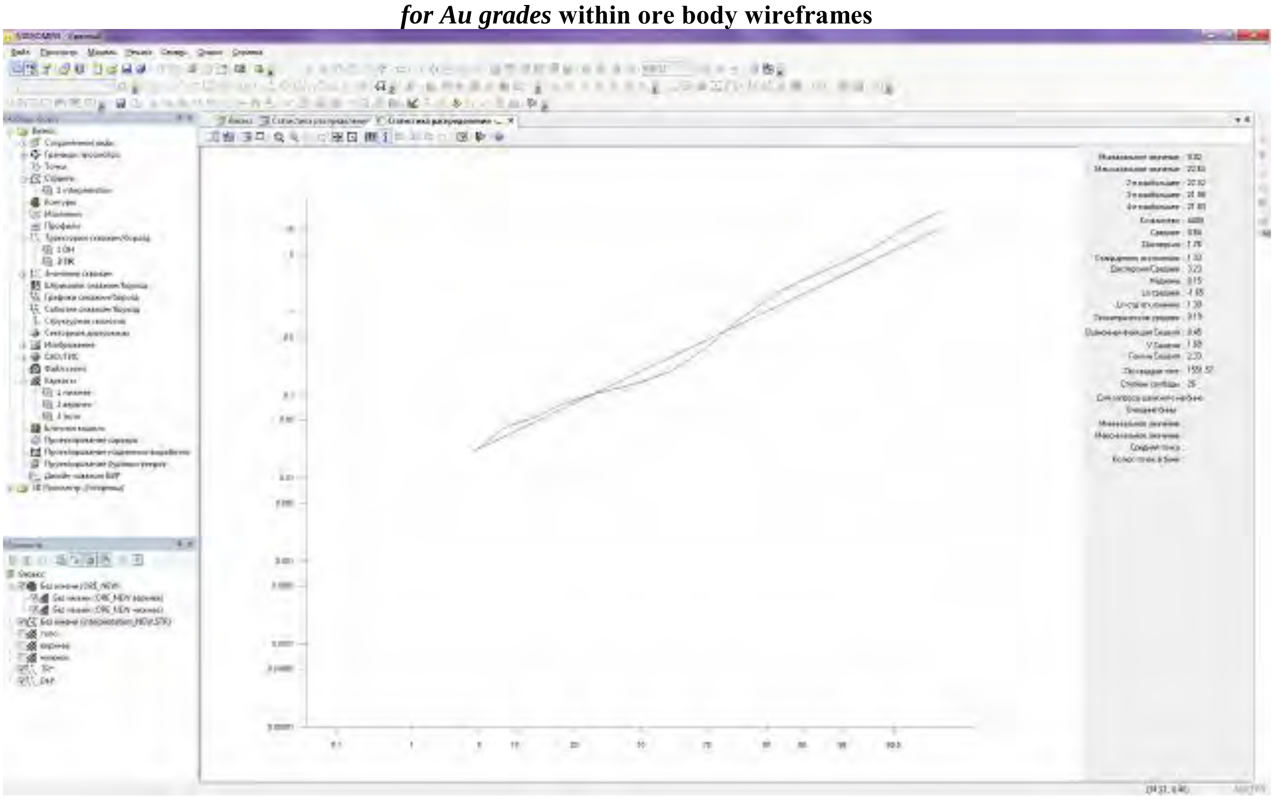

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Figure 14-9 Data on classic statistics Normal/Log
for Au grades **in trenches within ore body wireframes**

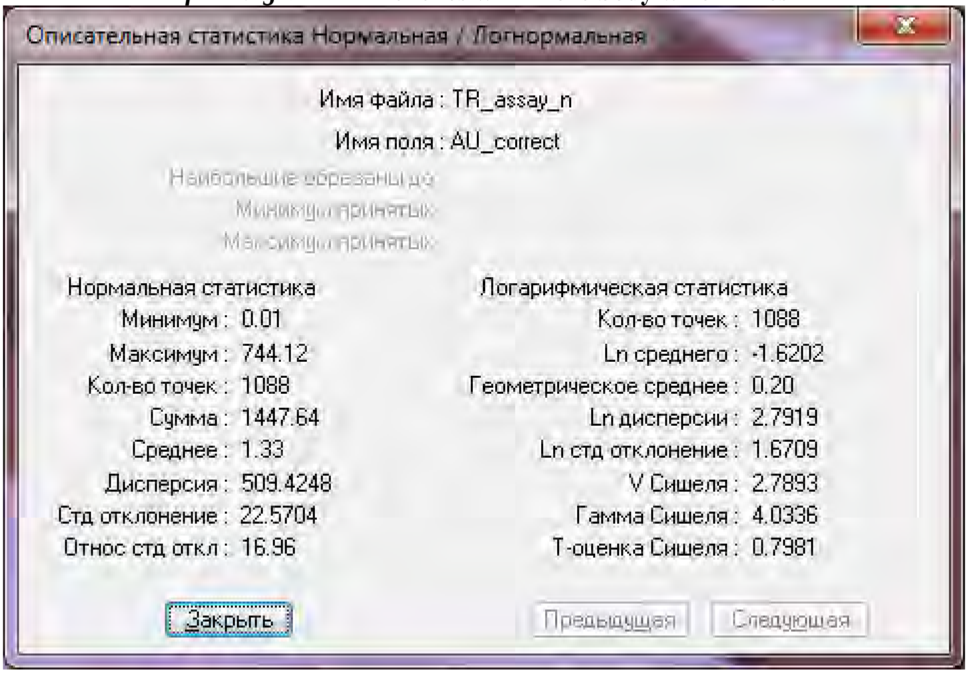

Figure 14-10 Data on classic statistics Median/Moda
for trenches within ore body wireframes

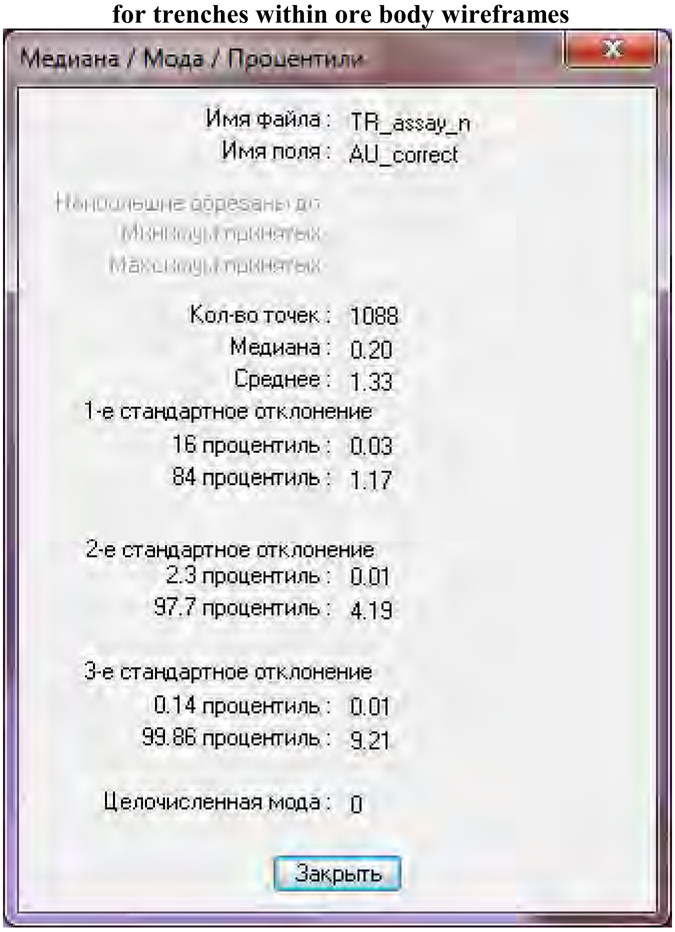

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Figure 14-11 Histogram of Au grade distribution for trenches within ore body wireframes

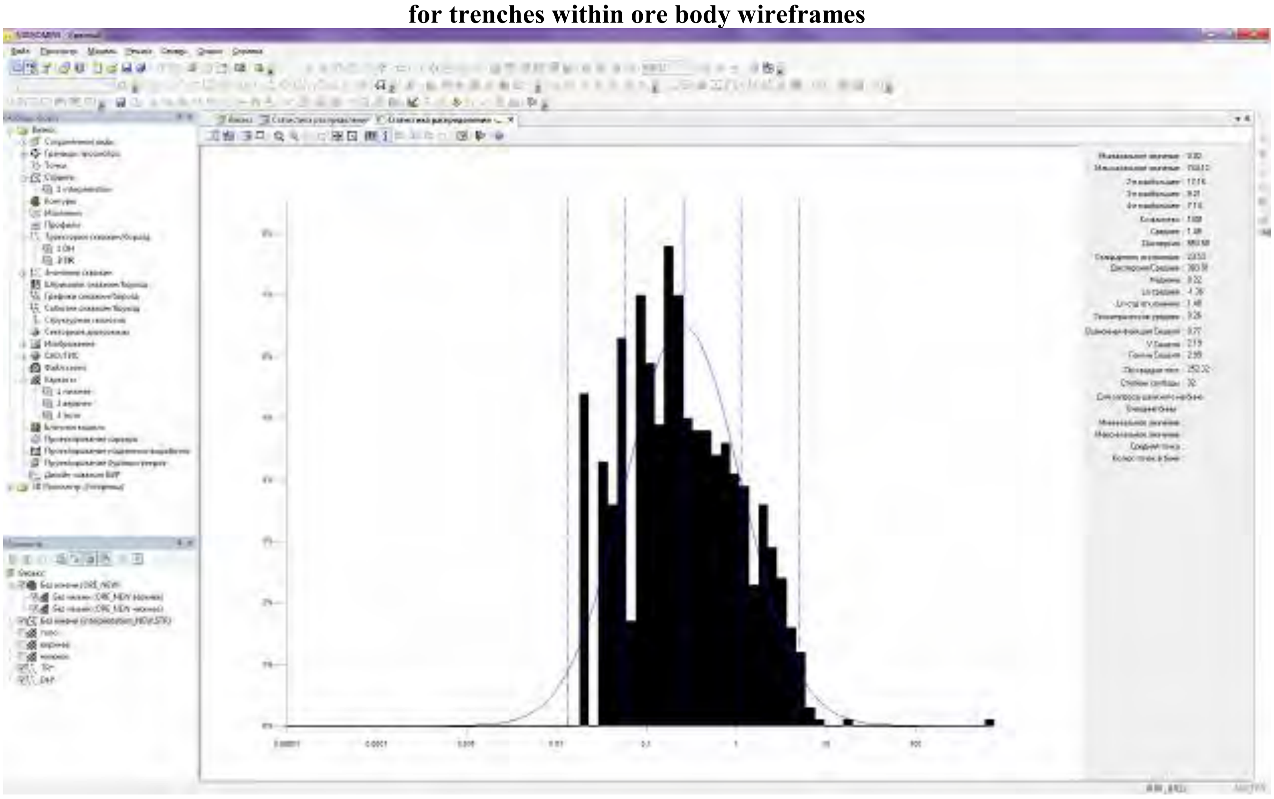

Figure 14-12 Probability diagram for trenches *for Au grades* within ore body wireframes

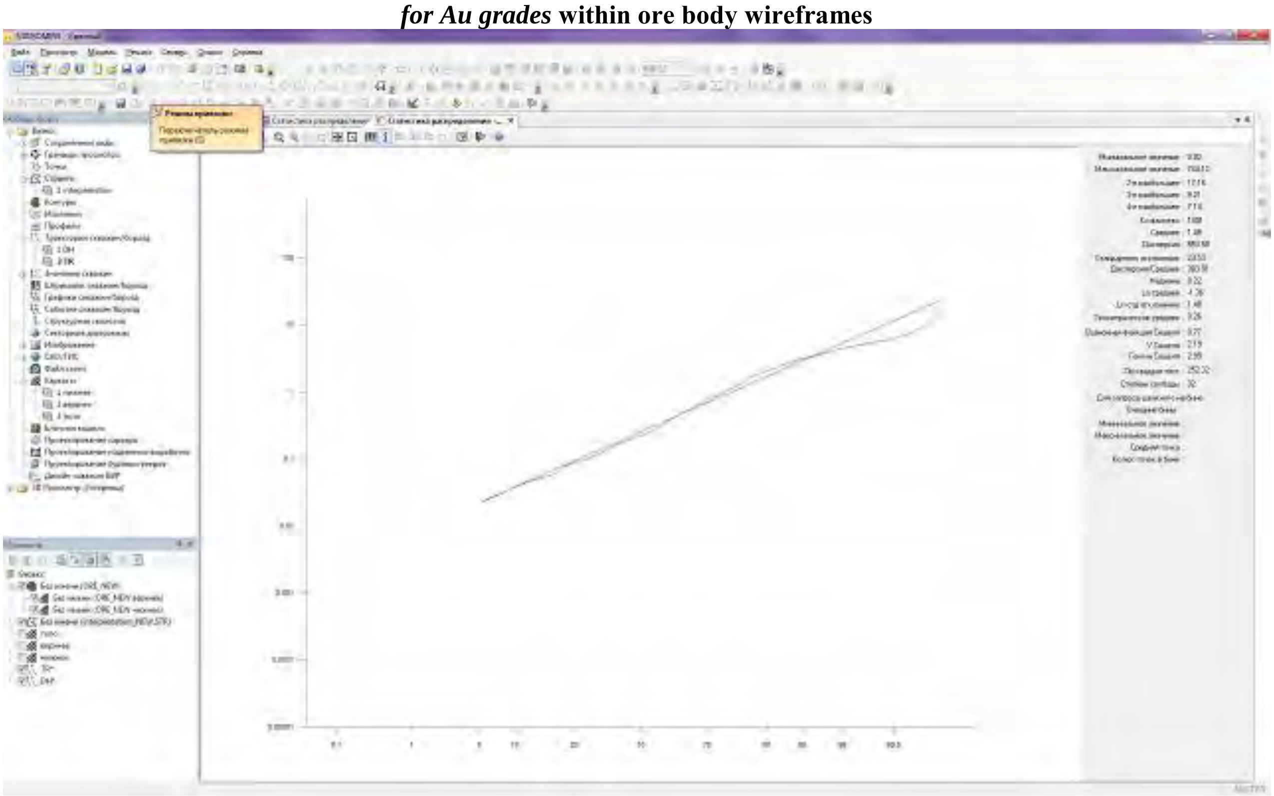

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Figure 14-13 Data on classic statistics Normal/Log
***for Au grades* within the upper ore body wireframe**

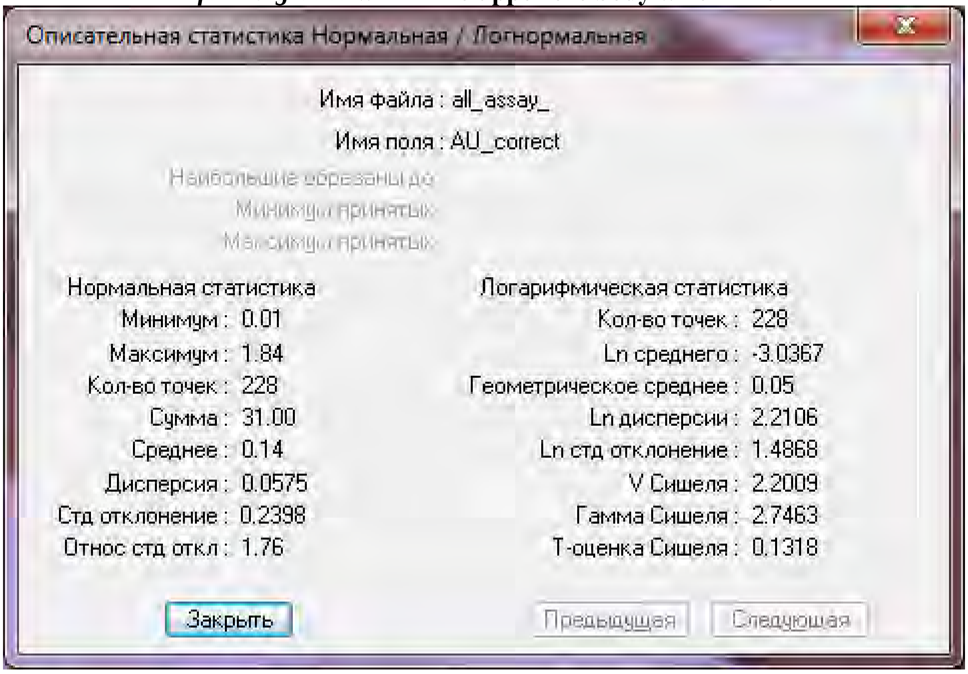

Figure 14-14 Data on classic statistics Median/Moda
for Au grades within the upper ore body wireframe

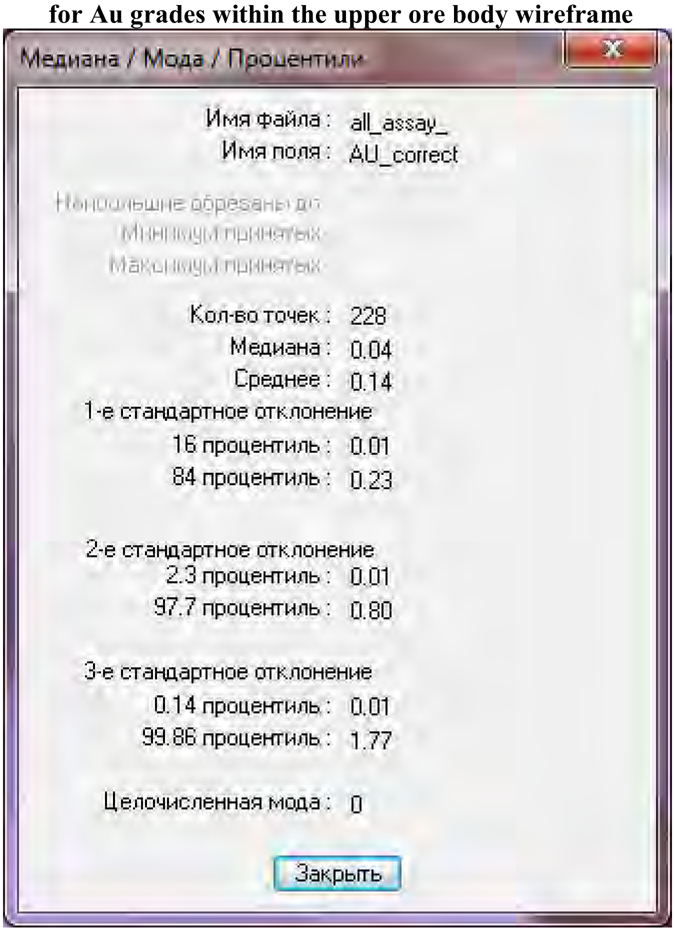

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Figure 14-15 Histogram of Au grade distribution within the upper ore body wireframe

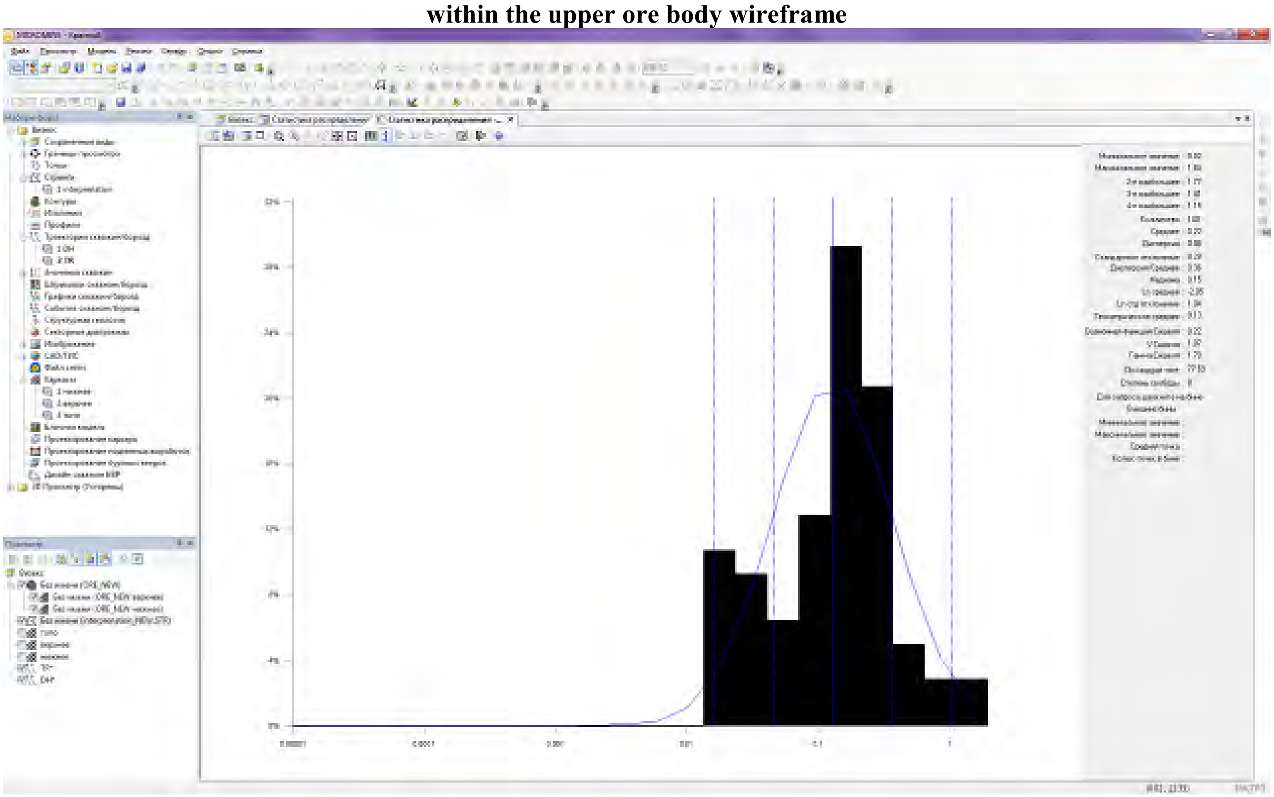

Figure 14-16 Probability diagram *for Au grades* within the upper ore body wireframe

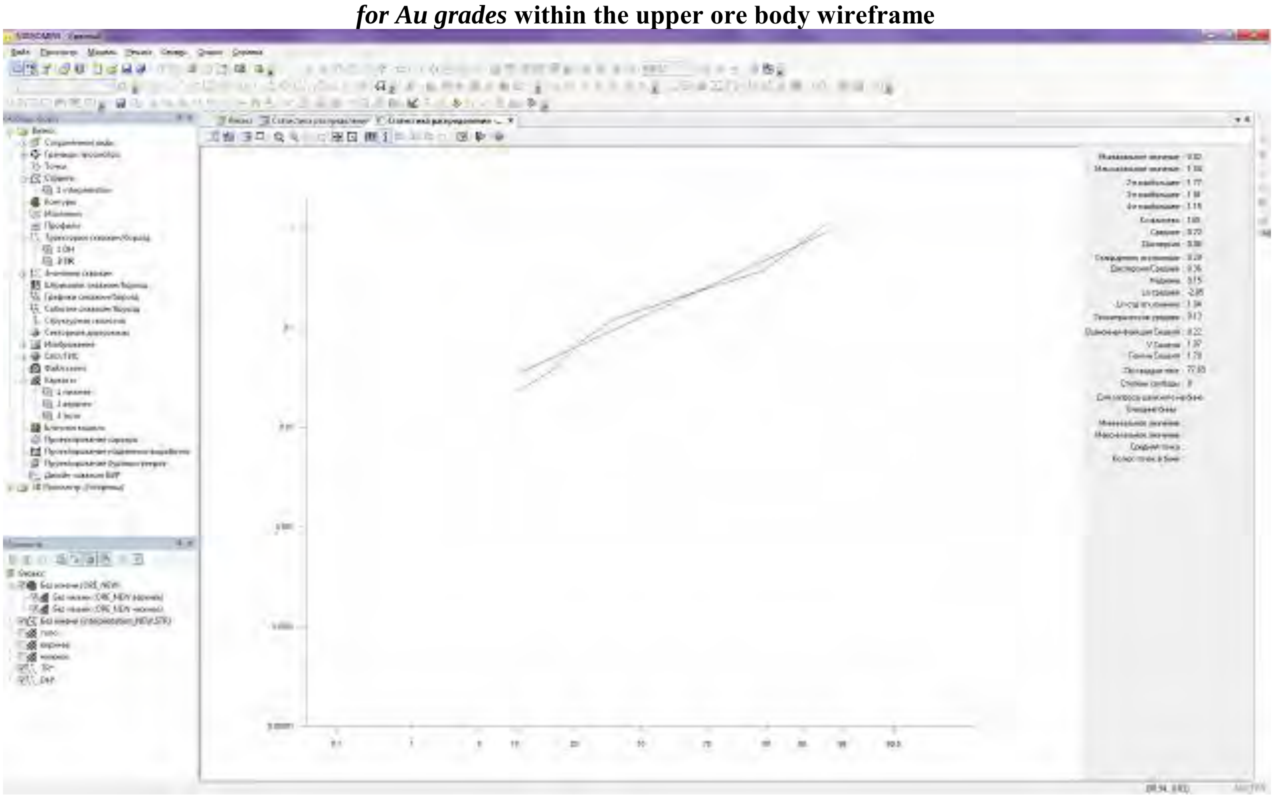

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Figure 14-17 Data on classic statistics Normal/Log *for Au grades* within the lower ore body wireframe

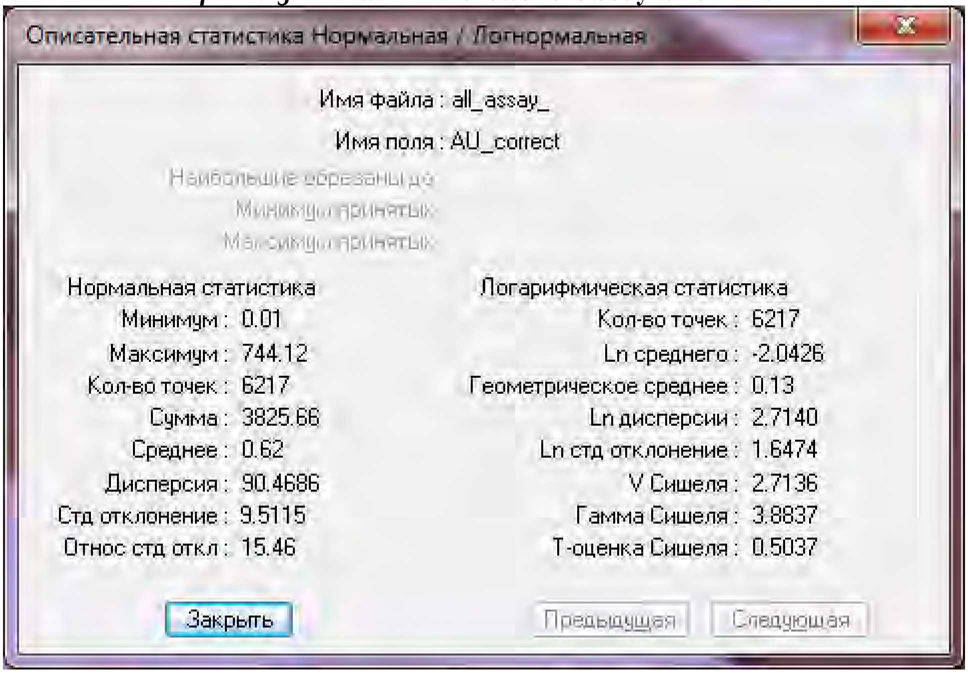

Figure 14-18 Data on classic statistics Median/Moda within the lower ore body wireframe

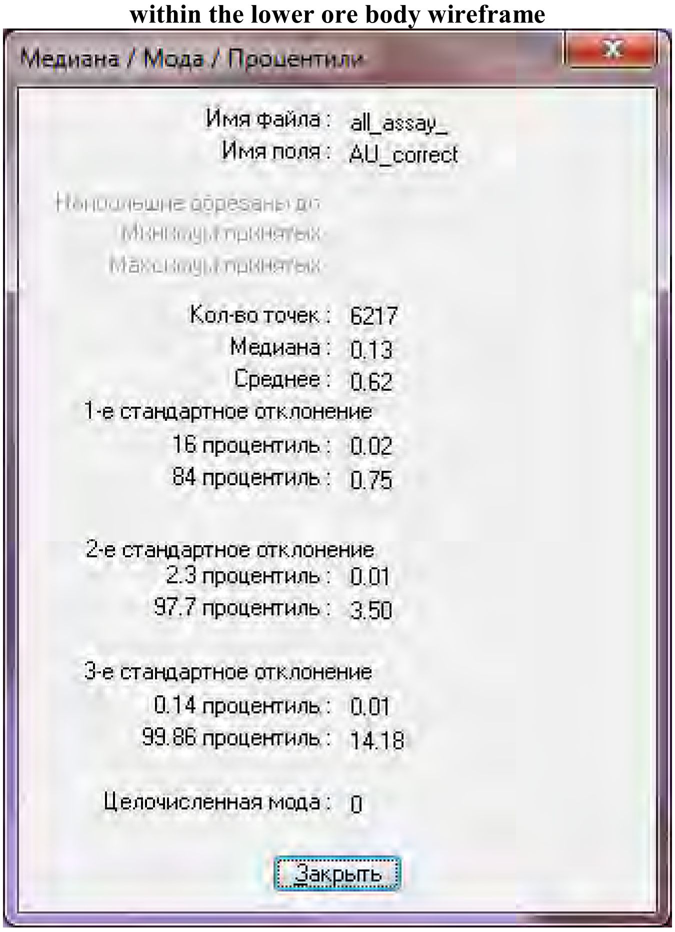

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Figure 14-19 Histogram of Au grade distribution within the lower ore body wireframe

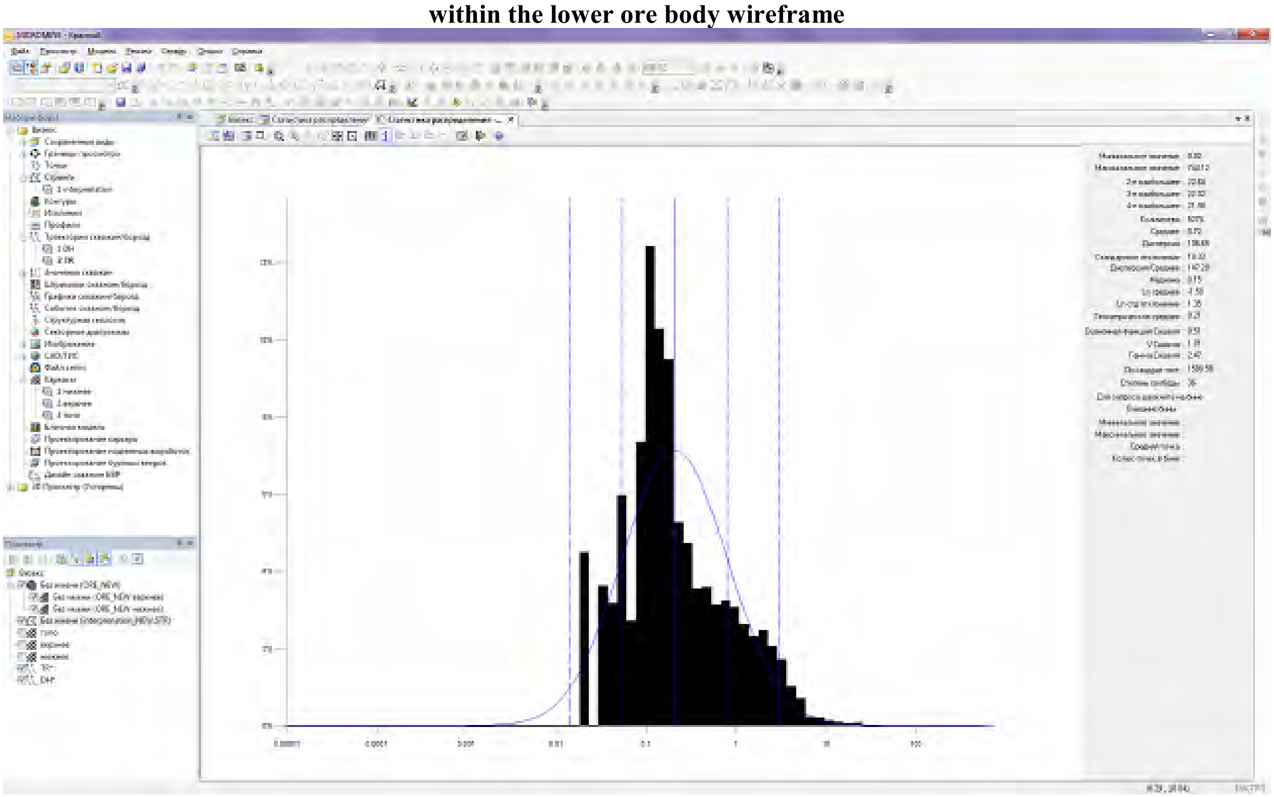

Figure 14-20 Probability diagram *for Au grades* within the lower ore body wireframe

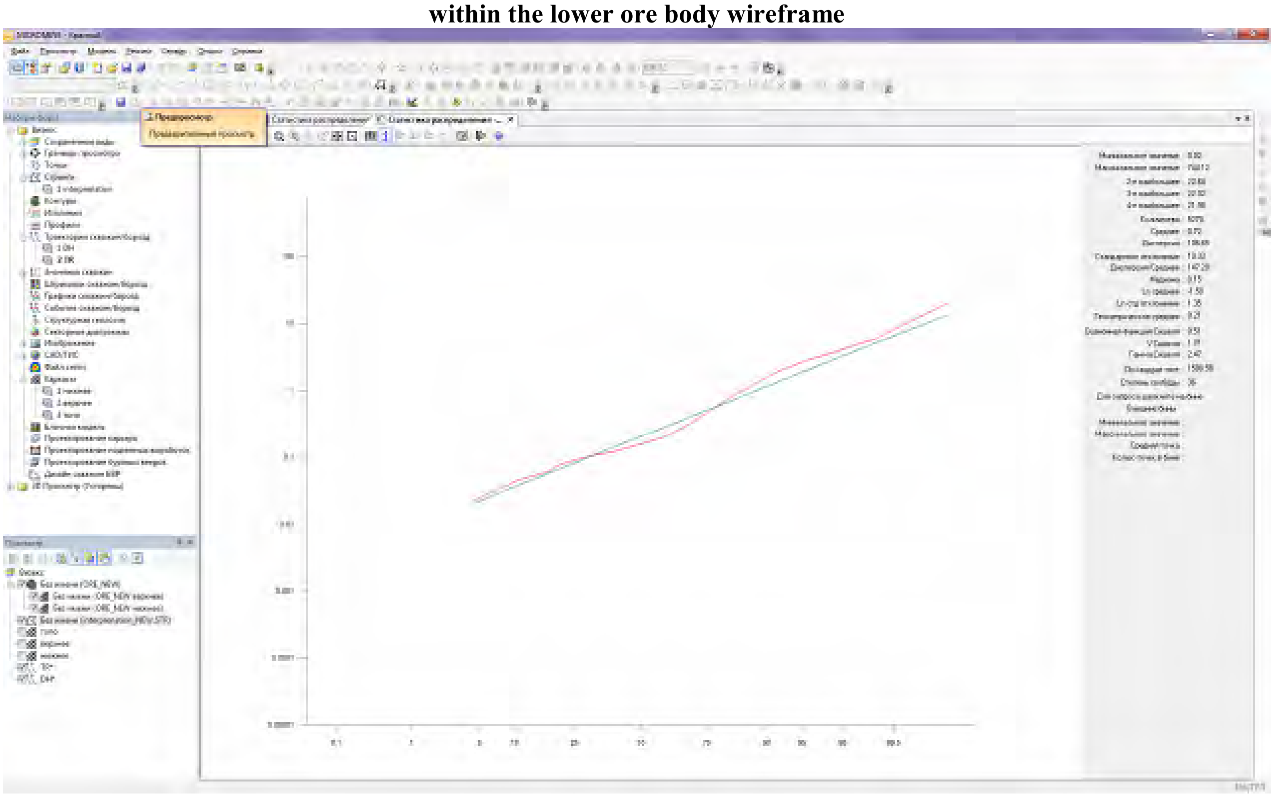

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Figure 14-21 Data on classic statistics Normal/Log
***for Au grades* within the ore body wireframe (KP=1)**

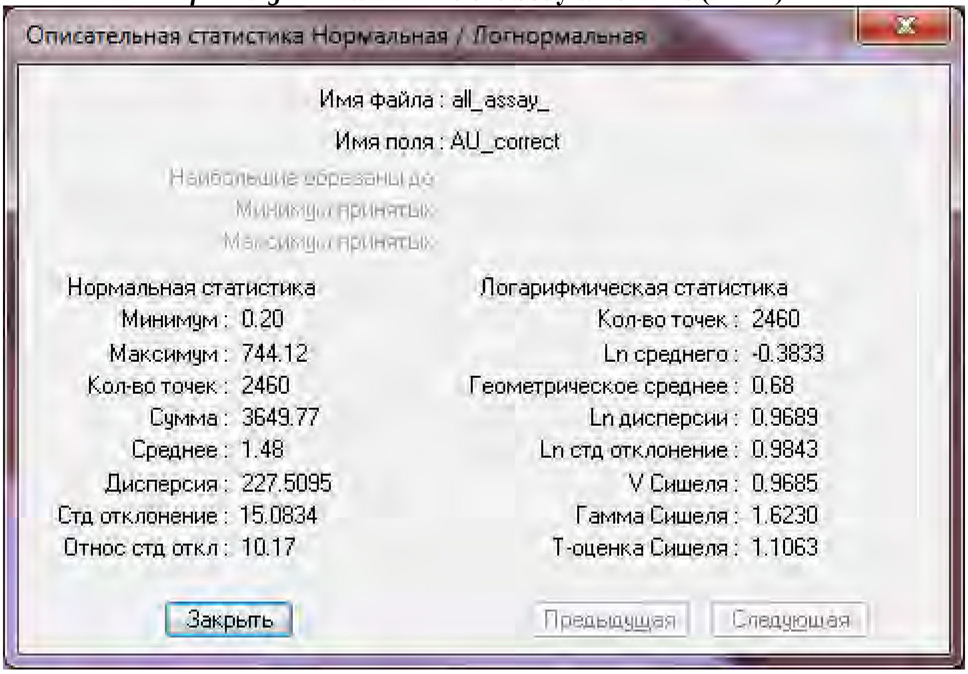

Figure 14-22 Data on classic statistics Median/Moda
***for Au grades* within the ore body wireframe (KP=1)**

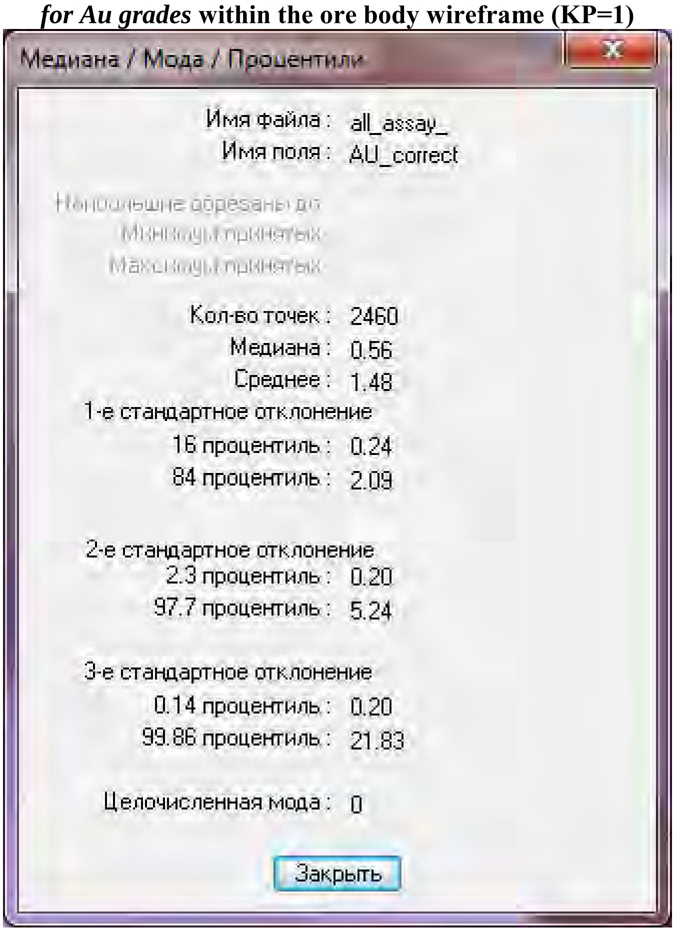

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Figure 14-23 Histogram of Au grade distribution within the ore body wireframe (KP=1)

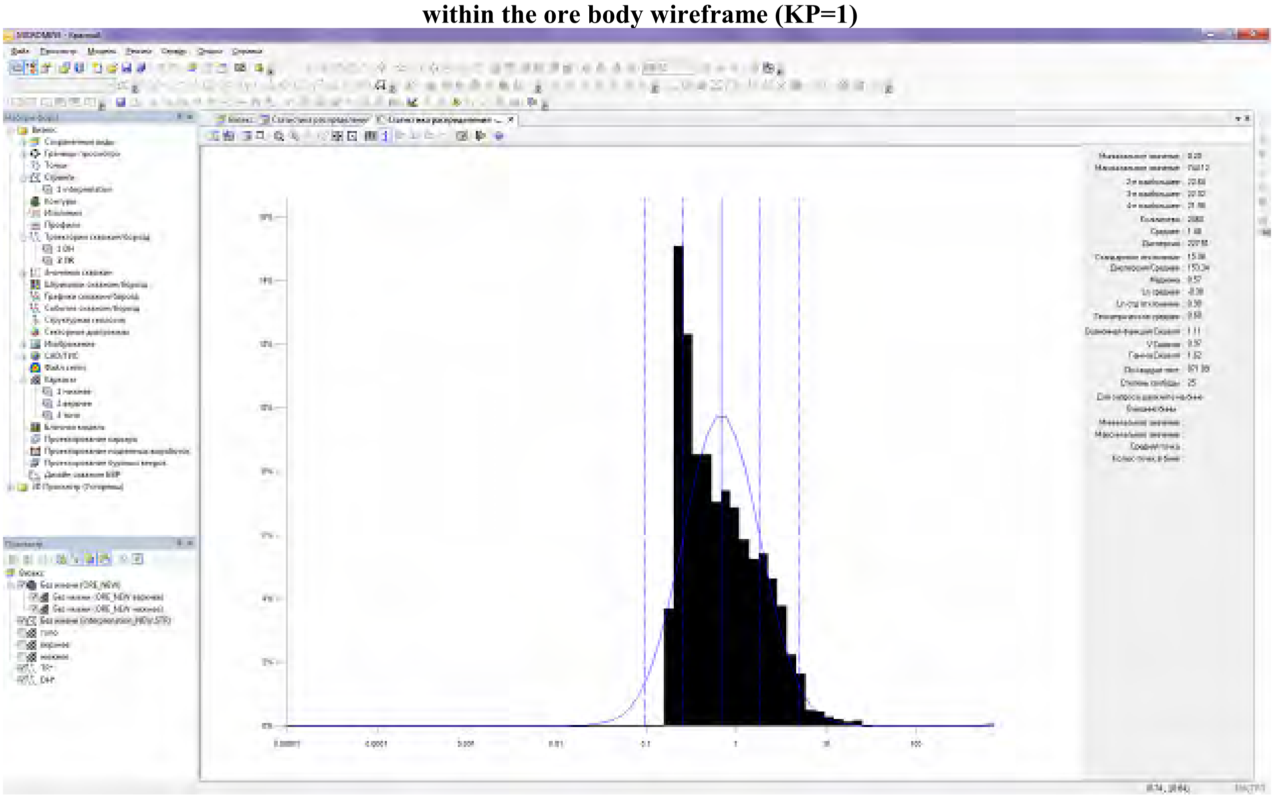

Figure 14-24 Probability diagram *for Au grades* within the ore body wireframe (KP=1)

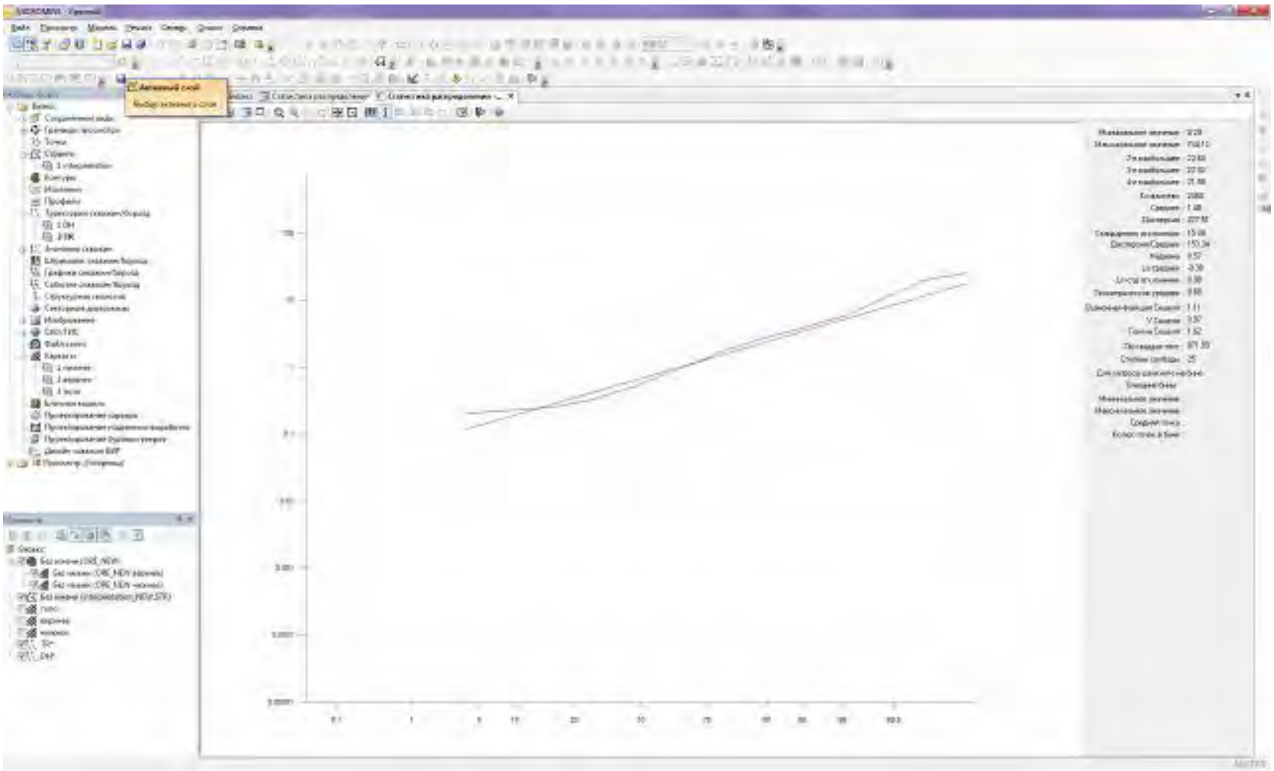

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Table 14-1 Summary table of Au grade classic statistics data for ore body wireframes

Statistics Data	Number of samples	Minimum	Maximum	Mean	Coefficient of Variation	Median	Variation	Standard deviation
Within the contour of the upper ore body	228	0.01	1.84	0.14	1.76	0.04	0.0575	0.2398
Within the contour of the lower ore body	6217	0.01	744.12	0.62	15.46	0.13	90.4686	9.5115
Within the contour of the ore bodies as per all workings	6445	0.01	744.12	0.60	15.61	0.13	87.2775	9.3422
Within the contour of the ore bodies as per boreholes	5357	0.01	22.64	0.45	2.71	0.12	1.4880	1.2198
Within the contour of the ore bodies as per trenches	1088	0.01	744.12	1.33	16.96	0.20	509.4248	16.96
Within the contour of the ore body KP=1	2460	0.20	744.12	1.48	10.17	0.56	227.5095	15.0834

It follows from the figures and the table that higher grades are typical for channel samples of the lower ore body.

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15. Restriction of Top Cut Grades

A classic scheme for determination of the values of gold top cut grades based on the statistic analysis of sampling data was applied in this work.

A cumulative probability diagram was built with a statistic method for gold grades within all ore bodies, using the process *Statistics* | *Distribution*, for determining the top cut grade limit.

Figure 15-1 Cumulative probability diagram for Au grades within ore body contours

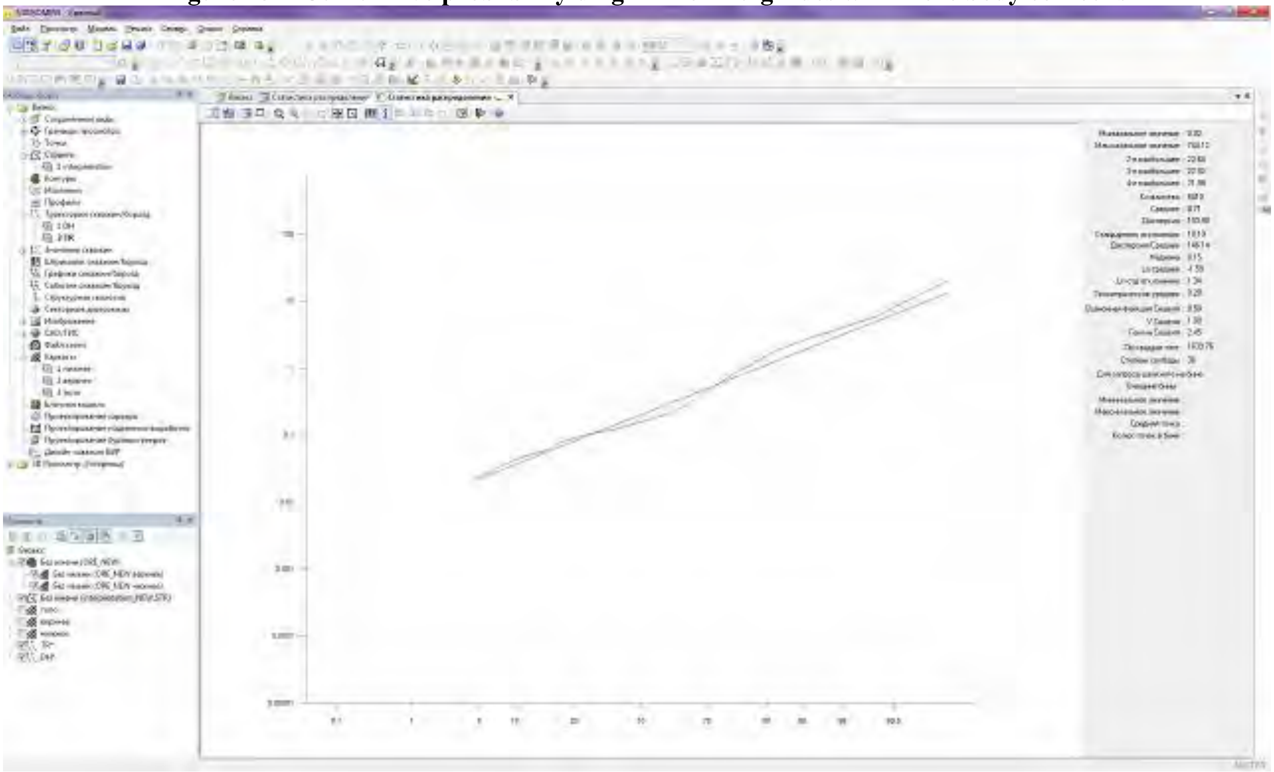
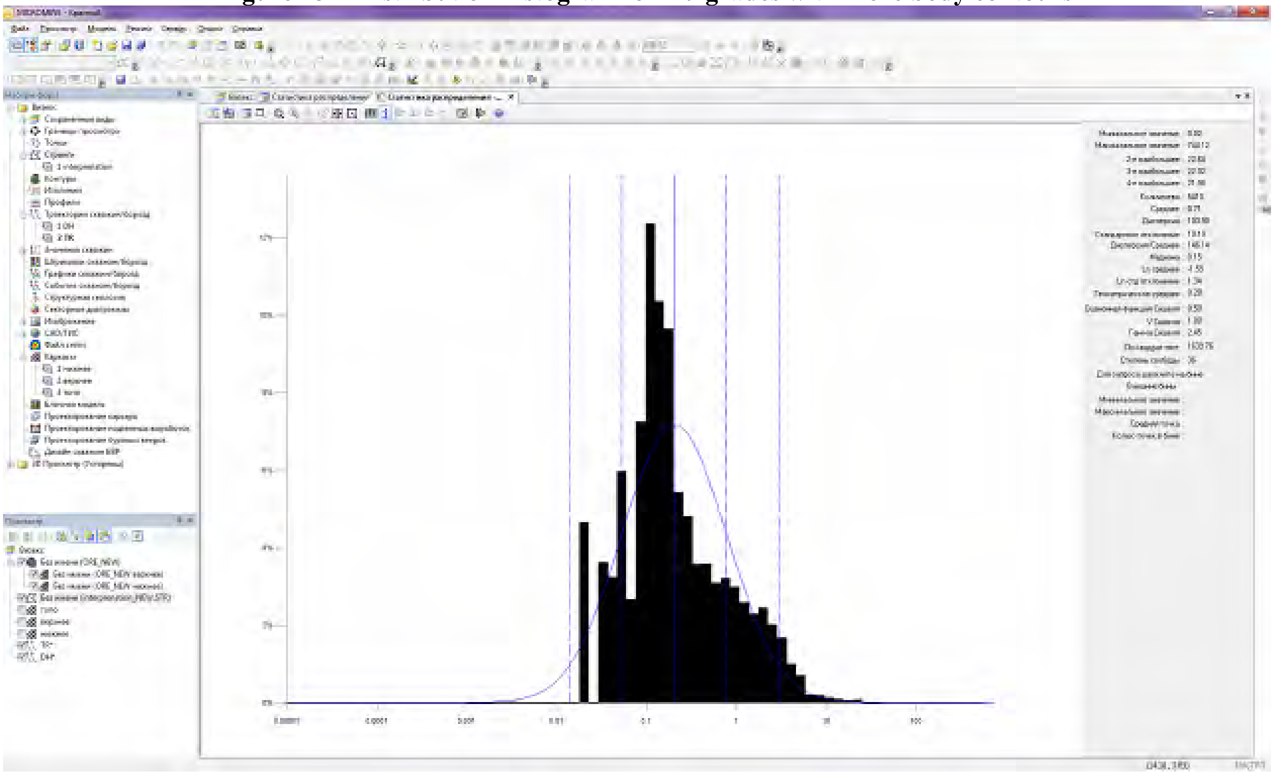


Figure 15-2 Distribution histogram for Au grades within ore body contours



The cumulative probability diagram for Au (Figure 15.1) shows that there are not evident bends in the high-value zone. However, a sample with an outstanding grade 744.12 g/t was detected. Therefore, it was decided to additionally create a grade field with restricted top cut values in the sampling file. The value of 22.64 g/t was assumed as a limit value for top cut grade restriction (the curve in the area of this grade has a bend in the cumulative probability diagram) (note: it is enough to place a cursor on the bend and read the grade value in the information window in the bottom of the screen).

After determining the top cut grade limit, the top cut grade sample was assigned the grade 22.64 g/t. The following operation was used for that:

- In the process *File* | *Fields* | *Calculate* an additional field was created in the sample file: *AU_CUT*. The process copied the gold grade to this field from the field *Au_correct*, applying a corresponding grade limit to it with the help of the function *Reduce till.*

The created field *AU_CUT* was later used for geostatistic analysis and grade interpolation.

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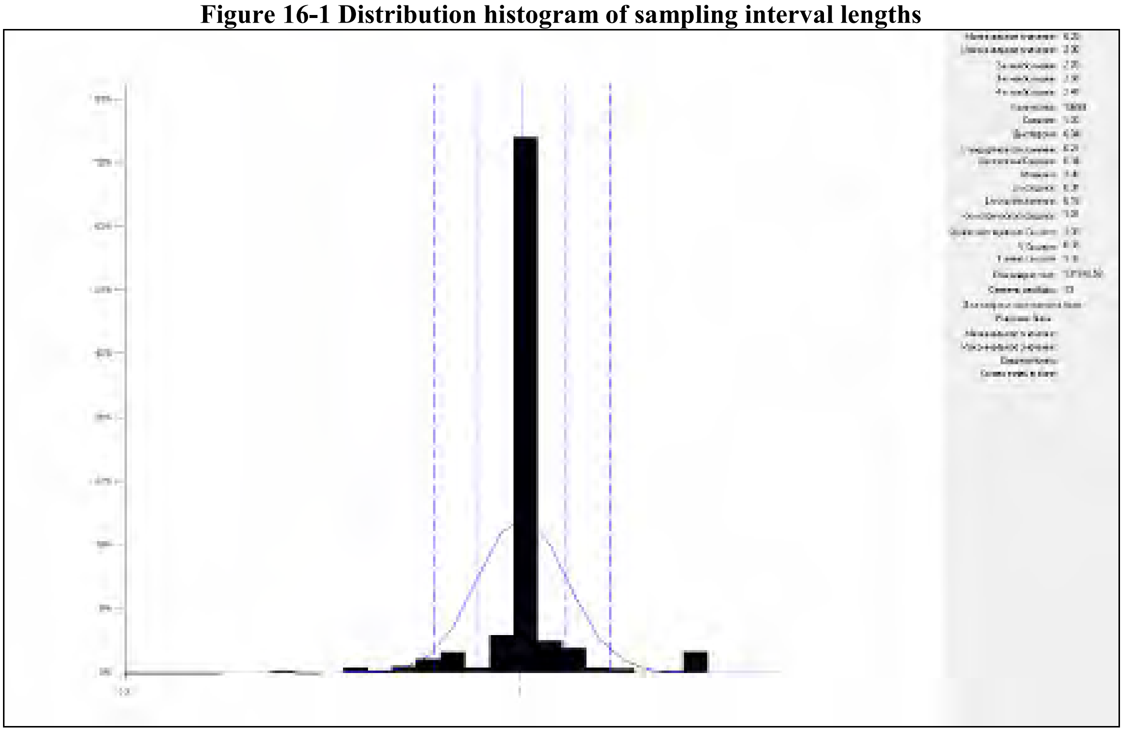
16. Compositing

Compositing is a standard procedure allowing to bring all sampling intervals to identical length. This allows all samples to have the same weight for grade interpolation. The length of composite intervals usually equals to the standard or the average sampling length.

In order to determine the optimal length of composite intervals, a distribution histogram of interval lengths was built, using the process *Statistics* | *Distribution.* The histogram (Figure 16.1) showed that most of sampling intervals have the length close to 1 m. The mean and the median values of sampling interval lengths within ore bodies were estimated in the process Statistics | Descriptive | Median/Moda as 1.0 and 1.03 m respectively. Based on these studies, it was decided to create a file of composite intervals 1 m long.

Figure 16-1 Distribution histogram of sampling interval lengths



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The process Borehole | Composite calculation | Along borehole was used for creation of the composite intervals file. At that, the process of creation of composite intervals with the set length occurred from the borehole/trench collar to the bottom. The field ORE_NEW was used as the constant field, i.e. the merging process stopped and began again when the values of these fields were changed, and the samples within ore bodies and outside ore bodies did not mix.

New coordinates of interval middles were calculated for compositing.

Thus, the composite files were created:

KOMP_1m__ALL_NEW.DAT

KOMP_1m__TR_NEW.DAT

KOMP_1m__DH_NEW.DAT

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17. Geostatistical Analysis

The purpose of geostatistic analysis is creation of a series of oriented diagrams which could be used as a weighting mechanism for the ordinary kriging algorithm. Variogram parameters contribute a lot to determination of the search ellipse sizes and resource categorization.

Therefore, the main purposes of geostatistic analysis were as follows:

- Evaluate the presence of oriented mineralization anisotropy.
- Assess spatial continuity of the mineralization in main anisotropy directions. Mineralization continuity can be assessed by means of usage of the variogram impact zone, i.e. the distance at which the variogram reaches the absolute limit (plateau). Respectively, the grades cannot be reliably evaluated if the search radius for grade interpolation is larger than the variogram magnitude. When the variogram reaches the limit, there is no correlation between a pair o samples within the distance separating these samples.
- Receive variogram parameters (nugget effect, absolute limit – sill, variability) which are used as input parameters for interpolation with the ordinary kriging method.
- Evaluate the presence of oriented mineralization anisotropy. This can be done by means of study of oriented variograms. Oriented variability exists if the variogram reaches the absolute limit within different distances in different directions.
- Receive an ideal distance for the exploration grid.

Geostatistic analysis (building of variograms) was conducted.

The process *Statistics | Semivariograms* was used for modeling of oriented variograms, and only for those samples in the composite interval file, which were selected within the ore body. A variogram was modeled for the whole selection of composite samples within ore body wireframes with log transformation, since the sample distribution is close to logarithmically normal one.

Semivariograms for the borehole with the space 1 to 7 m were used for determination of the nugget effect.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Figure 17-1 Variogram for the borehole

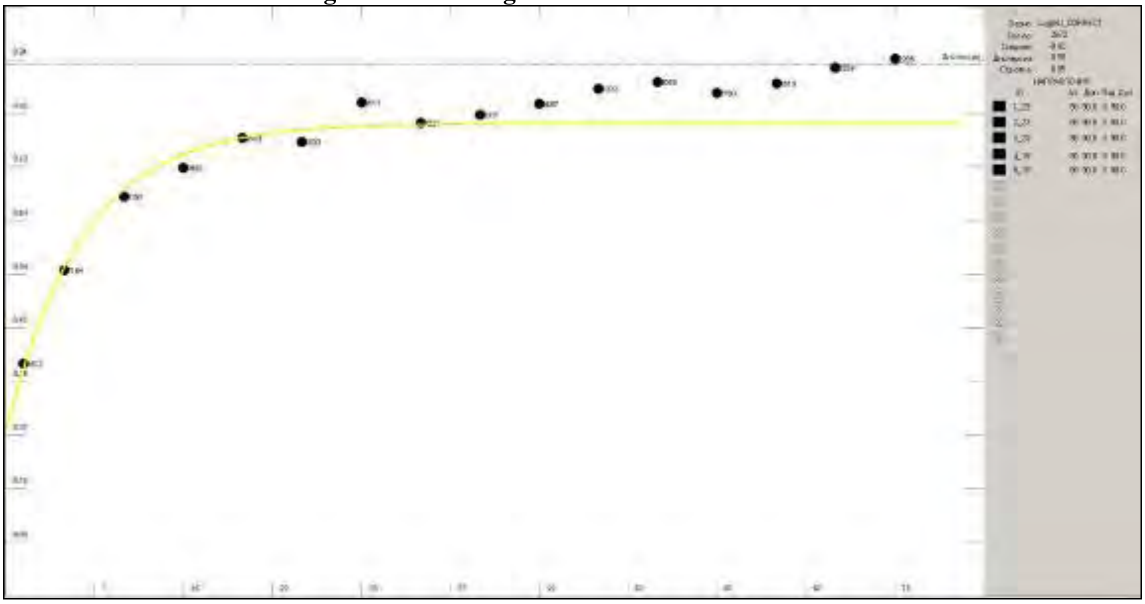

Figure 17-2 Omnivariogram

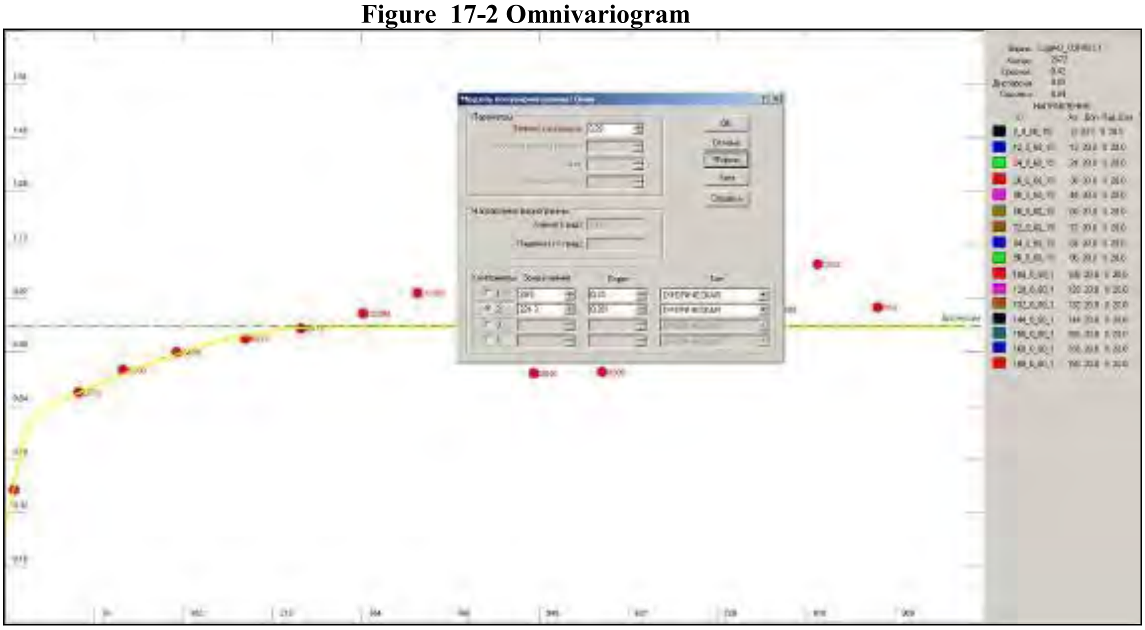

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Figure 17-3 Variogram for gold, main axis - azimuth 108, dipping 0°

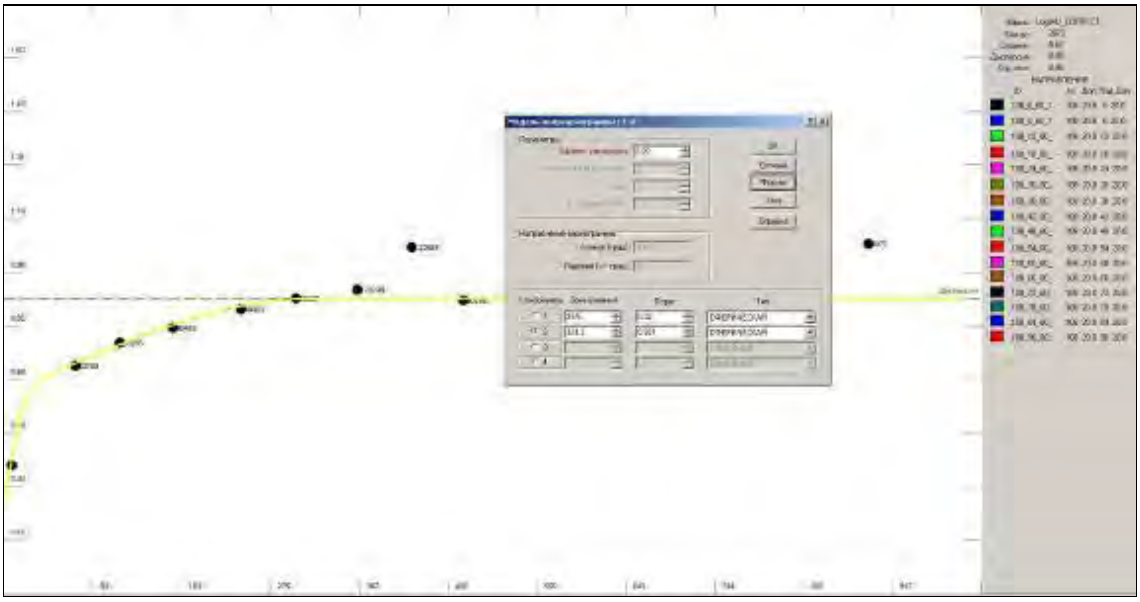


Figure 17-4 Variogram for gold, second axis - azimuth 198°, dipping 66°

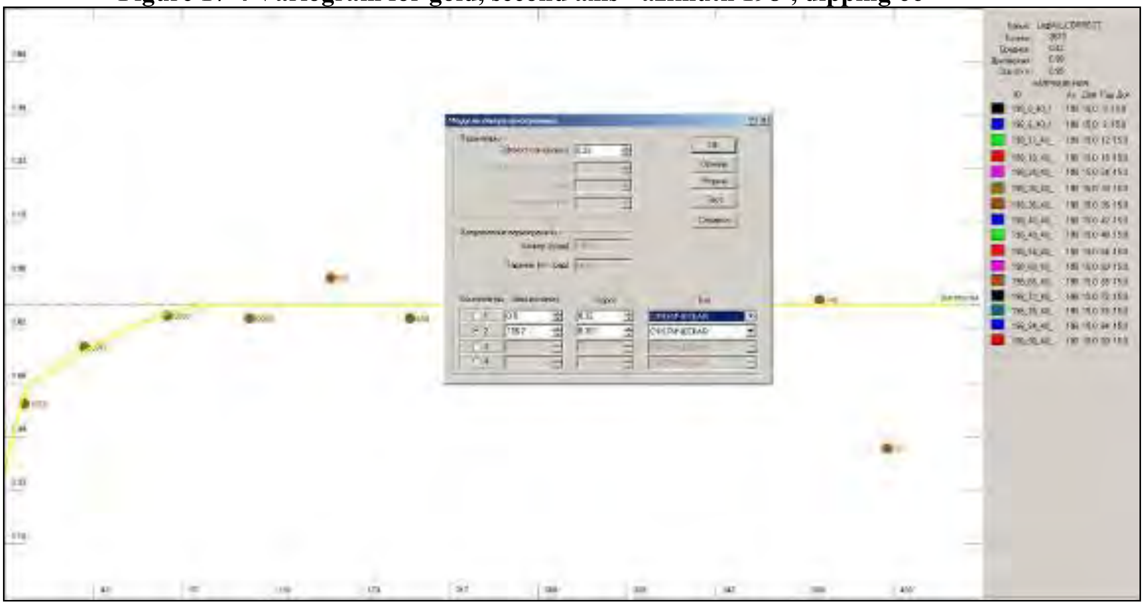
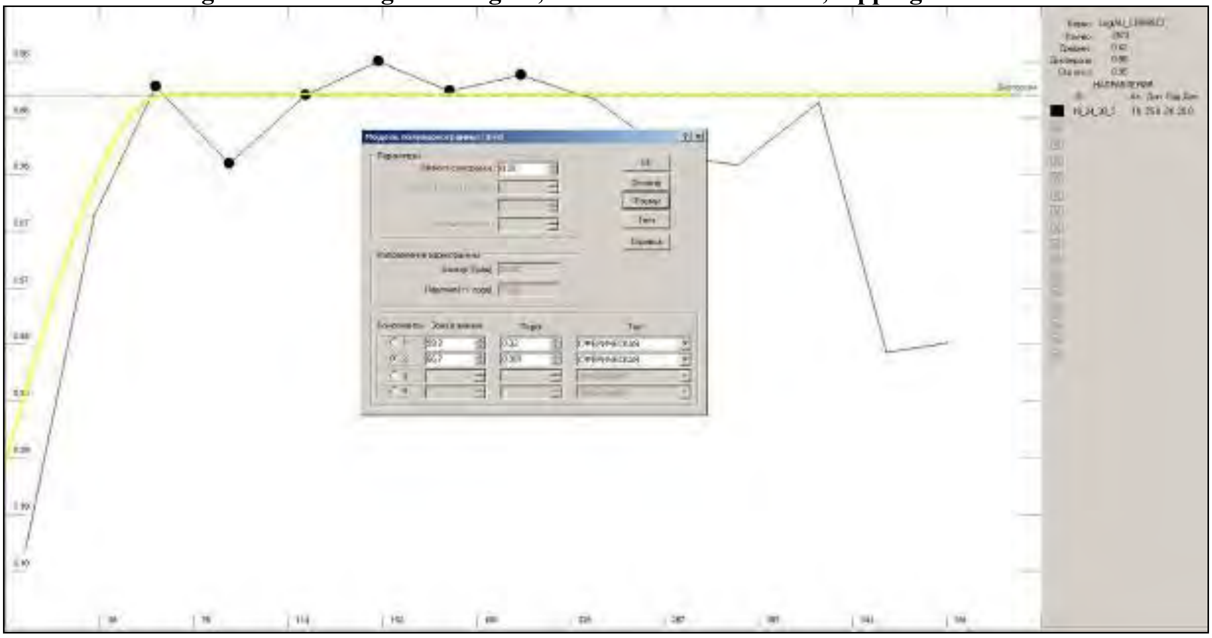


Figure 17-5 Variogram for gold, third axis - azimuth 180, dipping 240



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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

18. Block Modeling

Block modeling consisted of the following stages:

a. Building of empty block models for all ore bodies.
b. Coding of the block model with wireframe models of ore bodies.
c. Coding of the block model with wireframe sets.

18.1. Building of Empty Block Models

Prior to building an empty block model for each ore body it was necessary to determine minimum and maximum coordinates of the ore body boundaries. These parameters were defined in the following way:

- A set of wireframe models of ore bodies was exported to two files – a triangle file and a point file, using the process *File* | *Export* | *Wireframes.*
- The created point file contained the coordinates of all points used for building a wireframe model. It is enough to place the cursor on the file, right-click and choose the option *Min/Max* for determination of minimum and maximum values of coordinates.

The size of cells was dictated by the height of the working bench, the thickness of the exploration grid (more than ¼ and less than ½ of the distance between exploration workings with the grid at detailed sites 80 m x 60 m) and the sizes of the block model confirmed by means of declustering (rarefication of the sites with thickened sampling) of sampling data. The height of the working bench of the pit for such type of a deposit is usually assumed equal to 10 m. Therefore, it was decided to use the sizes of cells 30x25x10 m.

An empty block model was created using the process Modeling | 3D block evaluation | Create an empty block model.

Table 18-1 Block model characteristics

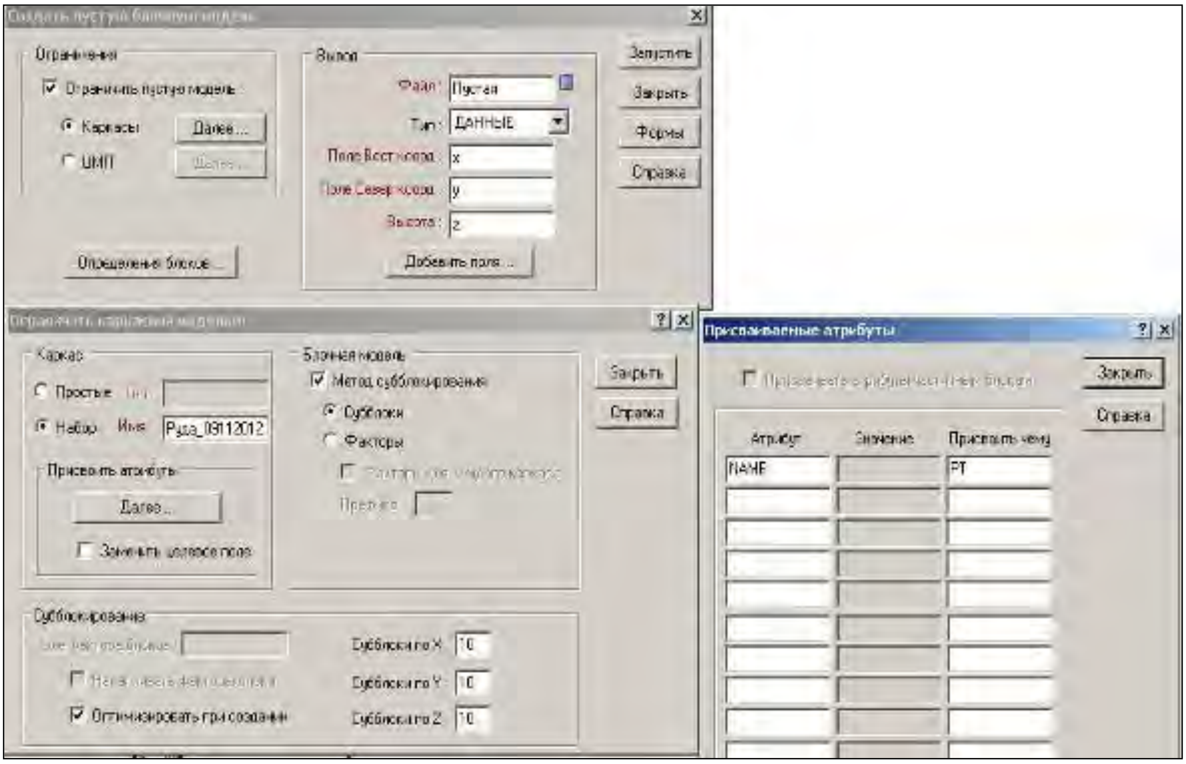
Direction	Length (m)		Grade Models	
	Minimum	Maximum	Size of Block (m)	Number of Subblocks
X	367502.5	370631.5	30	
Y	6462486.25	6464766.25	25	189525
Z	593.5	1018.5	10	

In the process of creation, empty block models were coded with wireframe models of ore bodies so that it were possible to choose only those blocks which fell within the corresponding ore bodies.

The subblock parameter was used for assigning (coding) wireframe models to block models. In this case this parameter was set as 10 by 10 by 10, i.e. each block was divided into 1000 parts (10 * 10 * 10 = 1000).

Prior to coding, a field was created in the block model file for each closed wireframe model – a field for the wireframe model flag. The name of the wireframe was recorded in this field. A block model was assigned to this wireframe.

Figure 18-1 Form for creating an empty block model



18.2. Grade Interpolation

Grades were interpolated to block models from the samples selected within all ore bodies.

Each ore body was interpolated separately, with sample division by ore bodies, because during interpolation the search ellipse in most cases could reach neighbouring ore bodies. Grades above 0.2 g/t were interpolated.

Since geostatistic analysis was conducted and variograms were modeled in three main directions, the ordinary kriging method was chosen as the main interpolation method. Kriging parameters for gold grades were used for interpolation of the ore content coefficient.

Search ellipse parameters indicated in Table 18-2 were used for the interpolation process. It also shows the ranges of variograms and the parameters of variogram models.

Table 18-2 Grade interpolation parameters

No of Interpolation Cycle	1	2	>2
Search radii	Less or equal to 2/3 of the variogram range	Full variogram range	Increase by the variogram range
Minimum number of samples	3	3	1
Maximum number of samples	12	12	12

Several points located in different parts of the block were interpolated for grades interpolation, for substantiation of the average grade estimate in the block within its whole volume. I.e. the Discretization function was used (5 points by 5 points by 5 points). These point estimates were simply averaged for evaluation of the average value of the blocks.

The declusterization process was conducted for interpolation by means of usage of four sectors within the search ellipse, with limitation up to 3 points maximum per sector. The maximum total number of samples used for interpolation was assumed equal to 12. Points were selected on the following basis: the point located farthest from the evaluated point was discarded (basis for evaluation). If the block did not receive the grade estimate, the search ellipse was increased until each block in the model received the interpolated grade. Two fields with gold grades and the ore content coefficient were interpolated separately, but all interpolations used the parameters of the search ellipse and variograms for gold.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

A macro Интерполяция.mcr (Interpolation) was written for work simplification and process automation. It creates empty block models, codes them, interpolates gold, the ore content coefficient, and classifies reserves.

The process Modeling | 3D block evaluation | Ordinary/Universal kriging was used for interpolation.

In order to use the processes in macros, the following variables were created in process forms:

- %1 – composite file,
- %2 – interpolated element,
- %3 – input block model,
- %4 – multiplier for search ellipse axes
- %5 – maximum number of composite intervals
- %6 – minimum number of composite intervals
- %7 – number of workings participating in interpolation,
- %8 – output block model,
- %9 – number of interpolation cycle,

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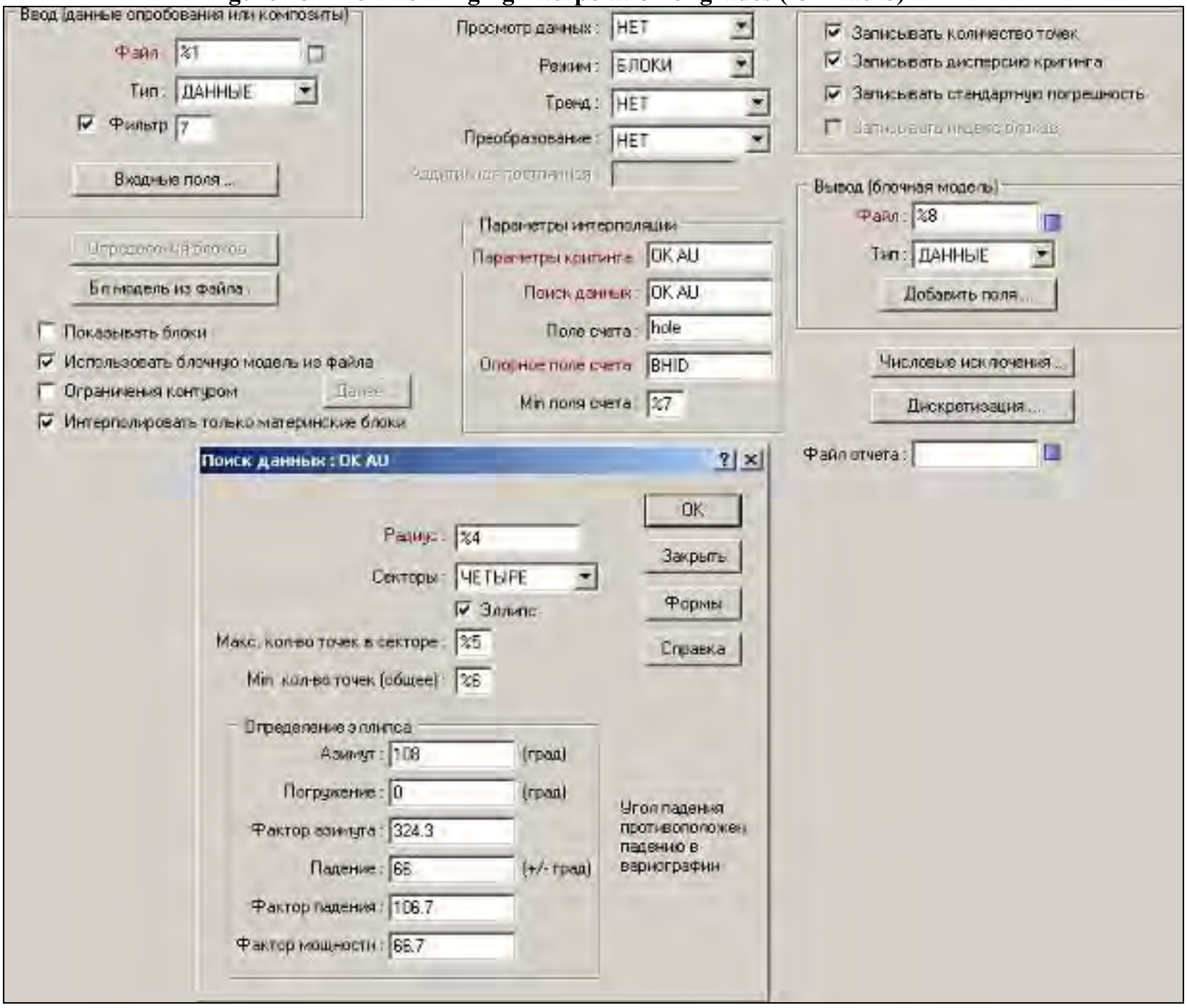
e-mail: info@miramine.ru

Figure 18-2 Form of kriging interpolation of grades (for macro)



The macro was run in the process Service | Macro | Start (or using the blue arrow icon on the control panel). The macro created block model files with interpolated Au grades and ore content coefficients, with corresponding fields of the interpolation number, the specific weight field and all codes. Macro run is possible starting not from the first process but from the one indicated by the user, which makes it possible to successively run macro blocks, with validation of temporary files created by the macro.

Figure 18-3 Fragment of the macro of block model creation and grade interpolation

#DECLARE	2												
Comment		OK по Au_correct	верхнее PT										
Comment				Файл композитов	элемент	модель на входе	радиус	макс точек	мин точек	выработка	файл на выходе	проход	PT
OKRIG	1			copm_ln_all_new	AU_CORRECT	Пустая	0.67	3	1	2	xxx1	1	верхнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx1	1	3	1	2	xxx2	2	верхнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx2	2	3	1	1	xxx3	3	верхнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx3	10	3	1	1	xxx4	4	верхнее
Comment		OK по Au_correct	нижнее PT										
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx4	0.67	3	1	2	xxx5	1	нижнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx5	1	3	1	2	xxx6	2	нижнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx6	2	3	1	1	xxx7	3	нижнее
OKRIG	1			copm_ln_all_new	AU_CORRECT	xxx7	10	3	1	1	xxx8	4	нижнее
Comment		OK по KF	верхнее PT										
OKRIG	2			copm_ln_all_new	KF	xxx8	0.67	3	1	2	xxx9	1	верхнее
OKRIG	2			copm_ln_all_new	KF	xxx9	1	3	1	2	xxx10	2	верхнее
OKRIG	2			copm_ln_all_new	KF	xxx10	2	3	1	1	xxx11	3	верхнее
OKRIG	2			copm_ln_all_new	KF	xxx11	10	3	1	1	xxx12	4	верхнее
Comment		OK по KF	нижнее PT										
OKRIG	2			copm_ln_all_new	KF	xxx12	0.67	3	1	2	xxx13	1	нижнее
OKRIG	2			copm_ln_all_new	KF	xxx13	1	3	1	2	xxx14	2	нижнее
OKRIG	2			copm_ln_all_new	KF	xxx14	2	3	1	1	xxx15	3	нижнее
OKRIG	2			copm_ln_all_new	KF	xxx15	10	3	1	1	Bl_модель_OK	4	нижнее
Comment		IDW по Au_correct	верхнее PT										
OIDWI	1			copm_ln_all_new	AU_CORRECT	Пустая	0.67	3	1	2	xxx1	1	верхнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx1	1	3	1	2	xxx2	2	верхнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx2	2	3	1	1	xxx3	3	верхнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx3	10	3	1	1	xxx4	4	верхнее
Comment		IDW по Au_correct	нижнее PT										
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx4	0.67	3	1	2	xxx5	1	нижнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx5	1	3	1	2	xxx6	2	нижнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx6	2	3	1	1	xxx7	3	нижнее
OIDWI	1			copm_ln_all_new	AU_CORRECT	xxx7	10	3	1	1	xxx8	4	нижнее

18.3. Setting of Specific Weight in Block Models

The specific weight value in block models can be defined with several methods:

1) Direct assignment of the specific weight value to all model blocks.

This method is used when the specific weight of ores is more or less constant or the data for specific weight determination is not sufficient.

2) Specific weight calculation with regression equations.

When the specific weight of ores depends on useful element grades, it can be calculated for each cell of the block model with regression equations. This method is frequently applied for iron or manganese ores, for instance.

3) Interpolation of specific weight values.

The specific weight can be interpolated to each cell of the block model in the same way as sampling values. This method is frequently used when the database has enough measurements of specific weight values.

4) Usage of the geological model for setting specific weight values.

A geological model of lithologies occurred within the deposit can be used for setting the specific weight. Built wireframes of each lithology can be used for that. It should be noted that it is desirable to have the depths of weathering crust development or an additional field with the degree of oxidation of sampling intervals or lithology in the geological database for correct assessment of the density of unconsolidated (weathered) rocks. Wireframe models on the basis of lithology are used for block model coding and further assignment of specific weight values to each cell of the block model. This method is most reliable if the specific weight does not depend on useful element grades.

In this work the specific weight was assigned with a direct method. The Customer provided with the tables of bulk weight studies with the derived average value 2.6 t/m^3 which was used in all calculations.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

19. Reserve Classification

When kriging is used for grade interpolation, the reserve classification strategy is usually mainly based on prospecting and interpolation parameters as well as the minimum number of samples and workings participating in the interpolation process.

The following methodology is commonly used for reserve (resource) classification.

1. Model cells can be classified as *Measured Resources* if they were interpolated with the use of prospecting radii not exceeding 2/3 of variogram ranges, under condition that at least two or three samples and two boreholes (or trenches) participated in the block interpolation process (model cell). If the variograms had several structures, then prospecting radii equal to long variogram structures can be used for interpolation of Measured Resources.
2. Model cells can be classified as *Indicated Resources* if they were interpolated with the use of prospecting radii not exceeding full variogram ranges, under condition that at least two or three samples and at least two boreholes (or trenches) participated in the block interpolation process (model cell). If variograms had several structures, long variogram strictures are used for setting the interpolation search ellipse.
3. All other cells interpolated with search radii exceeding variogram ranges or using less than three samples or less than two boreholes can be classified as *Inferred Resources.*

Resources cannot be classified as Measured and the block class is reduced till Indicated in case of possible risk of reliability of input information such as borehole coordinates data, sampling quality data, borehole directional survey data etc.

The analytical information received for the Krasny deposit is based on channel and core sampling, which is very reliable information, but with the thickness of sampling not sufficient for assigning the categories of Measured and Indicated in compliance with international requirements to resource classification and the JORC Code.

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

The purpose of work at the following stages included the study of such parameters important for reserve reliability assessment as drilling quality, channel sampling methodology, sample preparation methodology, quality and methods of analyses, core recovery, results of internal and external sampling control and other data required for preparation of bankable TEO (feasibility study). Therefore, the received categories of Mineral Resources can be used in the future in bankable TEO (feasibility study) without additional studies.

This work used the methodology of reserve classification for models with grades interpolated with the Ordinary Kriging method.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

19.1. Classification of OK Models

The classification executed by the author is conditional and reflects only possible resource reference to a specific category.

The data of geostatistic analysis and grade interpolation parameters were used for classification of gold mineralization in models with grades based on interpolation with the ordinary kriging method. Specific requirements were also taken into account, for example, the minimum number of samples used for grade interpolation to each block. These parameters are given in Table 18-2. The blocks which contain interpolated grades were classified as *Measured Resources* assuming that at least 3 samples were selected during interpolation, and the search radii equaled to or were less than two thirds of variogram ranges in all directions. If the cells of the block model contained interpolated grades with the use of search radii equal to or smaller than the full ranges of semi-variograms in all directions, such blocks were classified as Indicated Resources (unless they were classified as Measured Resources prior to that). It was assumed that at least 3 samples were used for grade interpolation. If the grades were interpolated to the block model using the radii greater than variogram ranges in all directions, such blocks were classified as *Inferred Resources* assuming that at least one sample was used for interpolation.

The RUN field was created in models for grade interpolation, corresponding to the interpolation cycle. The first interpolation was conducted with parameters corresponding to the Measured category. At that the *RUN* field contained the value 1. During the second interpolation run corresponding to the Indicated category, this field contained the value 2. All other model blocks interpolated with greater search radii received the value 3 and above in the *RUN* field (Inferred).

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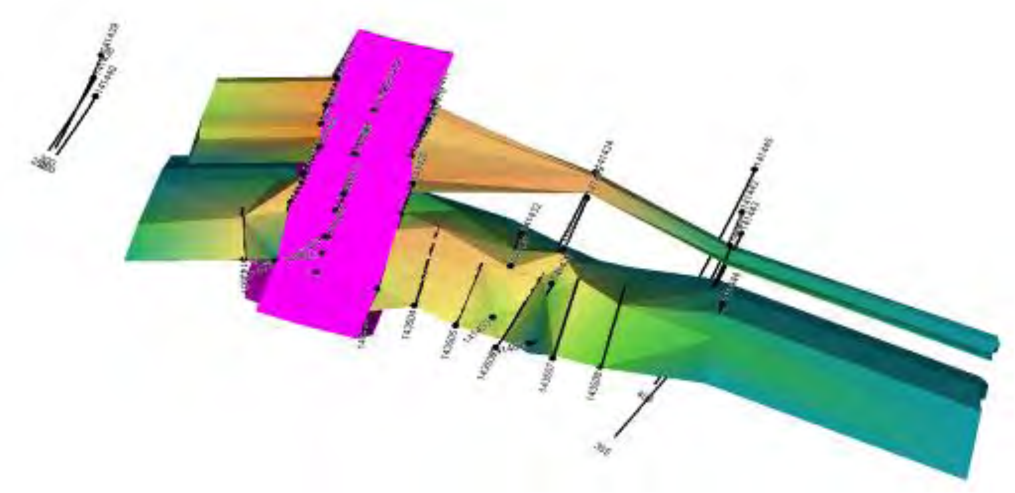
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Such resource classification meets the requirements of the JORC Code (Australasian Code for Reporting of Mineral Resources and Ore Reserves) in relation to the degree of reliability, the sampling grid density and grades continuity.

To take a final decision on the resource classification, the authors took into account the whole complex of the information provided and the results of statistic and geostatistic studies.

A sparse and irregular sampling grid does not currently allow to refer most of the resources to the category above the Inferred one based on the reliability degree. An insignificant part of resources in the central most studied part can be conventionally referred to the Indicated category (Figure 19-1).

Figure 19-1 Location of conventionally Indicated resources (purple wireframe).



This classification is conventional and does not correspond to the JORC Code criteria without completion of the QA/QC procedure (exploration quality control).

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

20. Block Model Validation

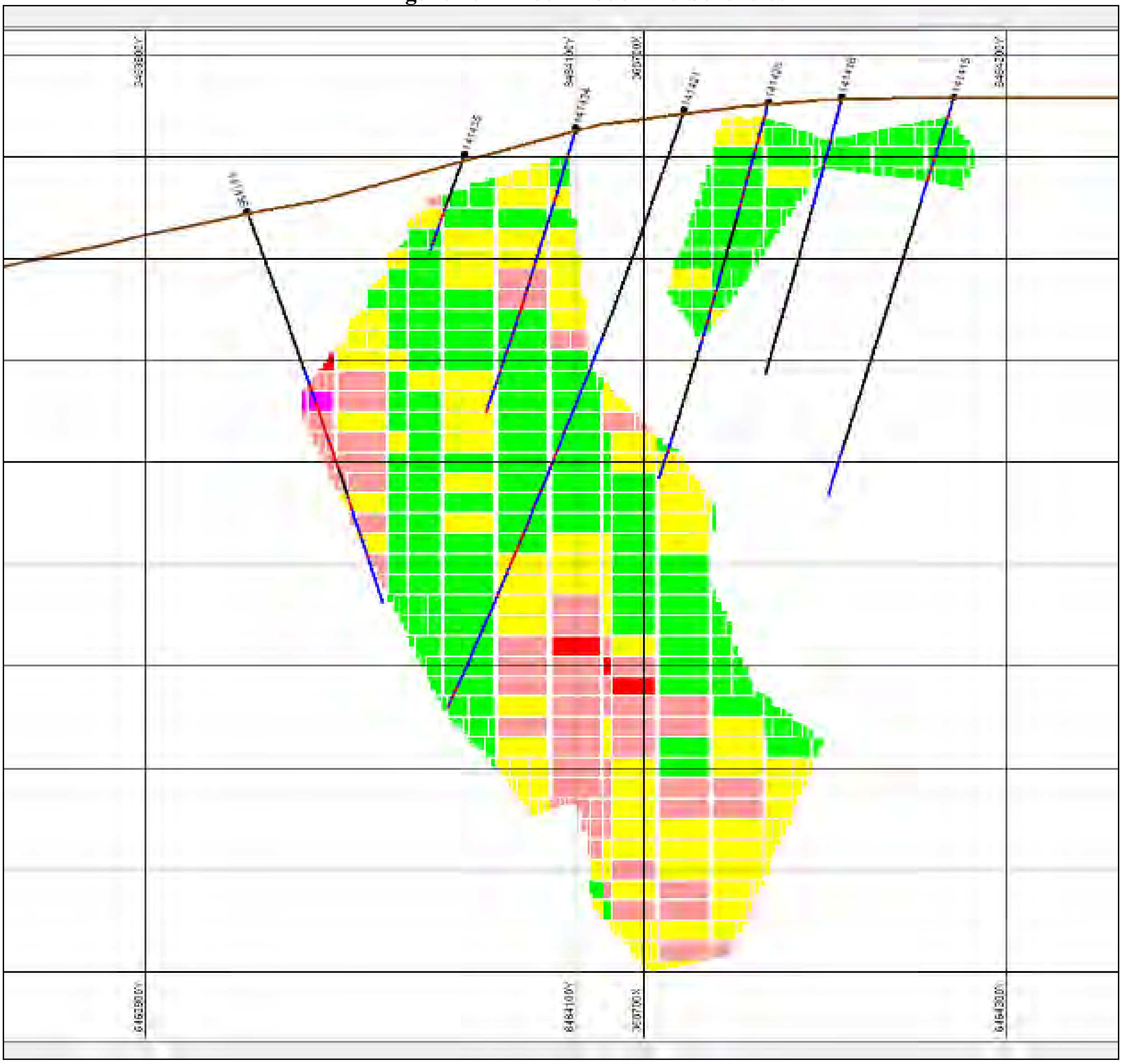
The block model can be validated with several methods:

- visual validation;
- digital validation;
- grade interpolation with an alternative method,
- cross validation,
- quantile plot,
- model comparison with actual data.

20.1. Visual Validation

For visual validation the block model was uploaded to *Vizex* together with sampling data. At that, samples and model blocks were coloured on the basis of gold grades and compared visually. The figure shows that the grades in the block model generally correspond to the samples in boreholes but are smoothed to greater extent than in samples, which is normal.

Figure 20-1 Block model and boreholes



20.2. Digital Validation

Digital validation of the block model is commonly conducted with the following methods:

The average gold grade in the block model was compared with average grades in the sampling database, chosen within the ore bodies (process *Statistics* | *Descriptive* | *Normal/Log*). This analysis showed that the average grades in the block model are slightly lower than according to sampling data and equal to 0.91 g/t as compared to samples - 1.20 g/t for gold. This is explained by the fact that the sampling grid is sparser in those parts of ore bodies where the average grades are

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

relatively low, and block models have regular filling with blocks within the whole volume of ore bodies. This preconditions lower general average grades in models than in sampling data.

20.3. Grade Interpolation with an Alternative Method

The Inverse Distance Weighting (IDW) method, degree 3, was chosen as an alternative grade interpolation method. At that, the block model coding, sample selection and grade interpolation methodology was similar to the main interpolation method described above. The difference is that the process for this interpolation did not use variogram models for weighting of samples participating in grade estimation in the block. Same search radii corresponding to variogram ranges were used.

The gold grade without restricted top cut grades was also used for alternative grade interpolation.

The search ellipse parameters indicated in Table 20-1 were used for the interpolation process.

Table 20-1 Parameters of grade interpolation with the IDW method

No of Interpolation Cycle	1	2	>2
Search radii	Less or equal to 2/3 of general variogram ranges within the deposit	Full variogram range	Increase by the variogram range
Minimum number of samples	3	3	1
Maximum number of samples	12	12	12

A macros Интерполяция.mcr (Interpolation) was written for work simplification and process automation. It creates empty block models, codes them, interpolates gold, the ore content coefficient, and classifies reserves.

The process Modeling | 3D block evaluation | Ordinary/Universal kriging was used for interpolation.

In order to use the processes in macros, the following variables were created in process forms:

- %1 – composite file,
- %2 – interpolated element,
- %3 – input block model,

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

- %4 – multiplier for search ellipse axes
- %5 – maximum number of composite intervals
- %6 – minimum number of composite intervals
- %7 – number of workings participating in interpolation,
- %8 – output block model,
- %9 – number of interpolation cycle.

The table of comparison of average gold grades received as a result of interpolation with OK and IDW methods is given below.

The table shows that ordinary kriging estimated the average grade slightly higher than the inverse distance method. Nonetheless, the correlation between grades received with different methods is very high which confirms the accuracy of grade estimation in block models.

As a result, block models were created with the ordinary kriging method and with the inverse distance method for validation, both with and without restriction of top cut grades.

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Table 20-2 Comparison of average gold grades for OK and IDW methods, without top cut grade restriction

cut_off	OK								
	Ore, t	Average Grade, g/t	Metal, kg	Ore, t	Average Grade, g/t	Metal, kg	Ore	Grade	Metal
0.00	54473531.97	0.94	51079.83	54473531.97	0.93	50616.81	0.00	0.91	0.91
0.20	54473531.97	0.94	51079.83	54473531.97	0.93	50616.81	0.00	0.91	0.91
0.40	42574164.09	1.11	47104.06	39771988.39	1.15	45765.63	7.05	-3.85	2.92
0.60	32284401.44	1.30	42018.15	29130152.06	1.39	40589.95	10.83	-6.60	3.52
0.80	22378753.37	1.57	35139.12	21737535.38	1.63	35451.75	2.95	-3.72	-0.88
1.00	16508572.82	1.81	29893.72	15839447.83	1.90	30163.06	4.22	-4.91	-0.89
1.20	12260749.64	2.06	25254.69	11844049.70	2.18	25796.34	3.52	-5.43	-2.10
1.40	9283057.76	2.31	21397.45	8934268.32	2.47	22035.48	3.90	-6.54	-2.90
1.60	6727297.94	2.61	17584.48	6832333.99	2.76	18889.35	-1.54	-5.45	-6.91
1.80	5170202.04	2.89	14952.74	5253314.16	3.09	16216.98	-1.58	-6.31	-7.80
2.00	3878913.05	3.22	12501.74	4134586.36	3.41	14103.07	-6.18	-5.51	-11.35

Table 20-3 Comparison of average gold grades for OK and IDW methods, with top cut grade restriction

cut_off	OK								
	Ore, t	Average Grade, g/t	Metal, t	Ore, t	Average Grade, g/t	Metal, kg	Ore	Grade	Metal
0.00	54473531.97	0.91	49614.493	54473531.97	0.91	49303.994	0.00	0.63	0.63
0.20	54473531.97	0.91	49614.493	54473531.97	0.91	49303.994	0.00	0.63	0.63
0.40	42574164.09	1.07	45639.504	39771988.39	1.12	44457.129	7.05	-4.10	2.66
0.60	32284401.44	1.26	40552.437	29130152.06	1.35	39279.097	10.83	-6.85	3.24
0.80	22378753.37	1.50	33673.310	21737535.38	1.57	34140.973	2.95	-4.20	-1.37
1.00	16508572.82	1.72	28429.413	15832544.83	1.82	28846.897	4.27	-5.48	-1.45
1.20	12260749.64	1.94	23789.533	11837146.70	2.07	24481.587	3.58	-6.18	-2.83

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

1.40	9283057.76	2.15	19931.653	8927365.32	2.32	20720.415	3.98	-7.49	-3.81
1.60	6727297.94	2.40	16118.606	6818783.40	2.58	17563.140	-1.34	-6.98	-8.22
1.80	5170202.04	2.61	13486.989	5239763.57	2.84	14891.408	-1.33	-8.21	-9.43
2.00	3878913.05	2.85	11035.896	4114015.42	3.10	12763.733	-5.71	-8.30	-13.54

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

20.4. Quantile Plot

Fitting of theoretic distribution to observed data can be visually validated on the Q-Q plot (also 'quantile plot'). This plot reflects the relation between observed values of variable and theoretical quantiles. If the observed values fall on a straight line, then theoretical distribution fits well to the observed data. In order to build the Q-Q plot, the program firstly regulates n points of the observed data in ascending order:

$$x_1 \le x_2 \le \ldots \le x_n$$

These observed values are reflected on one of the plot axes; and the following values are reflected on the other axis:

$$F^{-1}((i-r_{adj}) / (n+n_{adj})),$$

where i is the rank of the corresponding observation, r_{adj} and n_{adj} are corrections (≤ 0.5), and F^{-1} is reverse probabilistic integral for the corresponding standardized distribution. The plot received represents a diagram of dispersion of observed and expected (standardized) values with the corresponding set distribution.

In order to check model correctness quantile plots were built. They allow to compare and evaluate the correlation between input data and the data received as a result of interpolation to the block model.

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Tel.: +7 (495) 380-28-21
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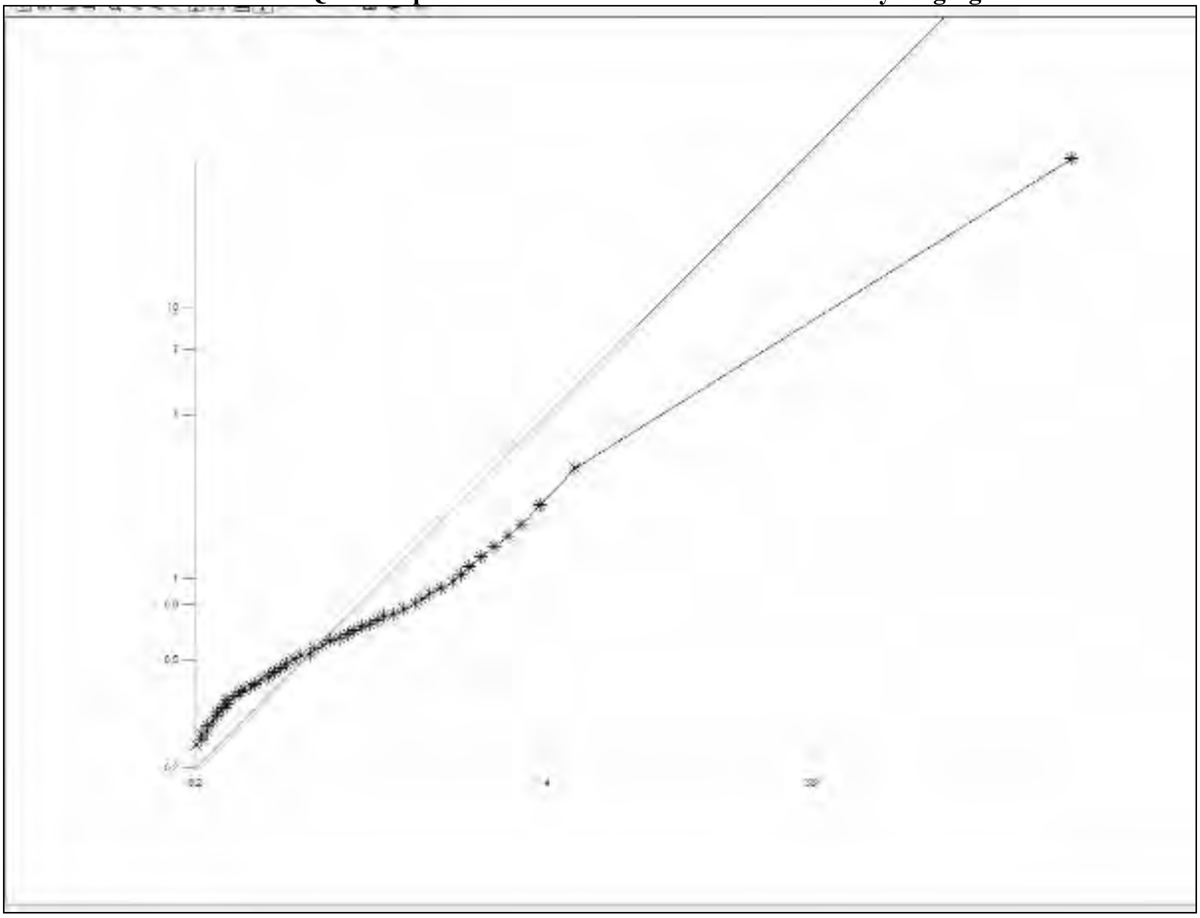
Table 20-4 Quantile plot for models received with the ordinary kriging method



The plot shows that overestimation in low grade classes and underestimation in high grade classes occurred during interpolation to the block model. This effect is particularly typical for ore zones with lower number of samples for interpolation. But in general the Spearman and Pearson correlation coefficients close to 100% speak to a high degree of compatibility of input and received values.

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Tel.: +7 (495) 380-28-21
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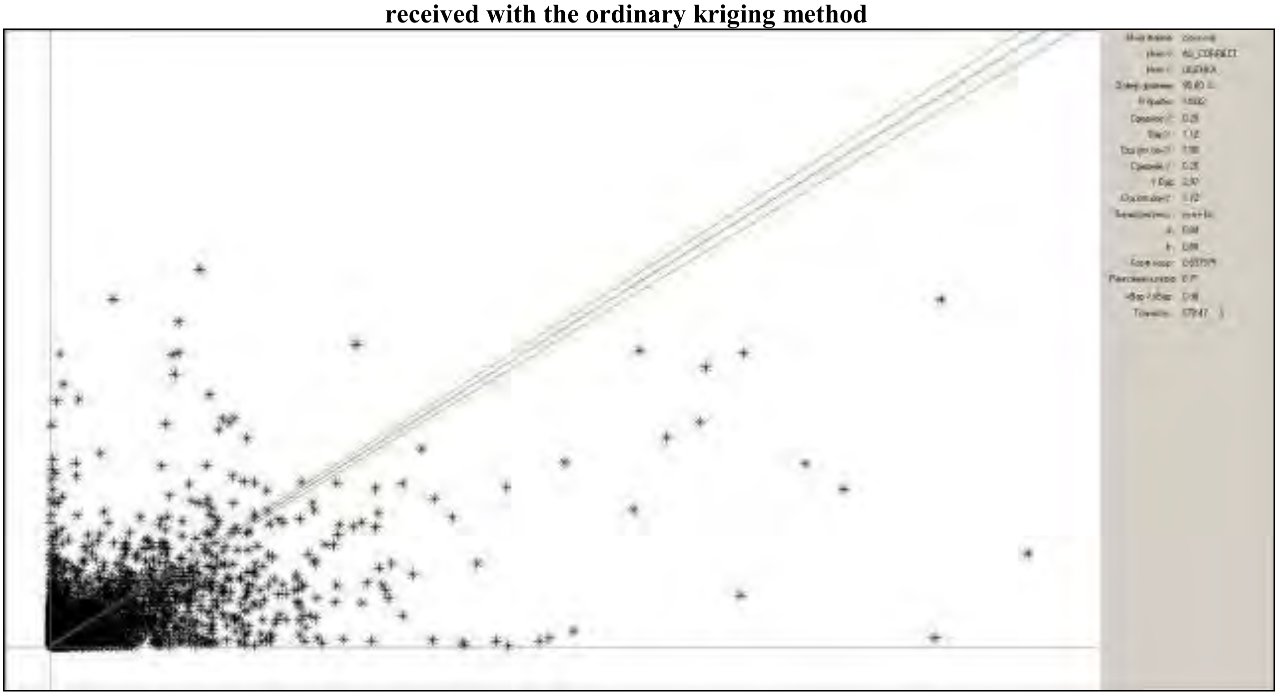
20.5. Cross Validation

Cross validation is validation of the reliability of the model, with the help of which researchers study whether the model is applicable for analysis of comparability of data not used for building the basic model.

The validation showed a comparatively high degree of convergence of the model without top cut grade restriction with basic data. The Pearson correlation coefficient equals to 54%, and the Spearman rank correlation coefficient is 71%. This speaks to correct geostatistic analysis, on the basis of which search ellipsoid and kriging parameters were defined (Figure 20-2).

Figure 20-2 Diagram of model dispersion according to the results of cross validation of the model received with the ordinary kriging method



21. Resource Statement

The models of the Krasnoye occurrence ore bodies were built using the natural cutoff grades. Therefore, the Resource Statement was prepared on the basis of the set of cutoff grades with diagrams of dependence of the average grade in ore bodies from the tonnage with different cutoff grade values used.

Since the ore bodies included a significant number of samples with grades below the cutoff one, an ore content coefficient was assigned to each block of the model (KP_NEW field), estimated individually for each wireframe. In this regard all samples with the grade above or equal to 0.2 g/t in the KP_NEW field were assigned the value 1 and the samples with the grades below the cutoff grade – value 0.

Table 21-1 Resources received with the OK method without top cut grade restriction

Cutoff Grade, g/t	Ore resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	mln.m^3	Kt			
0.00	21.0	54 473.53	2.60	0.94	51.080
0.20	21.0	54 473.53	2.60	0.94	51.080
0.40	16.4	42 574.16	2.60	1.11	47.104
0.60	12.4	32 284.40	2.60	1.30	42.018
0.80	8.6	22 378.75	2.60	1.57	35.139
1.00	6.3	16 508.57	2.60	1.81	29.894
1.20	4.7	12 260.75	2.60	2.06	25.255
1.40	3.6	9 283.06	2.60	2.31	21.397
1.60	2.6	6 727.30	2.60	2.61	17.584
1.80	2.0	5 170.20	2.60	2.89	14.953
2.00	1.5	3 878.91	2.60	3.22	12.502

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Figure 21-1 Resources and quality of ores of the deposit depending on the cutoff grade, Au

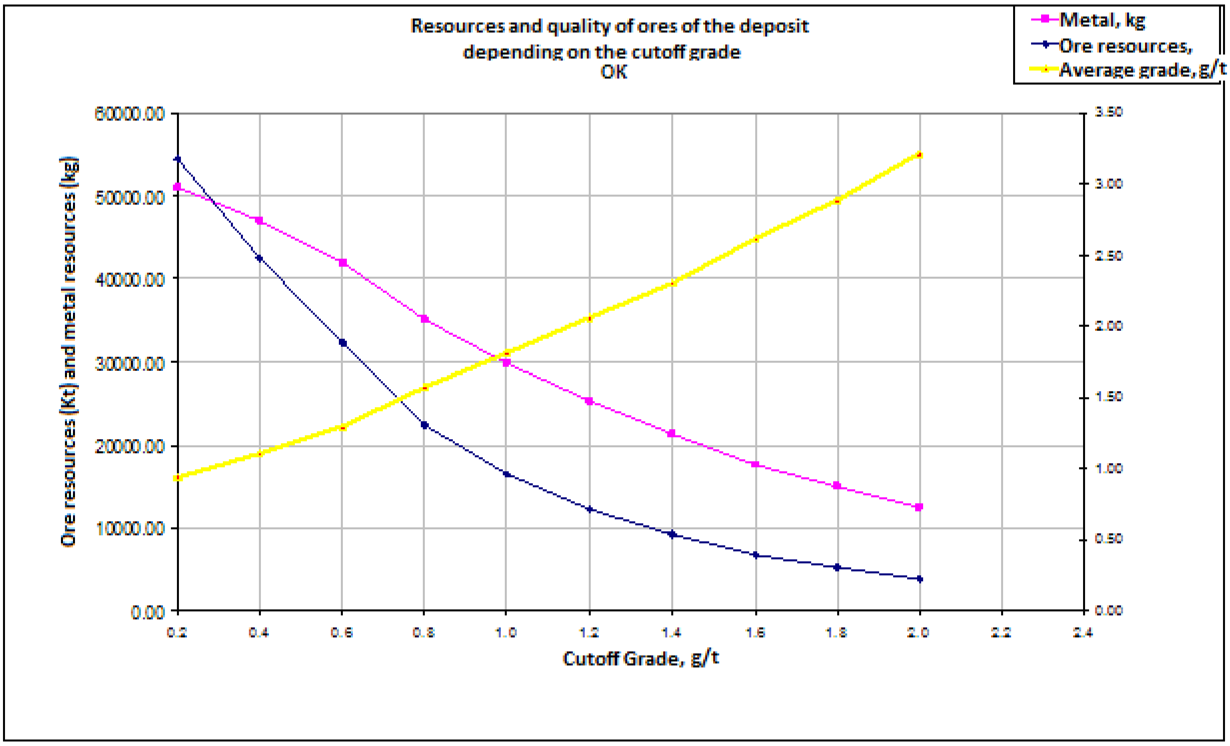

Table 21-2 Resources received with the OK method with top cut grade restriction

Cutoff Grade, g/t	Ore resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	mln.m^3	Kt			
0.00	21.0	54 473.53	2.60	0.91	49.61
0.20	21.0	54 473.53	2.60	0.91	49.61
0.40	16.4	42 574.16	2.60	1.07	45.64
0.60	12.4	32 284.40	2.60	1.26	40.55
0.80	8.6	22 378.75	2.60	1.50	33.67
1.00	6.3	16 508.57	2.60	1.72	28.43
1.20	4.7	12 260.75	2.60	1.94	23.79
1.40	3.6	9 283.06	2.60	2.15	19.93
1.60	2.6	6 727.30	2.60	2.40	16.12
1.80	2.0	5 170.20	2.60	2.61	13.49
2.00	1.5	3 878.91	2.60	2.85	11.04

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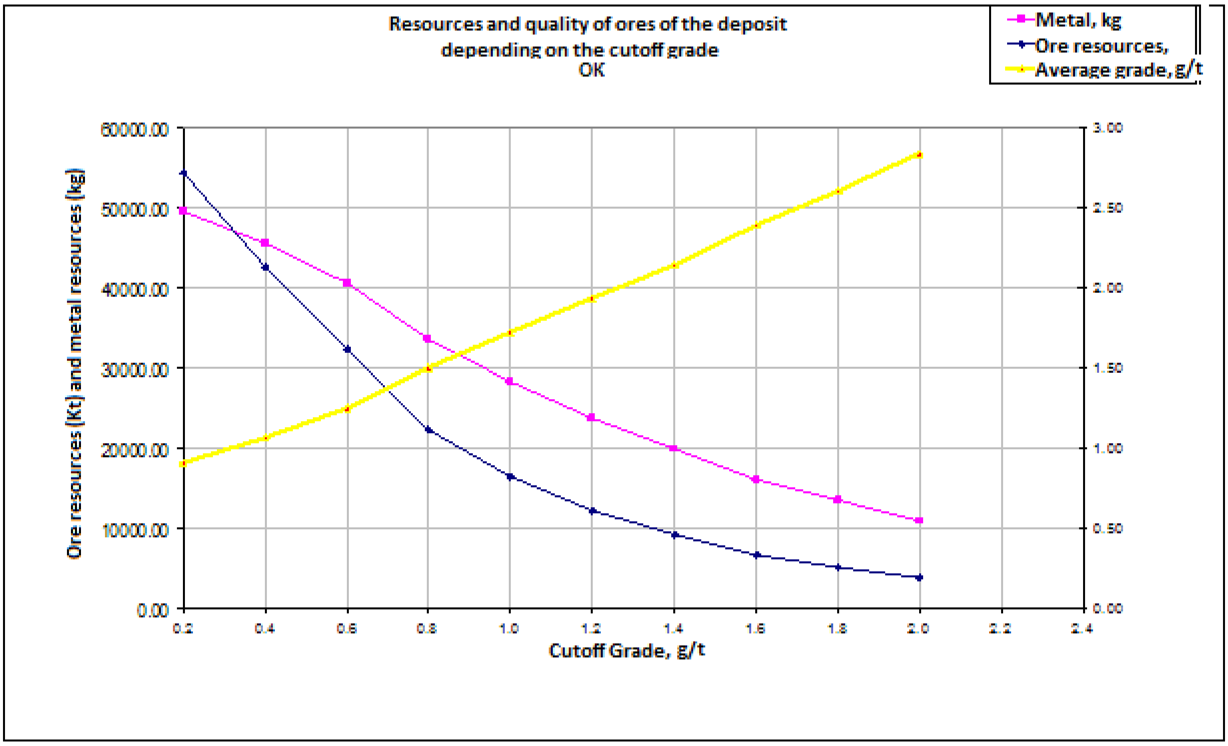
Figure 21-2 Resources and quality of ores of the deposit depending on the cutoff grade, Au



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22. Building of Optimal Pit Shells and Resource Estimation within the Contour of the Pit

Determination of rational boundaries of open-cast mining was conducted with regard to mining and geological conditions of the deposit, optimization parameters and commitment to involve the fullest possible volume to useful component explored reserves development.

The ‘optimization’ module in MICROMINE software was used for building optimal final pit shells. A geological block model of the deposit and input data received from the Customer were used for pit optimization.

The ‘optimization’ module is based on the Lerch-Grossman algorithm and allows to find a set of blocks, for which the difference between profits from the useful component sales and the total expenditures is maximum for each block. In this regard it is taken into account that extraction of any cell is possible only together with extraction of above-lying blocks. Both cost indicators (price of elements, processing cost etc.) and geotechnical indicators (slope inclines, losses and dilution etc.) are entered to the optimization module.

Since resource classification cannot be correctly provided in compliance with the JORC Code at this stage, optimal pits were built for all resources. This resource estimate serves as evaluation of the potential of the deposit which can serve for design of the maximum mining lease and infrastructure of the future mining enterprise (roads, plant, camp etc.) for the maximum possible LoM and other economic estimates and considerations for this project.

All block models created in this project were used for building the pit shell: with the ordinary kriging method; with the IDW method, with and without restriction of top cut grades.

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The Customer did not provide with the main input data for optimization. All parameters given below were taken by analogy with currently operating gold mining enterprises and were agreed with the Customer.

Table 22-1 Input data for optimization

Parameters	UoM	Value
Ore production	RUR/t	50
Waste production	RUR/m^3	120
Bulk weight of ore/waste	t/m^3	2,6
Mining dilution	un. fractions	1.03
Extraction during mining (losses)	un. fractions	0.97
Extraction during processing	un. fractions	0,9334
Processing cost	RUR/t	475
Pit slope inclination	degree	50
Price for Au element	RUR/g	1700

The optimal pit shells were recorded in the wireframe file of OPTY_PIT_KR_LINE.tdb type.

The Micromine optimization model creates report files during the process of building optimal pits. These files contain the information on the cost output parameters such as total profit from the pit, costs etc. This profit calculation procedure is absolutely conventional. These parameters cannot be used for real estimation of the project cost.

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Figure 22-1 Form of 'pit optimization' module

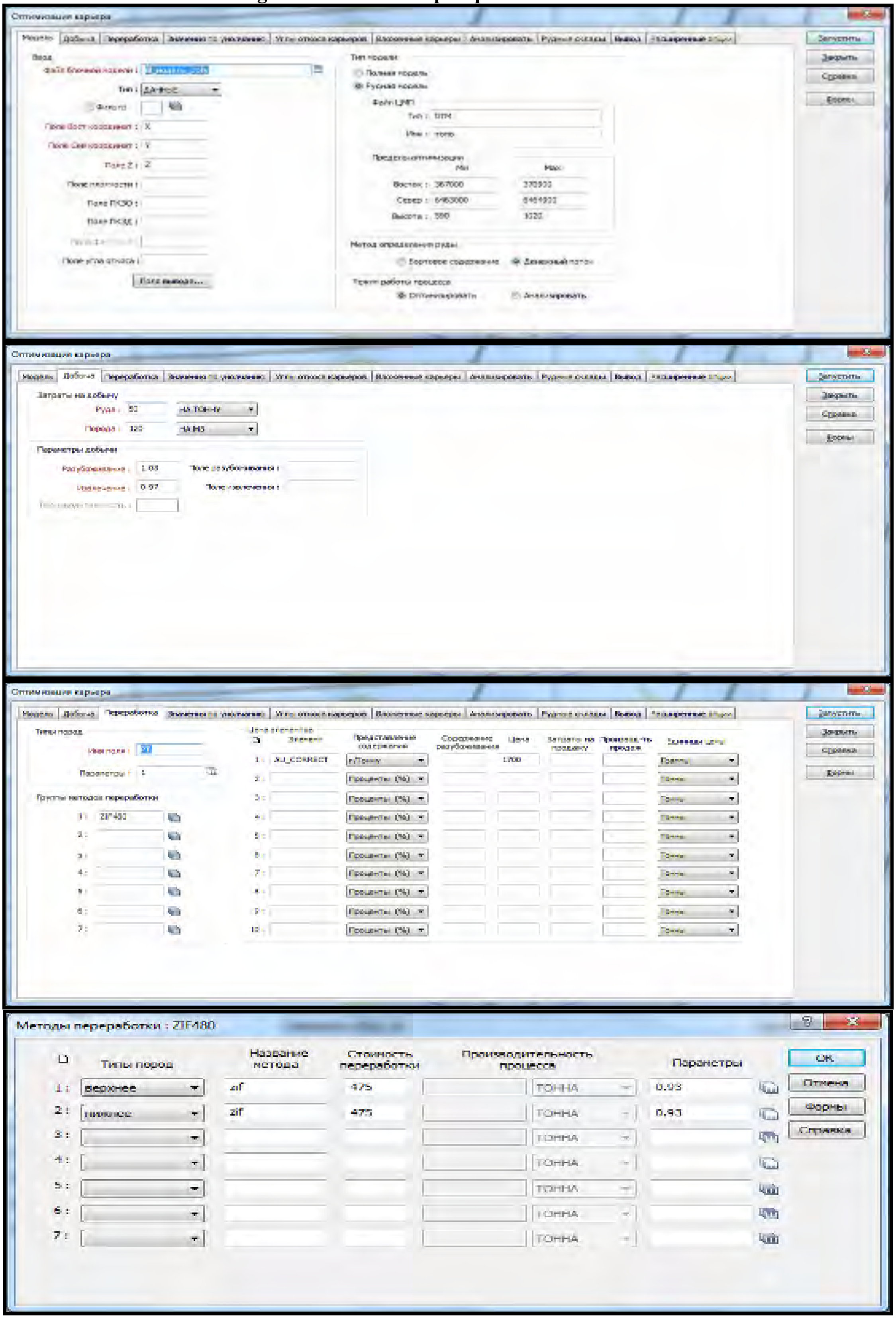

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Figure 22-2 3D view of the optimal pit bowl and the block model in accordance with the OK block model

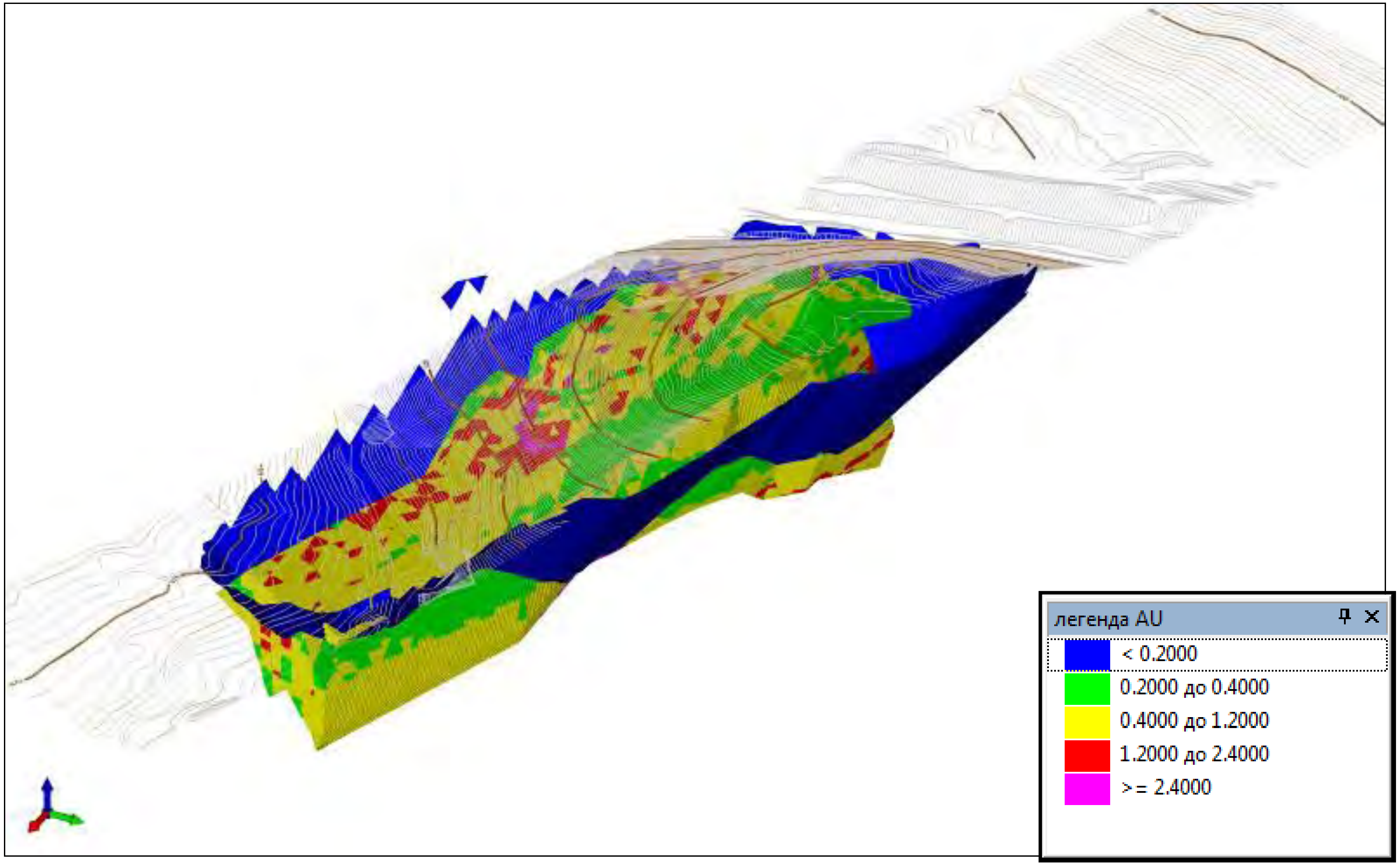

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Figure 22-3 View of optimal pit in accordance with the OK block model in isolines (Plan)

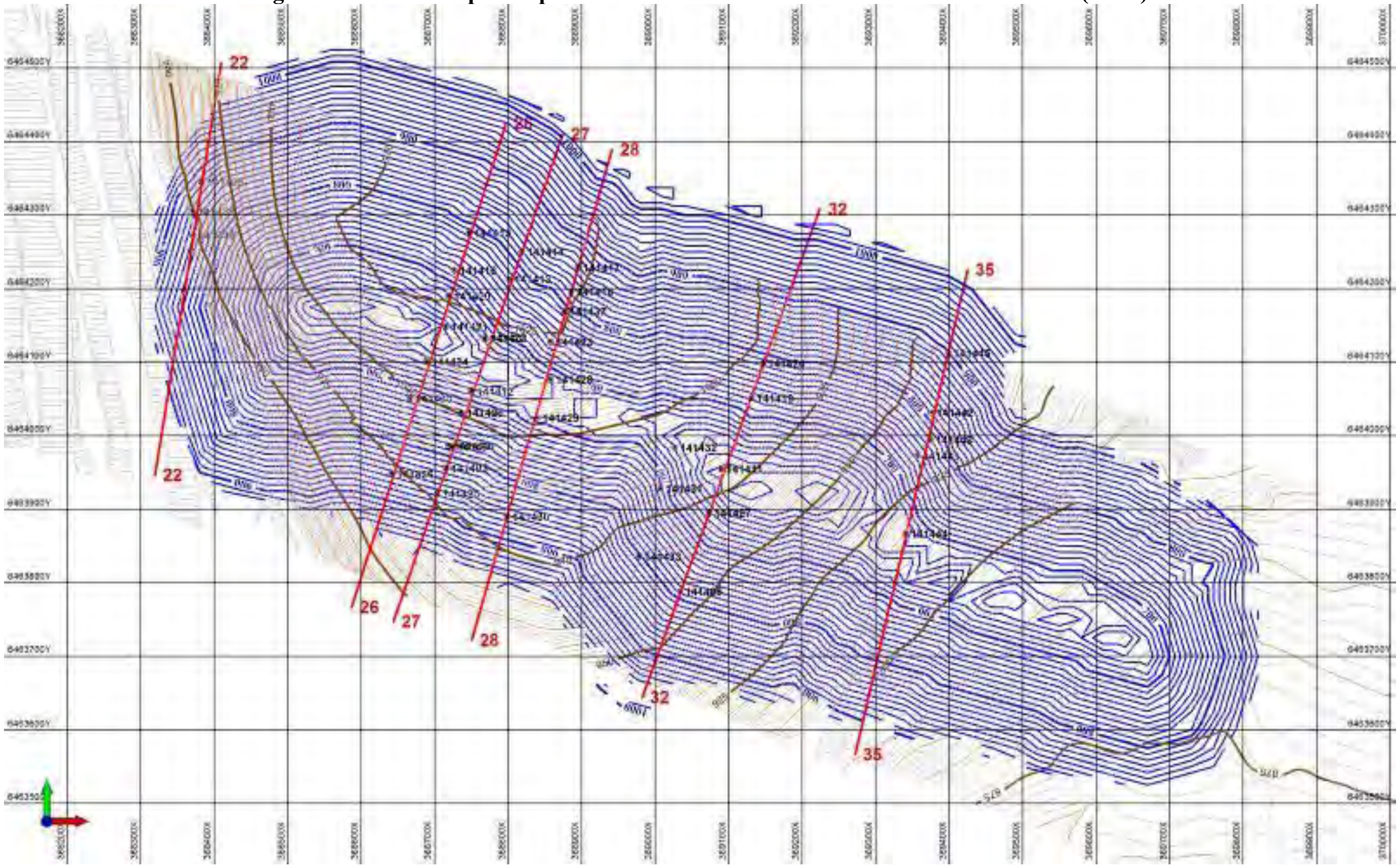

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Figure 22-4 View of optimal pit. Section 26

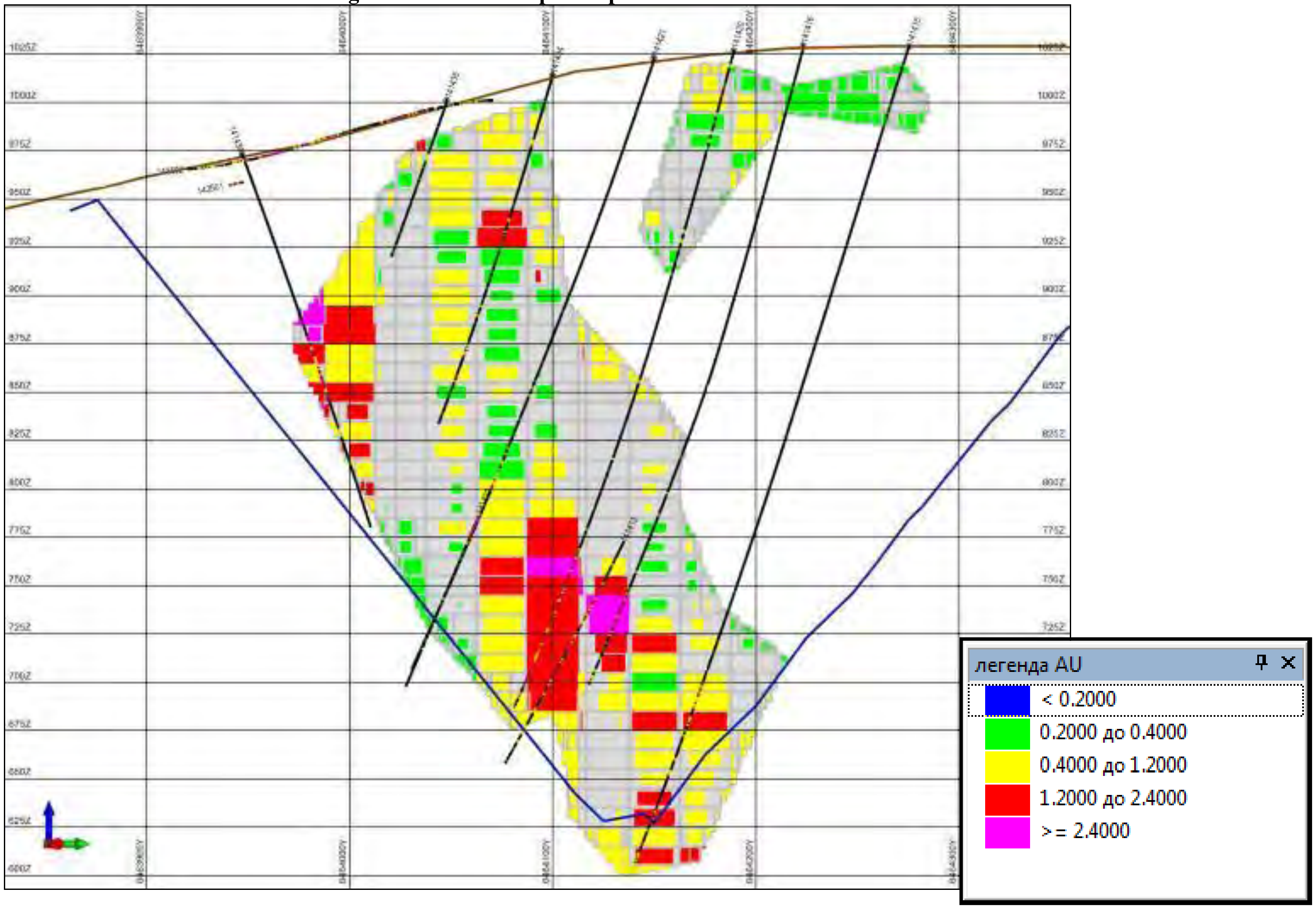

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Figure 22-5 View of optimal pit. Section 27

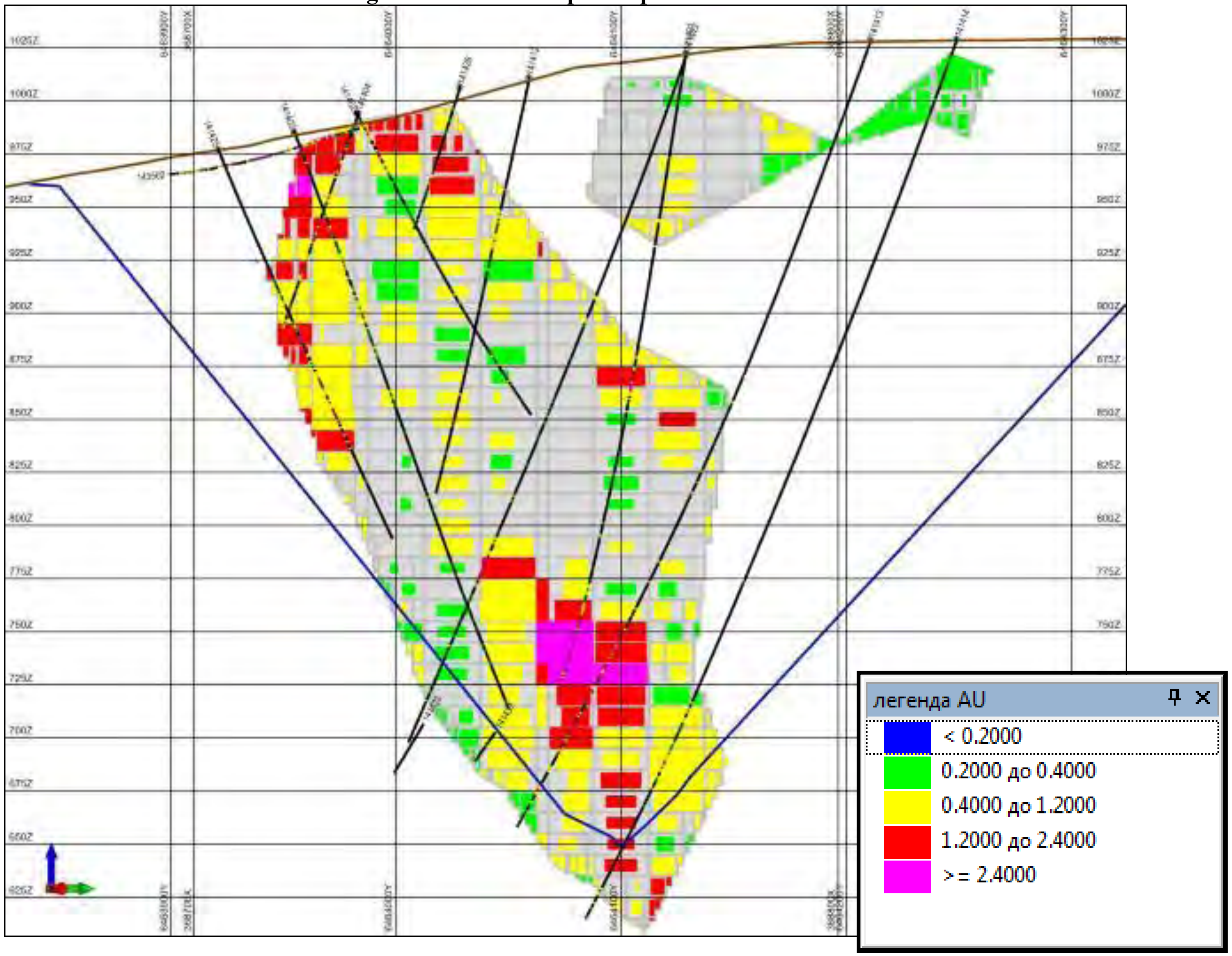

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Figure 22-6 View of optimal pit. Section 28

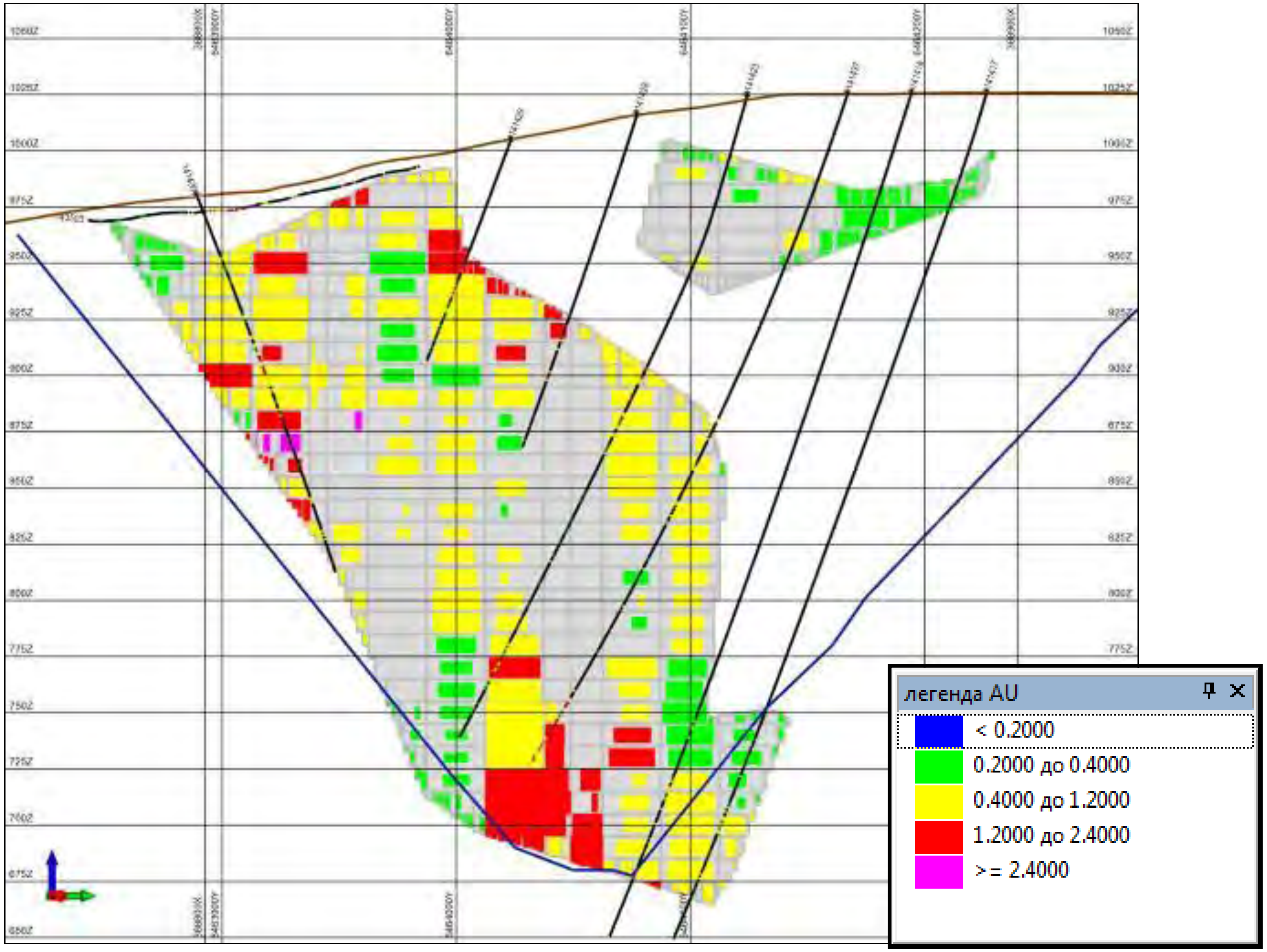

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Figure 22-7 View of optimal pit. Section 32

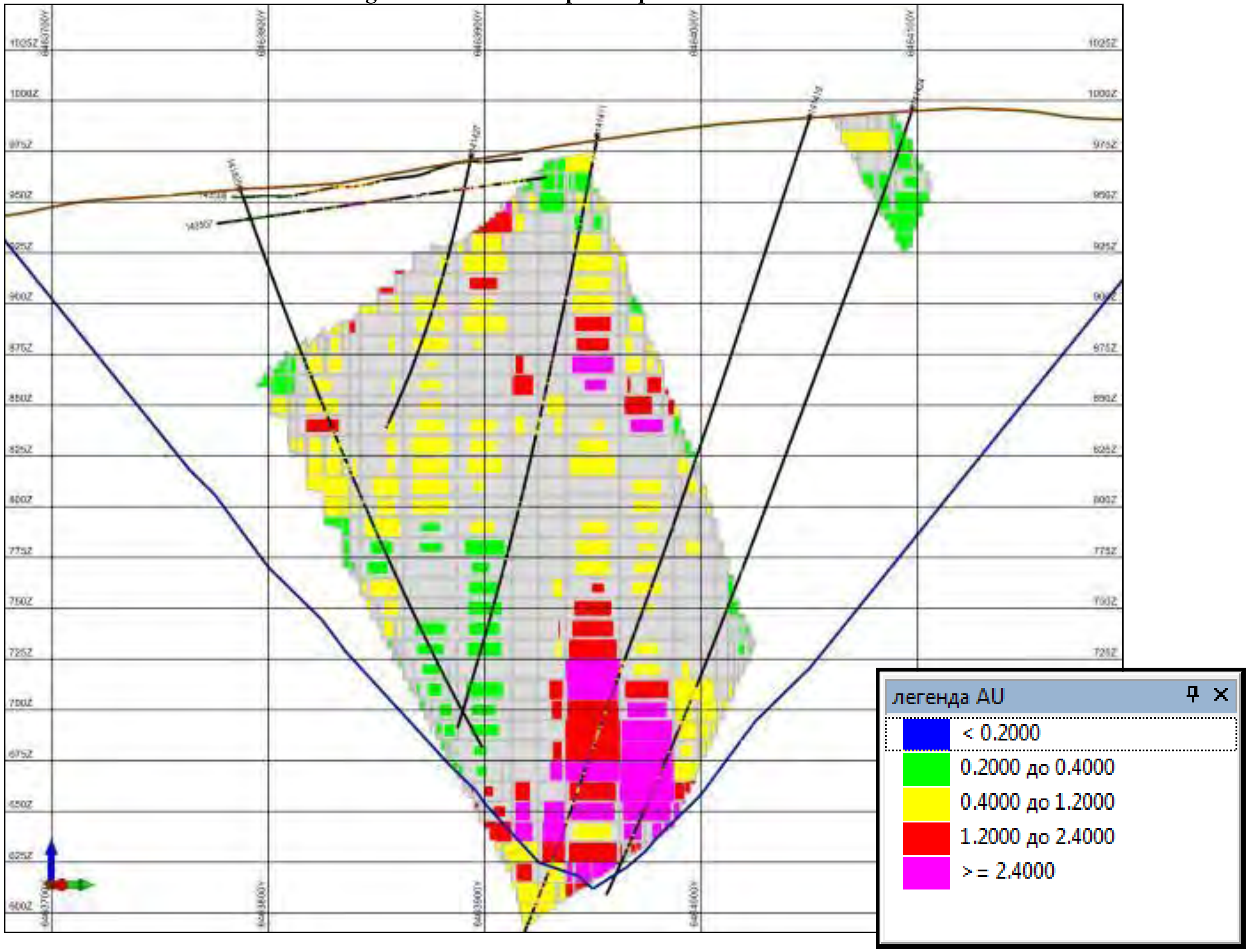

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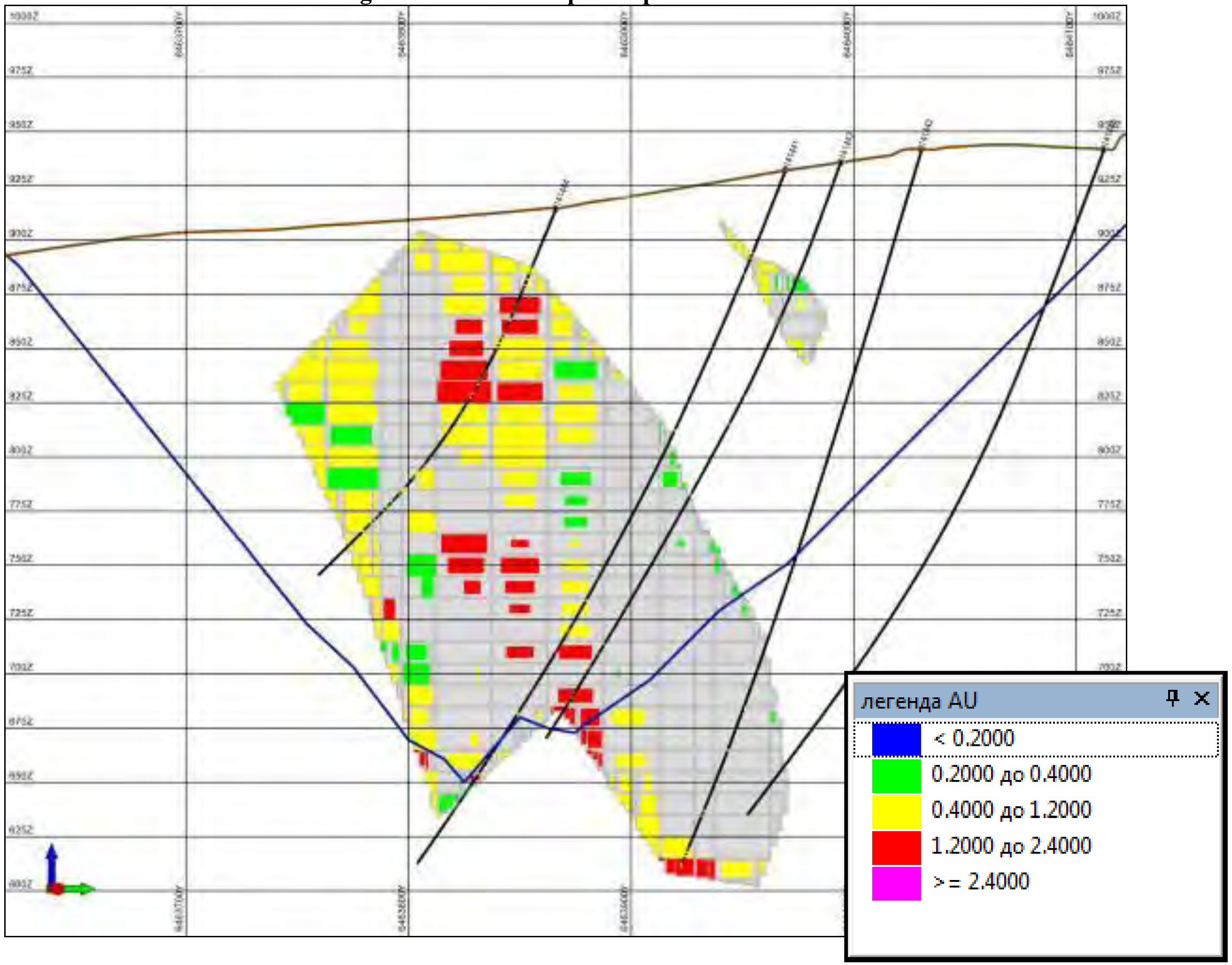
Figure 22-8 View of optimal pit. Section 35



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Tel.: +7 (495) 380-28-21
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Table 22-2 Main mining and economic parameters of the optimal pit in accordance with the block model created with the ordinary kriging method without top cut grade restriction

Description	UoM	Value
Weight of ore	t	44,888,056
Weight of waste	t	319,008,038
Au, quantity (metal)	g	41,376,627
Profit	RUR	70,340,266,614
Mining costs	RUR	16,967,850,713
Processing cost	RUR	21,302,637,058
Total profit from the pit	RUR	32,069,778,842
Minimum processed grade	g/t	0.311
Pit length	m	1 650
Pit width	m	650
Pit depth	m	360
Stripping ratio	m^3/t	2.73
	t/t	7.11

Table 22-3 Main mining and economic parameters of the optimal pit in accordance with the block model created with the IDW method without top cut grade restriction

Description	UoM	Value
Weight of ore	t	41,183,214
Weight of waste	t	294,857,136
Au, quantity (metal)	g	39,364,591
Profit	RUR	66,919,805,522
Mining costs	RUR	15,667,951,617
Processing cost	RUR	19,544,421,034
Total profit from the pit	RUR	31,707,432,871
Minimum processed grade	g/t	0.311
Pit length	m	1 650
Pit width	m	650
Pit depth	m	360
Stripping ratio	m^3/t	2.75
	t/t	7.16

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Tel.: +7 (495) 380-28-21
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Table 22-4 Main mining and economic parameters of the optimal pit in accordance with the block model created with the ordinary kriging method with top cut grade restriction

Description	UoM	Value
Weight of ore	t	44,888,056
Weight of waste	t	319,008,038
Au, quantity (metal)	g	40,049,504
Profit	RUR	68,084,156,517
Mining costs	RUR	16,967,850,713
Processing cost	RUR	21,302,637,058
Total profit from the pit	RUR	29,813,668,746
Minimum processed grade	g/t	0.311
Pit length	m	1 650
Pit width	m	650
Pit depth	m	360
Stripping ratio	m^3/t	2.73
	t/t	7.11

Table 22-5 Main mining and economic parameters of the optimal pit in accordance with the block model created with the IDW method with top cut grade restriction

Description	UoM	Value
Weight of ore	t	41,183,214
Weight of waste	t	294,857,136
Au, quantity (metal)	g	38,178,641
Profit	RUR	64,903,689,914
Mining costs	RUR	15,667,951,617
Processing cost	RUR	19,544,421,034
Total profit from the pit	RUR	29,691,317,263
Minimum processed grade	g/t	0.311
Pit length	m	1 650
Pit width	m	650
Pit depth	m	360
Stripping ratio	m^3/t	2.75
	t/t	7.16

Note: Quantitative parameters are of the 'final' product, i.e. with regard to extraction, losses and dilution.

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Table 22-6 Geological resources of the deposit and within the optimal pit for the block model created with the ordinary kriging method without top cut grade restriction

CUT-OFF, g/t	Ore Resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	mln.m^3	Kt			
Total for the deposit					
0.00	21.0	54 473.5	2.60	0.94	51.08
0.20	21.0	54 473.5	2.60	0.94	51.08
0.40	16.4	42 574.2	2.60	1.11	47.10
0.60	12.4	32 284.4	2.60	1.30	42.02
0.80	8.6	22 378.8	2.60	1.57	35.14
1.00	6.3	16 508.6	2.60	1.81	29.89
1.20	4.7	12 260.7	2.60	2.06	25.25
1.40	3.6	9 283.1	2.60	2.31	21.40
1.60	2.6	6 727.3	2.60	2.61	17.58
1.80	2.0	5 170.2	2.60	2.89	14.95
2.00	1.5	3 878.9	2.60	3.22	12.50
Within the optimal pit contour					
0.00	18.6	48 304.6	2.60	0.97	46.68
0.20	18.6	48 304.6	2.60	0.97	46.68
0.40	14.5	37 818.4	2.60	1.14	43.18
0.60	10.9	28 458.4	2.60	1.35	38.56
0.80	7.9	20 601.2	2.60	1.61	33.10
1.00	6.0	15 599.7	2.60	1.84	28.64
1.20	4.5	11 778.5	2.60	2.08	24.46
1.40	3.4	8 965.4	2.60	2.32	20.82
1.60	2.5	6 564.2	2.60	2.63	17.23
1.80	2.0	5 074.3	2.60	2.90	14.72
2.00	1.5	3 809.2	2.60	3.23	12.32
Outside the optimal pit contour					
0.00	2.37	6 168.9	2.60	0.71	4.40
0.20	2.37	6 168.9	2.60	0.71	4.40
0.40	1.83	4 755.8	2.60	0.82	3.92
0.60	1.47	3 826.0	2.60	0.90	3.46
0.80	0.68	1 777.5	2.60	1.14	2.04
1.00	0.35	908.9	2.60	1.38	1.26
1.20	0.19	482.2	2.60	1.65	0.80
1.40	0.12	317.7	2.60	1.83	0.58
1.60	0.06	163.1	2.60	2.15	0.35
1.80	0.04	95.9	2.60	2.47	0.24
2.00	0.03	69.8	2.60	2.67	0.19
% in the contour of the optimal pit from the total resource quantity					
0.00	88.68	88.68	100.00	103.05	91.38
0.20	88.68	88.68	100.00	103.05	91.38
0.40	88.83	88.83	100.00	103.21	91.68
0.60	88.15	88.15	100.00	104.10	91.77
0.80	92.06	92.06	100.00	102.34	94.21
1.00	94.49	94.49	100.00	101.38	95.79
1.20	96.07	96.07	100.00	100.81	96.85
1.40	96.58	96.58	100.00	100.73	97.28
1.60	97.58	97.58	100.00	100.44	98.01
1.80	98.15	98.15	100.00	100.28	98.42
2.00	98.20	98.20	100.00	100.31	98.51

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Table 22-7 Geological resources of the deposit and within the optimal pit for the block model created with the IDW method without top cut grade restriction

CUT-OFF, g/t	Ore Resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	$mln.m^3$	Kt			
Total for the deposit					
0.00	21.0	54 473.5	2.60	0.93	50.62
0.20	21.0	54 473.5	2.60	0.93	50.62
0.40	15.3	39 772.0	2.60	1.15	45.77
0.60	11.2	29 130.2	2.60	1.39	40.59
0.80	8.4	21 737.5	2.60	1.63	35.45
1.00	6.1	15 839.4	2.60	1.90	30.16
1.20	4.6	11 844.0	2.60	2.18	25.80
1.40	3.4	8 934.3	2.60	2.47	22.04
1.60	2.6	6 832.3	2.60	2.76	18.89
1.80	2.0	5 253.3	2.60	3.09	16.22
2.00	1.6	4 134.6	2.60	3.41	14.10
Within the optimal pit contour					
0.00	17.5	45 499.9	2.60	0.98	44.69
0.20	17.5	45 499.9	2.60	0.98	44.69
0.40	13.0	33 916.9	2.60	1.21	40.91
0.60	9.6	24 968.8	2.60	1.46	36.54
0.80	7.3	18 985.5	2.60	1.71	32.38
1.00	5.6	14 514.5	2.60	1.96	28.39
1.20	4.3	11 213.9	2.60	2.21	24.77
1.40	3.3	8 542.8	2.60	2.49	21.31
1.60	2.5	6 582.7	2.60	2.79	18.37
1.80	2.0	5 075.5	2.60	3.12	15.82
2.00	1.6	4 030.8	2.60	3.44	13.85
Outside the optimal pit contour					
0.00	3.45	8 973.6	2.60	0.66	5.93
0.20	3.45	8 973.6	2.60	0.66	5.93
0.40	2.25	5 855.0	2.60	0.83	4.85
0.60	1.60	4 161.3	2.60	0.97	4.05
0.80	1.06	2 752.0	2.60	1.12	3.07
1.00	0.51	1 325.0	2.60	1.34	1.78
1.20	0.24	630.2	2.60	1.63	1.03
1.40	0.15	391.5	2.60	1.85	0.72
1.60	0.10	249.6	2.60	2.07	0.52
1.80	0.07	177.8	2.60	2.22	0.40
2.00	0.04	103.8	2.60	2.45	0.25
% in the contour of the optimal pit from the total resource quantity					
0.00	83.53	83.53	100.00	105.69	88.28
0.20	83.53	83.53	100.00	105.69	88.28
0.40	85.28	85.28	100.00	104.83	89.40
0.60	85.71	85.71	100.00	105.02	90.01
0.80	87.34	87.34	100.00	104.58	91.34
1.00	91.63	91.63	100.00	102.70	94.11
1.20	94.68	94.68	100.00	101.40	96.01
1.40	95.62	95.62	100.00	101.14	96.71
1.60	96.35	96.35	100.00	100.95	97.27
1.80	96.62	96.62	100.00	100.98	97.56
2.00	97.49	97.49	100.00	100.73	98.20

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Table 22-8 Geological resources of the deposit and within the optimal pit for the block model created with the ordinary kriging method with top cut grade restriction

CUT-OFF, g/t	Ore Resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	mln.m^3	Kt			
Total for the deposit					
0.00	21.0	54 473.5	2.60	0.91	49.61
0.20	21.0	54 473.5	2.60	0.91	49.61
0.40	16.4	42 574.2	2.60	1.07	45.64
0.60	12.4	32 284.4	2.60	1.26	40.55
0.80	8.6	22 378.8	2.60	1.50	33.67
1.00	6.3	16 508.6	2.60	1.72	28.43
1.20	4.7	12 260.7	2.60	1.94	23.79
1.40	3.6	9 283.1	2.60	2.15	19.93
1.60	2.6	6 727.3	2.60	2.40	16.12
1.80	2.0	5 170.2	2.60	2.61	13.49
2.00	1.5	3 878.9	2.60	2.85	11.04
Within the optimal pit contour					
0.00	18.6	48 304.6	2.60	0.94	45.21
0.20	18.6	48 304.6	2.60	0.94	45.21
0.40	14.5	37 818.4	2.60	1.10	41.72
0.60	10.9	28 458.4	2.60	1.30	37.09
0.80	7.9	20 601.2	2.60	1.54	31.64
1.00	6.0	15 599.7	2.60	1.74	27.17
1.20	4.5	11 778.5	2.60	1.95	22.99
1.40	3.4	8 965.4	2.60	2.16	19.35
1.60	2.5	6 564.2	2.60	2.40	15.77
1.80	2.0	5 074.3	2.60	2.61	13.25
2.00	1.5	3 809.2	2.60	2.85	10.85
Outside the optimal pit contour					
0.00	2.37	6 168.9	2.60	0.71	4.41
0.20	2.37	6 168.9	2.60	0.71	4.41
0.40	1.83	4 755.8	2.60	0.82	3.92
0.60	1.47	3 826.0	2.60	0.90	3.46
0.80	0.68	1 777.5	2.60	1.14	2.03
1.00	0.35	908.9	2.60	1.38	1.26
1.20	0.19	482.2	2.60	1.65	0.80
1.40	0.12	317.7	2.60	1.83	0.58
1.60	0.06	163.1	2.60	2.15	0.35
1.80	0.04	95.9	2.60	2.47	0.24
2.00	0.03	69.8	2.60	2.67	0.19
% in the contour of the optimal pit from the total resource quantity					
0.00	88.68	88.68	100.00	102.76	91.12
0.20	88.68	88.68	100.00	102.76	91.12
0.40	88.83	88.83	100.00	102.90	91.41
0.60	88.15	88.15	100.00	103.77	91.47
0.80	92.06	92.06	100.00	102.07	93.96
1.00	94.49	94.49	100.00	101.14	95.58
1.20	96.07	96.07	100.00	100.60	96.65
1.40	96.58	96.58	100.00	100.52	97.08
1.60	97.58	97.58	100.00	100.26	97.83
1.80	98.15	98.15	100.00	100.10	98.24
2.00	98.20	98.20	100.00	100.11	98.31

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

Table 22-9 Geological resources of the deposit and within the optimal pit for the block model created with the IDW method with top cut grade restriction

CUT-OFF, g/t	Ore Resources		Bulk Weight, t/m^3	Average Grade, g/t	Metal, t
	$mln.m^3$	Kt			
Total for the deposit					
0.00	21.0	54 473.53	2.60	0.91	49.30
0.20	21.0	54 473.53	2.60	0.91	49.30
0.40	15.3	39 771.99	2.60	1.12	44.46
0.60	11.2	29 130.15	2.60	1.35	39.28
0.80	8.4	21 737.54	2.60	1.57	34.14
1.00	6.1	15 832.54	2.60	1.82	28.85
1.20	4.6	11 837.15	2.60	2.07	24.48
1.40	3.4	8 927.37	2.60	2.32	20.72
1.60	2.6	6 818.78	2.60	2.58	17.56
1.80	2.0	5 239.76	2.60	2.84	14.89
2.00	1.6	4 114.02	2.60	3.10	12.76
Within the optimal pit contour					
0.00	17.5	45 499.9	2.60	0.95	43.38
0.20	17.5	45 499.9	2.60	0.95	43.38
0.40	13.0	33 916.9	2.60	1.17	39.60
0.60	9.6	24 968.8	2.60	1.41	35.23
0.80	7.3	18 985.5	2.60	1.64	31.07
1.00	5.6	14 507.6	2.60	1.87	27.07
1.20	4.3	11 207.0	2.60	2.09	23.45
1.40	3.3	8 535.9	2.60	2.34	20.00
1.60	2.5	6 569.2	2.60	2.60	17.05
1.80	1.9	5 062.0	2.60	2.86	14.50
2.00	1.5	4 010.2	2.60	3.12	12.51
Outside the optimal pit contour					
0.00	3.45	8 973.6	2.60	0.66	5.93
0.20	3.45	8 973.6	2.60	0.66	5.93
0.40	2.25	5 855.0	2.60	0.83	4.85
0.60	1.60	4 161.3	2.60	0.97	4.05
0.80	1.06	2 752.0	2.60	1.11	3.07
1.00	0.51	1 325.0	2.60	1.34	1.78
1.20	0.24	630.2	2.60	1.64	1.03
1.40	0.15	391.5	2.60	1.85	0.73
1.60	0.10	249.6	2.60	2.07	0.52
1.80	0.07	177.8	2.60	2.22	0.40
2.00	0.04	103.8	2.60	2.45	0.25
% in the contour of the optimal pit from the total resource quantity					
0.00	83.53	83.53	100.00	105.33	87.97
0.20	83.53	83.53	100.00	105.33	87.97
0.40	85.28	85.28	100.00	104.46	89.09
0.60	85.71	85.71	100.00	104.63	89.68
0.80	87.34	87.34	100.00	104.21	91.02
1.00	91.63	91.63	100.00	102.41	93.84
1.20	94.68	94.68	100.00	101.17	95.79
1.40	95.61	95.61	100.00	100.93	96.50
1.60	96.34	96.34	100.00	100.75	97.07
1.80	96.61	96.61	100.00	100.76	97.34
2.00	97.48	97.48	100.00	100.54	98.01

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

23. Conclusion and Recommendations

The Krasny deposit is a greenfield project. But it has high potential despite insufficient sampling density. As the experience shows, mineral resources reduce in the process of detailing, but the project does not lose its value with significant gold reduction.

In the future it is recommended to carry out exploration with the purpose of thickening of the exploration grid till 60-40 m along the strike and 40-30 m across the strike.

Further study of physical-mechanical and process properties of ores is required.

The QA/QC procedure requires reception of the results of internal and external control as early as possible, and the use of blanks and standards.

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

24. Qualified Specialists' Declaration

This report has been prepared and signed by Qualified Specialists, who, having required experience in the study of mineralization under investigation at the given deposit, are the recognized Qualified Specialists, according to the definition of this term in the Joint Ore Reserves Committee Code (JORC Code).

Signing this agreement, we thus confirm that the report terminology, classification of mineral resources and the results received in the process of this study correspond to the policy and the rules required by and explained in the JORC Code for control and quality of Mineral Resource estimation reports.

Signed by:
Alexey Nikandrov……………………

4-2, Aptekarsky per., Moscow, Russia 105005
Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

26. Appendixes

26.1. Appendix 1. Glossary of Technical Terms and Abbreviations

Term	Description
%	percent
azimuth, azimuth angle	drillhole deviation (from north)
binary	digital file containing characteristics readable by the computer only
channel sampling	in exploration, a sampling method by means of cutting-out of continuous samples from the soil or the working wall
cut-off grade	the threshold value in exploration and geological resources estimation above which ore material is selectively processed or estimated
variation	in statistics, the measure of variance around the mean value of a data set
variogram	graph showing variability of an element by increasing spacing between samples
variography	the process of constructing a variogram
year	year
g	gram
histogram	diagrammatic representation of data distribution by calculating frequency of occurrence
geometric mean	the antilog of the mean value of the logarithms of individual values. For a logarithmic distribution, the geometric mean is equal to the median. A mean geometric value equals to median in case of lognormal distribution.
probability curve	diagram showing cumulative frequency as a function of interval size on a logarithmic scale
declustering	in geostatistics, a procedure allowing bounded grouping of samples within the octant sectors of a search ellipse
wireframe model	3D surface defined by triangles
km	kilometre
core sampling	in exploration, a sampling method of obtaining ore or rock samples from a drillhole core for further assay
JORC Code	Australasian Code for Reporting Mineral Resources and Ore Reserves
compositing	in sampling and resource estimation, process designed to carry all samples to certain equal length
Kriging	method of interpolating grade using variogram parameters associated with the samples' spatial distribution. Kriging estimates grades in untested areas (blocks) such that the variogram parameters are used for optimum weighting of known grades. kriging weights known grades such that variation of the estimation is minimised, and the standard deviation is equal to zero (based on the model)
coefficient of variation	in statistics, the normalised variation value in a sample population
coefficient of correlations	statistical measure of the degree of similarity between two parameters
lag	the chosen spacing for constructing a variogram
lognormal	relates to the distribution of a variable value, where the logarithm of this variable is a normal distribution
m	meter
M	million or mega (10^6)
macro	a set of commands written as a computer program for reading and handling data

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

median	value occupying the middle position in a database
mm	millimetre
OK	ordinary kriging
omni	in all directions
population	in geostatistics, a population formed from grades having identical or similar geostatistical characteristics. Ideally, one given population is characterised by a linear distribution
sample	specimen with analytically determined grade values for the components being studied
reserves	mineable geological resources
resources	geological resources (both mineable and unmineable)
range	with increase of the distance between pairs, the value of the corresponding variogram generally grows However the value of the average square of the difference between pairs of values does not change starting from the specific value of the distance, and the variogram reaches its plateau. The horizontal spacing at which a variogram reaches its plateau is called the range. Above this spacing there is no correlation between samples.
sill	a value of variation at which the variogram curve starts flattening
cm	centimeter
mean	arithmetic mean
standard deviation	the statistical value of data variance around the mean value
string	series of 3D points connected in series by straight lines
t	ton
t/m^3	ton per cubic meter
DTM	digital terrain model, a 3D wireframe model of the surface, for example, topography.
nugget effect	measure of the variability during repeat analysis of a sample due to a measurement error or the presence of natural, small-scale variability. Although the variogram value at 0 spacing should be equal to zero, these factors may affect the values of samples taken at a very short distance from each other such that their values may vary. A vertical jump from the zero value at the origin of a variogram with very small spacing is called the nugget effect.
ASCII	digital computer format containing text data
IDW	inverse distance weighting method
3D	volume (three-dimensional) model or data

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

26.2. Appendix 2. List of Key Files

File	Description
Database files	
DH_NEW.dhdb	Drilling database file
DH_collar_new.DAT	Collar file
DH_survey_new.DAT	Directional survey file
DH_assay_new.DAT	Borehole sampling file
DH_geo_new.DAT	Lithology file
TR_NEW.dhdb	Trench database file
TR_collar_new.DAT	Trench stake coordinates file
TR_assay_new.DAT	Channel sampling file
TR_Geo_new.DAT	Lithology file
all_assay_new.dat	General sampling file
KOMP_1m__ALL_NEW.DAT	General composite file
String files	
РЛ.STR	Profile lines
topo.STR	Topographic surface isolines
Interprenation_NEW.STR	Strings of contouring of ore bodies
Wireframe model files	
DTM.tdb	Wireframe model of the topographic surface
Ore_NEW.tdb	Wireframe model of ore bodies
OPTY_PIT_KR_LINE.tdb	Wireframe model of the optimal pit bowl
Block model files	
Bl_модель_OK_NEW.DAT	Block model file, ordinary kriging method without top cut grade restriction
Bl_модель_IDW_NEW.DAT	Block model file, IDW method without top cut grade restriction
Bl_модель_OK_CUT_NEW.DAT	Block model file, ordinary kriging method with top cut grade restriction
Bl_модель_IDW_CUT_NEW.DAT	Block model file, IDW method with top cut grade restriction

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru

26.3. Appendix 3. Description of Fields in Files

Field	Description
Collars	
BHID, DHID	Borehole/trench No.
X,Y,Z	Coordinates of borehole collar/trench stakes
EOH	Borehole depth (m from collar)
Directional Survey	
DHID	Borehole No
FROM	Measurement depth from, m
TO	Measurement depth to, m
AZ	Borehole inclination azimuth
DIP	Borehole dip angle
Sampling	
X, Y, Z	Coordinates of borehole/exploring pit collars, sample center coordinates
	Working depth
BHID, DHID	No. (name) of borehole/trench
SAMPLE	Sample No.
FROM, TO	Beginning (ending) of the sampling interval
AU	Gold grade, g/t
KP, KP_NEW, KP_LINE	Ore content coefficient
Ore_New	Field of belongingness to ore bodies
AU_correct	Corrected field of gold grade, g/t
AU_cut	Field of gold grade with regard to top cut grade restriction, g/t
Strings	
X, Y, Z, EAST, NORTH, RL	String point coordinates (X-easting)
join	Service field
Block models	
X, Y, Z, EAST, NORTH, RL	Block center coordinates
_X, _Y, _Z, _EAST, _NORTH, _RL	Model cell size
PT	Field of belongingness to ore bodies
Au_correct, Au_cut	Component grade in the block, g/t
run	Interpolation No.
точки	No of points (samples) used for block interpolation
Заход	Index number of interpolation
выработки, hole	No of workings used for block interpolation
PIT	Field of model cell belongingness to the process of building of the optimal pit

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Tel.: +7 (495) 380-28-21
e-mail: info@miramine.ru