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Parallel design with mining operations of a new modern mining and metallurgical complex based on the Almalyk MMC

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ABSTRACT:The article describes the geological, mining and technological characteristics of the Yoshlik-1 deposit as a raw material base for copper ores for mining and processing in industrial volume. Disclosed are proposals for open pit mining technology. The materials of the report on the results of geological exploration on the deposit of the Republican State Committee on Geology and Mineral Resources and the materials of the technical and economic calculation (TER) of the project were used, the question of the relevance of implementing investment projects in the Republic of Uzbekistan with the creation of additional jobs was also raised. As well as questions of ecology and labor protection and determination of Almalyk MMC JSC for timely and high-quality implementation of various projects, substantiated adopted medium-term and long-term industry development strategies and strategic objectives of the state investment policy were put forward.

KEY WORDS: mining, processing, deposit, investment, design, geological exploration, hydrogeology, mineral resources, balance reserves, off-balance reserves, copper, gold, molybdenum, ore body, lenticular, pyroxene, skarn, quarry, ledge, field discovery, development system, dump, blasting, excavator, drilling rig, energy complex, ecology, labor protection.

I.INTRODUCTION

The modern mining industry of Uzbekistan is rapidly developing thanks to the expansion and increase in production capacities of the mining and processing industries of the republic. Thanks to the support of the industry by the Government and in particular the President of the Republic, new capacities of the Navoi and Almalyk mining and metallurgical plants are commissioned.

Almalyk MMC JSC is the largest mining and smelting plant in the Republic of Uzbekistan and the largest copper producer in Central Asia. The resource base of the plant is made up of the reserves of a group of copper-molybdenum, lead-zinc and gold-silver deposits located in the Tashkent, Jizzakh, Surkhandarinsk and Namangan regions of the Republic.

At the moment, parallel investment design is being implemented with mining, in particular overburden, at the Yoshlik-1 field of the Almalyk mining and metallurgical complex. This project is carried out in accordance with the Decree of the President of the Republic of Uzbekistan dated 01.03.2017 No.PP-2807 and its implementation will ensure the strengthening of the raw material base and expansion of production capacities of Almalyk MMC JSC.

Within the framework of the investment project, the construction of the following production facilities is provided:

- energy complex (substation, overhead lines and communication networks);
- a complex of industrial drainage;
- facilities of the Office of Industrial Railway Transport, including stations, connecting railways, a contact network, transshipment nodes, reconstruction of stations, locomotive depots and lines;
- management objects of automobile transport;
- Warehousing and repair facilities for mining machinery and quarry equipment.

Description of the field. The area of the deposit is 26 square meters. km and is composed mainly of intrusive rocks: syenito-diorites (71.3%), diorites (21.8%) and granodiorite-porphyries of the Almalyk type breaking through them (0.7%), as well as sandy-carbonate deposits (0.5%), effusive quartz porphyry (3.9%) and andesitic-dacitic porphyry (0.6%). To a large extent, the intrusion is blocked by loess and pebbles up to 40 m thick.

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Sulphide ores are complex. The main useful components are represented by copper, molybdenum, gold, silver and sulfur.

Hydrogeological conditions. The Almalyksai and Nakpaysay river basins are located in the middle part of the northern slopes of the Kuramin ridge with absolute watershed marks in the range of 850-1000 m, the bottoms of the valleys are at 720-790 m. The river basins are 2-6 km wide and extend in the meridional direction. The average annual river discharge occurs from March to June (80%). The maximum water discharge usually coincides with the period of snowmelt and heavy rainfall (the third decade of March-April).

By the chemical composition of water, hydrocarbonate-sulphate-calcium, have a general acidic aggressiveness towards concrete. Two types of groundwater are distinguished: pore groundwater of the Quaternary sediments and fissure-groundwater of Paleozoic rocks.

The total water inflow into the quarry is due to atmospheric precipitation and underground fissure-groundwater.

The expected water inflow into the Yoshlik-1 quarry will be at the level of 425 m 1378 m^3/h and 589 m^3/h at the level of 605 m.

Mining and technical conditions. Due to the shallow location from the surface, the Yoshlik-1 field is planned to be developed by the open-pit method [2].

The most durable rocks are syenito-diorites. The density in the array of sulfide ores is 2.6 t / m^3, oxidized 2.5 t / m^3. Humidity of sulfide ores 0.22%, oxidized 0.57%.

The area of the ore field is almost entirely covered by Quaternary sediments represented by loesslike loams and sandy loams, pebbles, conglomerates and breccias. Loesslike rocks are developed over almost the entire territory of the deposit, covering it with a cover with a thickness of 1 to 53 m (average 20 m) with a bulk density of 1.48-1.74 g / cm^3 and a specific gravity of 2.69-2.73 g / cm^3 and slightly subsiding.

Engineering and geological conditions for mining the Yoshlik-1 field are complex, which is determined by geological and tectonic conditions, the possibility of developing engineering geological and exogenous geological processes.

II. SIGNIFICANCE OF THE SYSTEM

Reserves of the field. By protocol No. 1832-k of August 19, 1983, the State Reserves Committee of the USSR approved the following permanent conditions for calculating the reserves of copper ores of the Yoshlik-1 deposit for open-cut mining conditions [4]:

- side content of copper in sulfide ore - 0.2%;
- minimum industrial content of conditional copper in sulfide ore in the calculation unit is 0.45%;
- the minimum thickness of ore layers and the maximum thickness of waste rock and substandard ores, included in the calculation of reserves –15 m;
- conversion factors for calculating the contents of conventional copper:

molybdenum - 5.7, sulfur - 0.06, 1 metal - 0.28, 2 metal - 0.026;

- the minimum content of components, taking into account when converting to conventional copper:

molybdenum - 0.001%, 1 metal - 0.1 g / t, 2 metal - 0.2 g / t;

- the reserves shall be calculated in the open-cast mining circuits agreed with Giprotsvetmet.

Off-balance reserves - the on-board copper content for calculating the reserves of sulfide and oxidized ores in open-cast mining circuits - 0.15% and the minimum thickness of ore interlayers and the maximum thickness of waste rock and off-grade ores included in the calculation of reserves - 15 m.

The reserves of the Tsentralnoye field site as of 01.01.2017 (B + C1 + C2) are more than 2 billion tons, off-balance reserves are 203 million tons.

The project provides for the comprehensive extraction of useful components from mined ore [1].

Mining part. The production capacity of the Yoshlik-1 open pit is determined according to the mining and technical conditions of the field development and according to the VNTP 35-86 standards by decision of the ONTS AGMK in 2017: the average annual pit capacity for ore (estimated) is planned at 23 million tons / year, overburden operations are 22.8 million m^3/year with a current stripping ratio of 1.0 m^3/t and the average annual decrease in mining operations is 20.5 m/year, the average horizontal area of ore bodies is 430000 m2, the ore extraction coefficient is 0.98, the ore dilution factor is 0 , 09, bulk density of ore - 2.6 t / m^3, average losses and dilution on the 1st stage of mining 2% and 8.6%, respectively [2].

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Quarry parameters: - the length of the quarry on the surface is 2510 m and the width is 1380 m with an area of 3.3 square meters. km, bottom mark +425 m, the volume of rock mass in the first-stage quarry is 254.8 million m^3 and reserves are 201.4 million tons.

Before the start of mining operations, the soil-plant layer (ORS) in the volume of 700 thousand m^3 is removed in a 25-meter zone around the final contour of the quarry using quarry equipment (bulldozers, loaders and dump trucks).

III. LITERATURE SURVEY

Loess processing is carried out by EKG-15 excavators with loading into dump trucks and transportation to an external dump. At the loess dump, the work of ECG-15 excavators is also provided.

Opening the field. It is planned to open the deposit with 3 trenches located in the north, east and west of the contours of the first stage quarry for organizing the movement of rail, road and conveyor transports. The width of the trench along the lower edge is 50 m. The height of the face is not more than 15 m.

During the operation of the quarry, an autopsy scheme using a car spiral exit ensures the efficient operation of heavy vehicles. The opening of the ledges in the working area of the quarry is carried out by temporary automobile exits [3].

1. Fig.Development of stripping operations at the Yoshlik-1 deposit quarry

Mining and capital works. Mining and capital works (GKR) include:

- construction of temporary roads inside the contour of the quarry;
- excavation of mining and overburden (STB);
- construction of infrastructure facilities for the maintenance of mining machinery and quarry equipment.

The composition of the GKR at the open pit includes the carrying out of initial open pit mines and overburden operations aimed at creating prepared ore reserves for mining operations and, as a result, horizons of 725-665 m are revealed.

IV. METHODOLOGY

Development system. Successful experience in operating stockwork copper-molybdenum deposits, in particular the Kalmakyr quarry, it is recommended to use an in-depth mining development system with overburden transportation by rail and industrial vehicles to external loess dumps, and ores from transshipment points by rail to the MOF beneficiation plant located northwest of the deposit [5].

The slope angle of the quarry sides is 20°, the slope of the ledges is 60°.

The width of the excavator entry of the ECG excavator is 18.9 m.

The width of the safety berms of the quarry safety is 40 m.

The height of the ledges temporarily idle side - 30 m

The height of the working ledges on the horizons is - 15 m for vehicles and 22.5 m for railway transport.

The minimum width of the working platform is 50-60.6 m.

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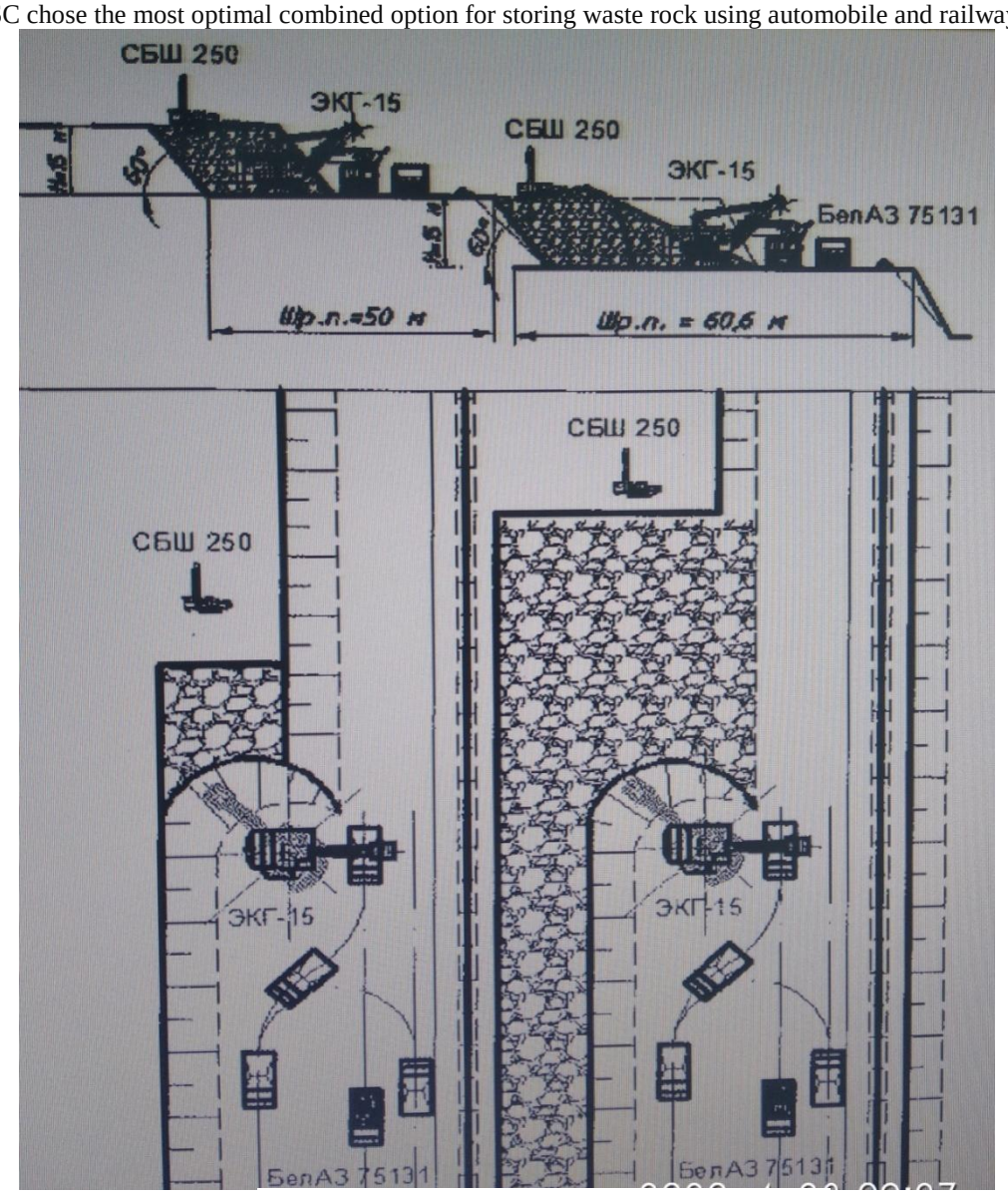
Formation of waste dumps is provided south of the contour of the project quarry on barren areas. Off-balance and oxidized ores are stored in special dumps, delivery to which is planned to be carried out by motor transport. Loesses on the state balance are also delivered by road to a separate warehouse. And the specialists of Almalyksky MMC JSC chose the most optimal combined option for storing waste rock using automobile and railway transport [5].



2. Fig.The technological scheme of rock development
EKG-15 excavators followed by loading into dump trucks

V. EXPERIMENTAL RESULTS

Mining processes. Loosening of ore and rock overburden is carried out using drilling and blasting operations (BWR) with borehole charges. For blast holes in ore and overburden, the use of cone drilling machines of the SBSh-250 MNA type is envisaged; the use of SBU-100G machines is provided for ejection of benches.
The calculations determined the specific consumption of explosives (BB) for overburden of 0.63 kg/m^3 and for ore 0.64 kg / m^3.

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Emulsion emulsion explosives of the Emulgit-30 or AN-FO type will be used for borehole breaking in dry massifs, and Emulgit-60 or a combination depending on the size of the column (height of the water level in the well) of water, which are manufactured at its own WW plant, will be used in flooded massifs .

At the quarry, it is planned to use various schemes for switching borehole charges using a detonating cord or non-electric blasting systems Iskra-P, Iskra-S during installation of an explosive network. Almanit of own production is used as an intermediate detonator.

During excavation and loading operations on the excavation of the rock mass and on the dump, excavators of the ECG-15 type (16 units) are used, and for the development of ores ECG-10 (2 units).

For auxiliary works, the use of:

- loader Dressta-53E– 6 units,
- loader Dressta-560E - 6 units,
- bulldozerDressta TD-25M– 13 units,
- Dressta TD-40 bulldozer - 12 units,
- wheeled bulldozer BelAZ-78231–4 units.

Quarry mining is carried out using technological transport, and ore from the faces is planned to be delivered by dump trucks to transshipment points, from where it will be transported by rail to the MOF. And overburden is planned to be transported to external dumps by road and rail [5].

The quarry will be protected from surface water by upland ditches. A career drainage will be carried out by collecting melt, rain, groundwater at a mark of +605 m, where a sump and a pumping station with central nervous system pumps 300x300 are equipped.

Ancillary and service facilities are also being built and organized:

- repair service;
- repair base for mining vehicles;
- assembly site;
- repair base of mining machinery and quarry equipment;
- expansion and modernization of the existing car park;
-storage facilities.

The power supply of the facility is decided on the basis of technological, sanitary, and construction decisions on buildings and structures, decisions on the master plan and in accordance with the requirements of the administrative and regulatory documents on the design of power supply, power electrical equipment, electrical lighting, lightning protection and grounding of electrical installations of main and auxiliary facilities.

For operational monitoring and forecasting of dust conditions in the quarry, a special service should be created, which is equipped with a laser sensing station for monitoring the air basin of the surrounding area, and a dust meter for workplaces.

This project is planned to be implemented at the expense of own funds, credit funds of the development fund of the republic and bank loans for a period of 15 years.

The second stage of the field development project provides for the construction of a complex of processing, smelting, related and auxiliary facilities. Technical solutions for facilities associated with the processing of ores of existing and planned quarries will be developed at the next stage of design - in the feasibility study of the project.

When compiling a calendar schedule, this project should consider the effective allocation of ore production and processing volumes for the projected annual productivity of MOF (40.3 million tons) and MOF-3 (23 million tons) for stable operation and mining and processing complex.

In modern designed industries, environmental issues play an important role. An environmental analysis of the technological processes of the mining and processing complex shows emissions of nitrogen dioxide, nitric oxide, aldehydes, sulfur dioxide, aerosols of lead, benzapirine, hazardous substances, divinyl, iron oxide, isoprene, silicon oxide, oil vapor, sulfuric and hydrochloric acid vapors, abrasive dust, inorganic dust with a SiO2 content of 20-70% carbon black, hydrocarbons, carbon monoxide, fluorides and hydrogen fluoride [6].

Sources of air pollution at the designed enterprise will be:

- quarry with blasting and mining equipment;
- overburden dumps with unloading and placement of rocks in the dump;
- quarry sites during the repair of mining and transportation equipment and during welding and during the work of metalworking machines and in fuel and lubricant warehouses;
- diesel-powered vehicles.

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To normalize the sanitary and hygienic working conditions and control environmental pollution, it is planned:

VI.CONCLUSION AND FUTURE WORK

- Organization of a system for monitoring open-air air and the identification of harmful working conditions by the labor protection department;
- organization of dust and ventilation service at the quarry;
- monitoring of the environment and control of working conditions of the quarry workers by the environmental protection department.

Production wastewater is planned to be used in technology or discharged into storage ponds.

The determination of the list of especially dangerous equipment with the indication of hazardous substances is carried out in accordance with the law of the Republic of Uzbekistan "On the industrial safety of hazardous production facilities" during the design period [6].

During the construction and operation of the Yoshlik-1 field, the following risks may occur:

- failure to achieve the planned volumes and planned dates for the production of stripping and mining and capital works;
- an increase in the cost of construction and construction works due to rising prices for energy resources;
- increase in the specific consumption of raw materials, auxiliary materials, energy resources;
- untimely delivery of components;
- increased costs for the placement of waste dumps and substandard ores;
- for currency related to the change in the US dollar against the national currency, which gives rise to pricing uncertainties.

Despite all these and other possible risks, the Almalyk Mining and Metallurgical Company, to fulfill all the tasks set by the timely and high-quality implementation of the Yoshlik-1 deposit development investment project, is based on the accepted medium-term and long-term industry development strategy and strategic objectives of the state investment policy.

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