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ANALYSIS OF THE INFLUENCE OF RELIEF ON THE CHOICE OF TRANSPORT FOR TRANSPORTING ORE FROM THE ORE STORAGE HOUSE OF THE "SKIPOVOY" STOVOLY, LOCATED IN THE ZARMITAN GOLDEN MINE ZONE, TO THE 4-GMZ ORE STORAGE HOUSE

Khudoyberdiyev Lochin Nekovich
Acting Associate Professor of the "KEM" Department,
Navoi State Mining and Technology University.

Abstract
In modern global and national economic conditions, the efficiency of extracting and processing technological gold-bearing ore deposits is being improved through the integration of mining teams and processing enterprises into powerful structural units. These formations enable the complex development of deposits. The optimization of ore flows and evaluation of ore quality enhancement methods require scientific justification tailored to the specific conditions of each mining enterprise. However, the theoretical foundations and technologies for extracting polymetallic and complex ores remain insufficiently developed, particularly in the context of current economic demands. A deeper understanding of the interdependence between geological data reliability, exploration, enrichment, and market processes is essential for forming cost-effective technological schemes. The optimal use of transport systems in mining is determined by technical parameters, terrain constraints, and logistical factors. This paper considers the example of the Zarmitan deposit, presenting transport layouts and operational plans for enhancing ore delivery efficiency.

Keywords: Gold-bearing ores, mining efficiency, ore flow optimization, complex ores, technological schemes, geological reliability, economic feasibility, transport systems in mining, Zarmitan deposit, resource extraction.

Introduction

Various types of transport are used for transporting rock mass, economic and technical cargo at mining sites, the main ones being railway, automobile, and conveyor transport. The selection of a rational mode of transport for specific conditions is determined by the physical, technical, and chemical properties of the extracted rock, the location conditions of the object,

climate, cargo turnover, transportation distance, types and parameters of cargo, loading equipment, the service life of the mining complex, and other factors.

LITERATURE ANALYSIS

On a global scale, including in our country, in order to increase the efficiency of mining technological gold-ore areas under modern economic conditions, mining groups and processing enterprises of deposits are united into large administrations, and powerful structural units have been created that allow for their integrated development. Assessment of the expediency of applying various methods for improving the quality of the extracted ore mass and the formation of optimal ore flows, the selection of highly effective technologies require appropriate changes in the scientific foundations for solving these problems and taking into account the specific conditions of a given mining enterprise [1,2].

However, the theoretical principles and technology for the extraction of multi-component and mixed types of ores have not been sufficiently developed, especially in modern economic conditions. Such factors as the degree of reliability of geological data on reserves, the interconnectedness of all processes from exploration to enrichment and product sales, are not sufficiently taken into account. A deeper study of these issues will contribute to the more effective and widespread application of mining technological schemes with the formation of optimal ore flows without additional costs [3,4,5].

For specific operating conditions of transport at mining enterprises, its technical capabilities, indicators, economically optimal maximum slope, and minimum radius of curves are calculated. These indicators, to a certain extent, determine the volume of mining capital works and the possibility of placing transport communications within the boundaries of the relief. The rational possibility of using various types of transport depends on their technical and technological parameters. The following are the main modes of transport for ore transportation: Situational plan of the territory and plan of the existing highway indicating the loading and unloading points of vehicles. The diagram of the existing technological route of the Zarmitan ore field, compiled based on data provided by the enterprise facilities, is shown in Figure 1.

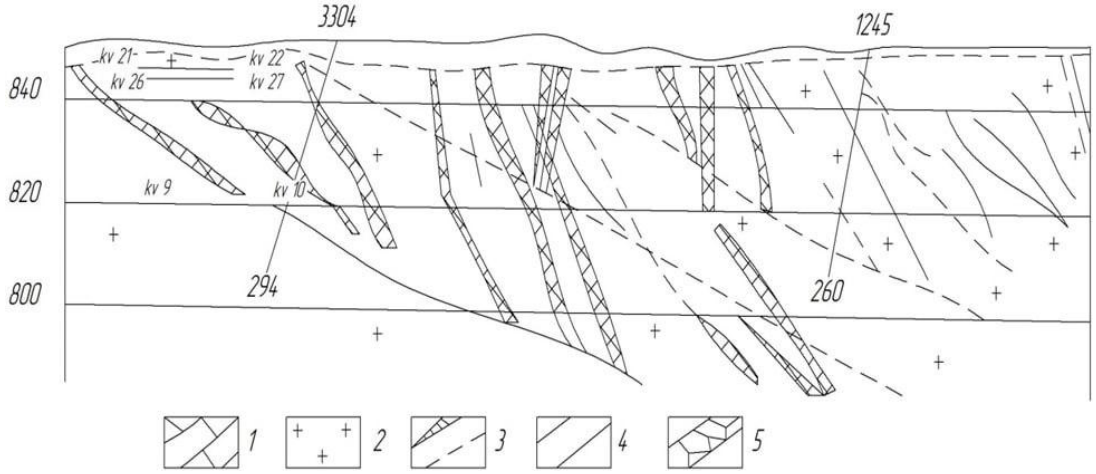

Figure- 1. Road plan of the Zarmitan gold mining zone, transportation distance and cargo flow

Currently, there are 8 ore storage facilities and technological ore flows for ore dispatch in accordance with the calendar plans for mining operations in the Zarmitan gold ore zone.

The total volume of ore transported is 1950 thousand tons per year, the distance of ore transportation is from 2.3 km to 6.2 km.

Railway transport is suitable for use in medium and high-performance quarries. Usually, the transportation distance is from 8 to 12 km or more, the slope is 40-60 ‰, which does not allow the use of this transport in the Zarmitan gold ore zone.

Automobile transport is the most widespread in the development of relatively small-sized deposits in difficult conditions. Automobile transport is used in mines with small and medium productivity (freight flow from 0.5 to 5 million tons per year). Typically, transport distances range from several hundred meters to 7 km or more, with a slope of 60-100 ‰.

In world practice, belt conveyors with suspended rollers are increasingly used. For example, out of 11 types of underground belt conveyors with a width of 1200 mm (taking into account the modification), 10 types are belt conveyors with suspended rollers attached to a rope or rigid support.

According to a study of technological transport schemes in the USA, more than 90% of belt conveyors operating underground have cable-mounted rollers. Advantages and disadvantages of cable and suspended roller conveyors compared to rigid roller conveyors: 1) simplicity of conveyor delivery and small dimensions of conveyor parts, as well as simplicity of installation, dismantling and construction of the conveyor; 2) capital costs are 10-20% lower than on rigid roller conveyors, while operating costs (in terms of a conveyor unit with a length of 500 m) are 3-5% lower; 3) damage to belt and roller supports, low load loss; 4) good belt centering using flexible roller supports, conveyor transport is used on large and small areas, mainly in a single composition, in a straight-line position. Typically, the transportation distance ranges from 3 to 10 km, with an annual cargo flow of 20-80 million.

Taking into account the productivity of freight rope transport (430 t/h), it is considered efficient to use a freight rope transport for the transportation of 0.5 to 2.5 million tons of cargo per year over a distance of 15-20 km or more.

Analysis shows that the cost of constructing a gas station abroad is relatively low. For example, the cost of constructing 1 km of single-rope roads ranges from 400 thousand to 600 thousand US dollars, two-rope ring roads - from 600 thousand to 1 million US dollars, the cost of transporting 1 ton of cargo on single-rope roads - from 0.5 to 1 US dollar, two-rope roads - from 0.7 to 1.5 US dollars.

Based on the deposits of the Zarmitan gold ore zone, developed in accordance with the feasibility study project, it is necessary to develop the lower horizons of the mining complex - to construct the "Skipovoy" shaft from 70.0 m to 1000 m depth. It is also necessary to develop mining operations and create a unified network of underground transport and internal transport logistics connecting the mine workings of the Zarmitan and Urtalik deposits.

The cross-sectional area of the shaft is 33.18 m2 and 39.59 m2, the shaft reinforcement is monolithic concrete, the shaft reinforcement supports are metal, and the conductors of the load-bearing vessels are box-shaped (in skip) and rail-shaped (in cage lifting). The shaft is designed

to lift 850 thousand tons of ore per year in the first stage using multi-rope, two-slip, and cage-type lifting devices. The capacity of the "Skipovoy" shaft is 1400 thousand tons of ore per year. Two skip with a capacity of 7 m3 and one cage with a counterweight of 61KM3.1 are installed on the cross-sectional surface of the shaft.

The area of the mine and the "Skipovoy" shaft is located at the southeastern end of the Koshrabad granitoid massif, characterized by a sharp change in relief and a technological scheme of roads (Fig. 2). The relief in the area where the "Skipovoy" shaft was built is low-mountain, with a height of +931 m. In the area where the "Skipovoy" shaft is being built, there is a highway with a roadway width of 8-10 m.

To study the operational indicators of the operation of transport equipment and establish operating parameters, we divided the route of the technological highway into sections with relevant data and slopes (Fig. 2).

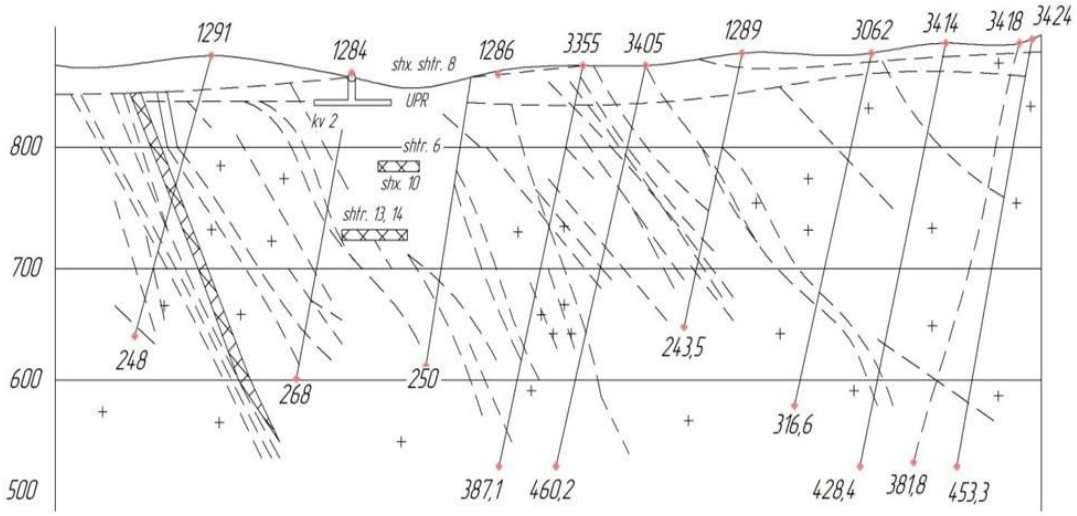

Figure 2. General plan and cross-section of the technological scheme of the mining road from the "Skipovoy" shaft ore storage to GMZ-4.

When transporting ore to the GMZ-4 ore storage facility using a conveyor, the ore is transported from the skip lifting hopper to the loading complex of the conveyor line by road transport. The total length of the conveyor line is about 2.6 km, and the width of the conveyor belt is 1200 mm. Along the length of the conveyor line, depending on the terrain of the conveyor line route, it is necessary to install 4 main conveyor units of different lengths.

For further study of the operational indicators of transport equipment and establishment of operating parameters, we divided the route of the technological conveyor line into sections with appropriate data and slopes, taking into account the presence of relief, natural and artificial obstacles (Fig. 3).

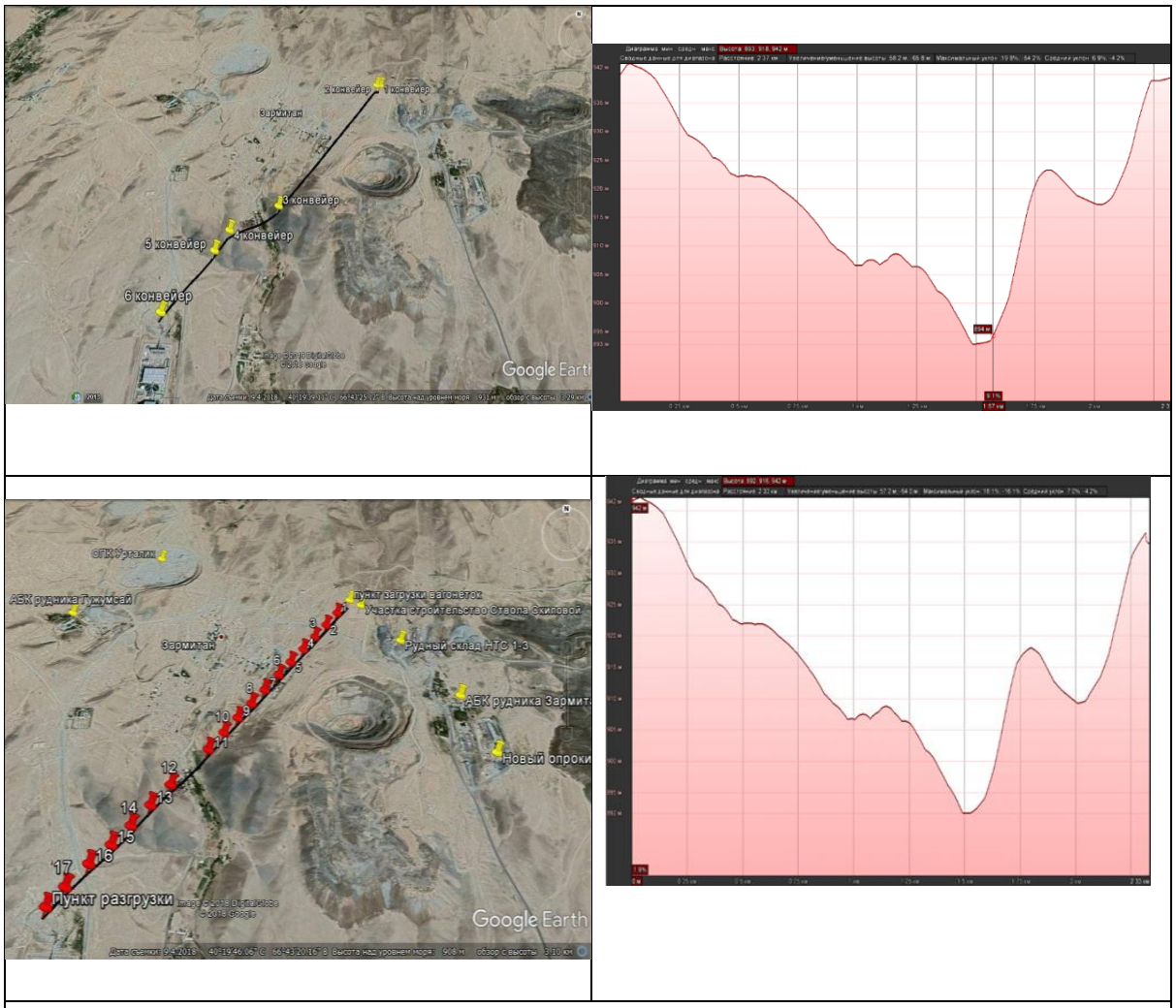

Figure 3. General plan and cross-section of the straight line construction of the conveyor line from the "Skipovoy" shaft to the GMZ-4 ore storage facility.

We have developed a technological scheme for the transportation of ore from the "Skipovoy" shaft to the GMZ-4 ore storage facility using a double-rope cargo cableway with rectangular wagons with rotary motion (Fig. 4).

The developed technological scheme provides for the transportation of 1.4 million tons of ore per year from the "Skipovoy" shaft to the ore storage facility of GMZ-4 at a wagon speed of 6 m/s. The elevations of the ZAY are +943 m at the beginning, the lowest elevation in the middle of the route is +896 m, and the final elevation is +936 m. We chose special VG-2000 carriages with a capacity of 1.6 m3 and a carrying capacity of 2.4 tons.

General plan and cross-section of the construction of a cargo overhead cable car from the "Skipovoy" shaft to the 4th GMZ ore storage facility.

DISCUSSION AND RESULTS. Transport equipment was chosen taking into account the unfavorable terrain. As a result of comparing the technical and economic indicators of the selected vehicles, a variant of the technological scheme for transporting ore from the

"Skipovoy" shaft loading warehouse to the 4-GMZ ore warehouse using a MAN 40.400 TGS 25t dump truck in the Zarmitan gold ore zone was recommended and proved to be effective.

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