

Criteria for Division and Development of Reserves of Upland Deposits by Open-Underground Method

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Annotation: This article deals with the problems of open-underground mining of upland deposits.

Key words: Upland quarries, technological schemes, open-pit mining.

INTRODUCTION

In modern practice, depending on the mining and geological conditions of the strike of ore bodies, it is produced by open, underground and combined methods. Most upland deposits of the vein type are developed using open-pit mining [1].

The combined development of a deposit can have various options for the spatio-temporal relationship between open and underground operations with the division of the deposit reserves into separate categories:

- the upper part of the deposit is initially mined by a quarry, after the cessation of work in which further excavation of reserves to a depth is carried out only by an underground method;
- transition to an open-pit method of deposit development from the previously used underground method, while the treatment work at the underground mine is stopped;
- joint development of the deposit by open and underground methods.

The results of the research show that the use of the open-pit method is most effective at the fall angles of the deposit of 50-55° or more, thickness of 150-200 m and length of about 4-5 km or more.

At the same time, the reserves of the deposit are considered as separate equity areas and are developed by separate extraction units. Open-pit mining of upland reserves with the separation of deposit reserves can have various options for the spatio-temporal relationship between open and underground operations:

- initially, the upper part of the deposit is mined in a quarry;
- the main reserves of the deposit are mined in a quarry, at the same time near-pit and under-pit reserves with an underground mine;

To organize parallel mining of the deposit by open-pit and underground method, while ensuring a stable supply of ore from the object, it is necessary to determine the optimal contour or final shape of the quarry, which allows the following:

- ensuring the conduct of mining and capital work on the sides of the quarry for opening and working out near-side reserves;

- ensuring the conduct of mining and capital work outside the contours of a quarry (or in contours) for the opening and development of under-quarry reserves;
- stabilization of the supply of ore during the attenuation of mining operations in the open pit due to the operation of underground mining facilities of near-pit reserves and under-pit reserves.

The trend in the price of gold requires the adoption of certain decisions on the choice of the final form of the quarry, depending on the accepted price, i.e. the higher the price of gold, the deeper the quarry can be, covering the deeper sections of the deposit with the contour of the quarry, leaving minimal sites for placing the above-pit structures of the underground complex [2].

Taking into account the above, as well as the prevailing conditions for the development of upland deposits in the Kyzylkum region, it determines the study of the possibility of involving in the development of marginal and under-pit reserves in mining. Accordingly, the criteria for choosing the configuration for the formation of the final form of a quarry for the development of upland deposits by an open-pit and underground method is one of the urgent tasks [3].

Deposits of significant depth and limited strike, if it is necessary to increase the intensity of mining, it is advisable to work out simultaneously with a quarry and a mine with a combination of mining in one vertical plane. The uneven distribution of the metal in the ore requires the use of an open pit method to extract a richer part of the reserves, which gives better results. With the deep occurrence of the rich part of the deposit, prerequisites are created for the priority development of underground work.

When developing marginal and under-pit reserves by underground mining, the choice of technological schemes is mainly influenced by the thickness of the ore body, the angle of incidence, the length along strike and dip, the physical and mechanical properties of ores and host rocks, the shape and number of ore bodies, as well as their relative position, as well as also the nature of the distribution of the metal in the deposit, the water cut of the deposit. Depending on the occurrence elements, the technically possible productivity of the quarry and mine, the location of the opening workings, and the service life of the enterprise are determined.

The relief of the day surface has a significant impact on the geological and geographical location of the opening workings. The mountainous terrain favors the use of technological schemes with common underground workings.

For example, Fig. 1 shows the final form of a quarry during open-underground mining of a highland deposit and a scheme for opening a pr

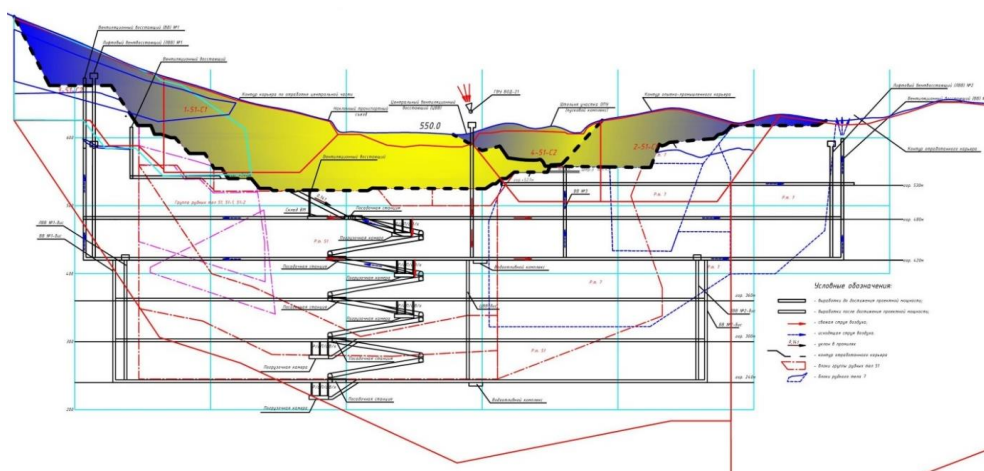


Fig. 1 - The final form of a quarry during open-underground mining of a highland deposit and a scheme for opening near-edge and under-pit reserves.

Organizational factors also include the mode of development of marginal reserves with different spatial arrangement of open-pit mining zones. Obviously, underground mining in the zone of influence of the quarry must be carried out either with backfilling or leaving strong pillars. If in the contours of the mine field the day surface can collapse, this will greatly simplify the organization of mining operations at the deposit. In some cases, several technological schemes are combined (with backfilling when working under the active side of the quarry and with collapse after the side reaches the limiting contour and frees it from transport communications). In addition, when conducting underground work in the immediate vicinity of the working faces in the quarry, the parameters of the elements of the development systems, methods of blasting and ventilation schemes must be mutually linked.

Conclusions:

At the stage of development of pre-project and project documentation, there is a question of developing strategic decisions on the placement of the main opening mine workings. At the same time, it becomes necessary to consider the development of reserves of upland deposits by open-pit and underground methods. Open-pit mining of upland gold deposits with the separation of all reserves of the deposit should provide for the following:

- open-pit development of the central part of the field with the creation of appropriate sites for further underground development of marginal reserves;
- stripping, preparation and mining operations in the marginal zone of the quarry, working out marginal reserves (exploring the deposit by adits);
- Opening, preparation and mining operations in the underpit zone of the quarry, working off the underpit reserves (opening the deposit with inclined or vertical shafts).

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