AP27511129 “ Geomechanical justification of technological solutions for efficient development of low-power gold deposits aimed at reducing losses and dilution of ore” Principal Sc.s. – A.K. Matayev

Relevance

At present, numerous low-power (narrow-vein) deposits are being developed across the territory of Kazakhstan. Typically, the extraction of such deposits is carried out using a downward mining scheme, employing systems that involve ore storage (stoping with ore passes), or systems with open stoping spaces.

It should be noted that ore storage systems are characterized by low productivity and require significant labor input. Therefore, for the development of low-power ore deposits, it is more preferable to use systems with open stoping spaces — most commonly, sublevel drifts in a downward sequence — which ensure higher productivity and lower labor intensity.

However, the main drawbacks of the sublevel drift system with downward ore extraction include significant ore losses and excessive dilution beyond calculated parameters. These factors negatively impact the cost of mining operations and the economic feasibility of deposit development. Hence, it is necessary to explore alternative approaches to the organization of mining operations that could minimize ore losses and improve resource utilization efficiency, thereby increasing the profitability of mining activities.

Ore dilution is an inevitable process during the development of mineral deposits. In the case of thick and compositionally homogeneous ore bodies, dilution generally occurs only at the boundary where the ore body contacts the host rocks, resulting in minimal dilution and loss of valuable components. However, in narrow ore bodies, the degree of dilution increases significantly. This is associated with the collapse of host rocks in the near-ore zone, which can occur due to various factors such as geological conditions, mechanical stresses, and technological processes. Therefore, dilution in narrow ore bodies requires more rigorous control and optimization of mining methods to minimize resource losses.

The extent of dilution in low-power ore bodies largely depends on the mining system used, as well as the structural and mechanical properties of the rock mass. Key influencing factors include the sequence of extraction, the negative impact of anthropogenic factors on surrounding rocks, the natural stress state of the rock mass, and the geometric characteristics of the ore body, including its thickness and dip angle. All of these elements are interrelated and require detailed analysis to optimize mining processes and improve the efficiency of mineral extraction.

Results Achieved in the First Half of 2025:

A systematic analysis of international experience and research related to methods for minimizing ore loss and dilution during the exploitation of low-power ore bodies has been conducted.

Existing underground mining technologies for narrow ore deposits were reviewed to evaluate their efficiency, identify weaknesses, and determine opportunities for optimizing the applied methods. As part of the study, modern underground mining approaches were systematized, allowing not only to identify their strengths and limitations but also to develop recommendations for improving the processes of mineral extraction.

List of Publications for the First Half of 2025:

1) A. Suimbayeva, A. Imashev, A. Matayev, A. Mussin, A. Auelbekova, Zh. Shlatayev.

“Analysis of International Experience in Reducing Ore Loss and Dilution in the Mining of Narrow Ore Bodies” Prepared and submitted to the journal Engineering Journal of Satbayev University (CiteScore-indexed).

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Information for Potential Users

The objects of the research are the geomechanical state of the rock mass during the underground development of low-power gold ore deposits, as well as technological solutions and mining systems that affect the level of ore loss and dilution.

Field of Application

The obtained results can be used in the design of mining systems, selection of backfilling methods, justification of drilling and blasting parameters, and in the development of

recommendations aimed at reducing ore losses and improving the quality of extracted ore at mining enterprises engaged in the development of low-power gold ore deposits.

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