AP14972873 "Development of economical technologies for the development of ore deposits in order to increase the completeness of mineral extraction" – p.m. Balpanova M. Zh.

Relevance:

Currently, the issues and tasks of rational use of all available mining, geological and technological resources to maintain an appropriate level of efficiency of underground mines are becoming increasingly relevant, while one of the most important reserves for increasing the efficiency of mine development should be considered the most complete extraction of reserves through the subsequent excavation of supporting pillars.

A common system for developing horizontal and inclined ore deposits is the room-and-pillar mining system followed by pillar excavation (re-mining). The high-performance system, however, is characterized by significant drawbacks: ore losses throughout the panel as a whole reach 20...40%, which increase under conditions of increased rock pressure, due to premature collapse of the roof and pillars. The main structural elements of the chamber-and-pillar development system are the ceiling (chamber roof) and the pillar.

Despite the large amount of theoretical and experimental research on assessing the stress state of the structural elements of the mining system, there is still no final scientifically based approach to the effective design of technological parameters for mining ore deposits. A generally accepted method for calculating the parameters of a development system is to calculate the parameters of pillars and spans of production chambers depending on the depth of development and based on empirical dependencies obtained in specific fields, which is not always applicable in other similar fields. Even taking into account the fact that mining and geological conditions at one deposit can change to the same extent, and the use of rock sliding parameters from one area of the deposit to another area can lead to an increase or decrease in the magnitude of the load acting on the pillars. This, accordingly, leads to an increase or decrease in the size of the pillars, loss of minerals, imbalance of the geomechanical structure "pillar - roof" and its collapse.

Therefore, the problem of increasing the efficiency of ore deposit development, taking into account the stress-strain state of the massif to ensure complete extraction of minerals, is an important task from a practical and scientific point of view, the solution of which makes it possible to reduce the cost per unit of extracted mineral.

Based on the analysis and review of the state of the issue, the goal of scientific and applied work is formulated - the creation of new technologies for the development of ore deposits, ensuring the complete extraction of minerals, by establishing the order and direction of mining pillars in panels, based on determining the load on the pillars, by constructing curved sliding lines for each lithological type of rocks composing the overlying strata.

Therefore, the relevance of the problem of developing technological schemes for optimizing field development parameters, taking into account the geomechanical state of the rock mass during the development of stratified (layered) ore bodies, is always an important task in the mining industry.

The goal of the project is to create new mining technologies that ensure complete extraction of minerals by determining the order and direction of mining on panels based on determining the load on the deposits by creating curved sliding surfaces for each lithic rock type.

Expected and achieved results:

New resource-saving technologies for the development of ore bodies have been developed and tested, ensuring the complete extraction of mineral reserves from the subsoil, and research is underway on a feasibility study of the effectiveness of the proposed technological scheme.

At the first and second stages of field development, an improved version of the development system with an open treatment space was developed, which allows you to control rock pressure, ensuring safe and rational production. Shows that at all stages of numerical modeling of the extraction of pillars from an open working space using new experimental-industrial parameters of

a chamber-column system of excavations with massive pillars, the strength coefficient of the pillars is no less than K = 1.0. This is a positive result for justifying and conducting pilot tests on the re-development of pillars from an open mining space and confirms the reliability of the accepted parameters of the chamber-column mining system using massive pillars.

The feasibility of using a new approach to assessing the structural elements of the development system is scientifically substantiated, which involves comparing the results of reverse calculation methods based on the facts of destruction of pillars and the method of calculating loads on inter-chamber pillars, based on determining the deformation zone by constructing curved slip lines in the overlying rock strata. (Figure -1).

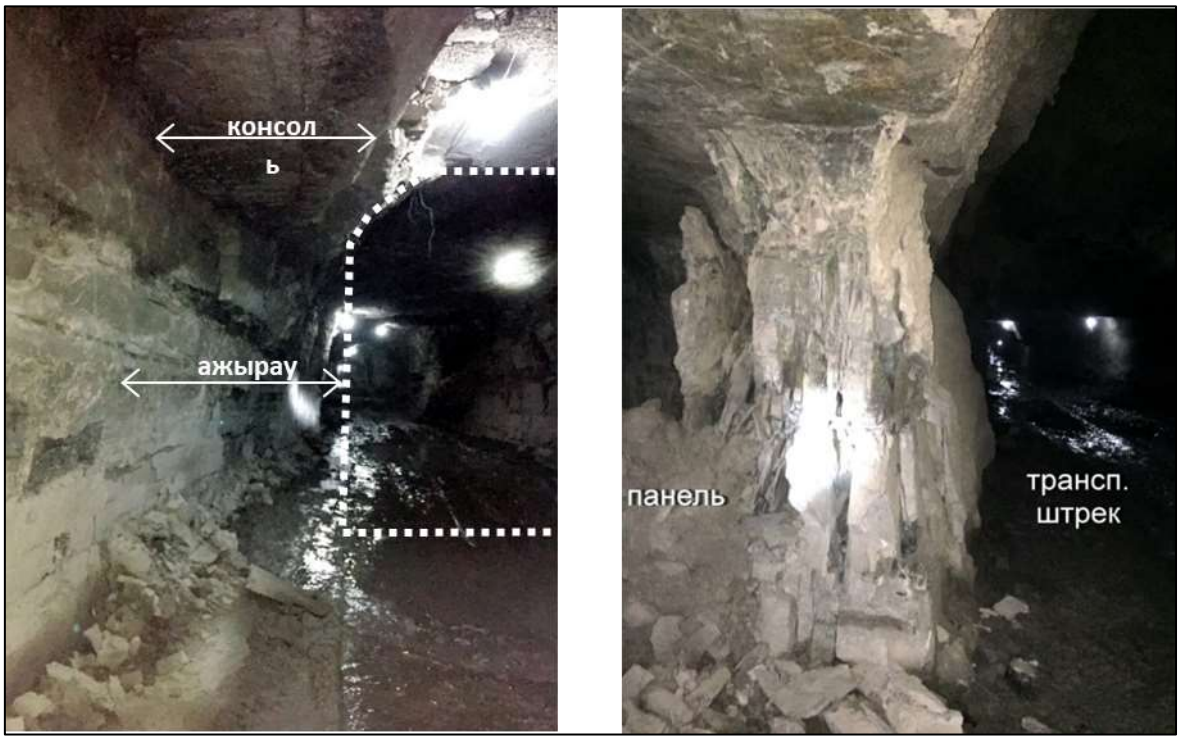

Figure 1 – Determination of the nature of destruction of pillars

The predictive method of geomechanical support proposed in this research work for the development of ore with an open working space is based on the construction of curved lines of sliding surfaces in a rock mass.

Using the BABO method, the coordinates of sliding surfaces were calculated for these three lithological types.

Further on the previously mined deposit 4-1 in the Zhomart-1 area 1, 39, 40, 41, 42, 43 - from the spaces from which the panel ore was extracted, deformation zones of the upper layer were identified. 1, 39, 40, 41, 42, 43—deformation zones of the top layer from remote ore spaces on the panels were determined using curved slip lines of group 2.

A new technological scheme for mining ore bodies has been developed, ensuring the stability of pillars at the stages of re-mining, based on a complex of geotechnical studies, multifactorial accounting of technological parameters for mining reserves, and assessment of the geomechanical state of the overlying rock mass.

The optimal parameters of the panels were determined for pilot development of the Zhaman-Aybat deposit.

Based on the calculation results, we can conclude that the optimal panel parameters for pilot testing are:

For a mined-out height of up to 6 m, they are (Figure 2):

- MC width 28 m;
- equivalent span between MCs 56 m.

For a mined-out height of up to 12 m, they are (Figure 2):

- MC width 35 m;
- equivalent span between MCs is 49 m, i.e. three rows of MCC and 4 cameras.

The calculation of the optimal parameters of the MCC and MC was carried out for two excavation capacities, up to 6.0 m - for the working face and up to 12 m - for the bench excavation. A reduction in the MC and an increase in the equivalent span between the MC is provided for when the excavation capacity is confirmed to be less than 6.0 m.

Work continues according to the calendar plan.

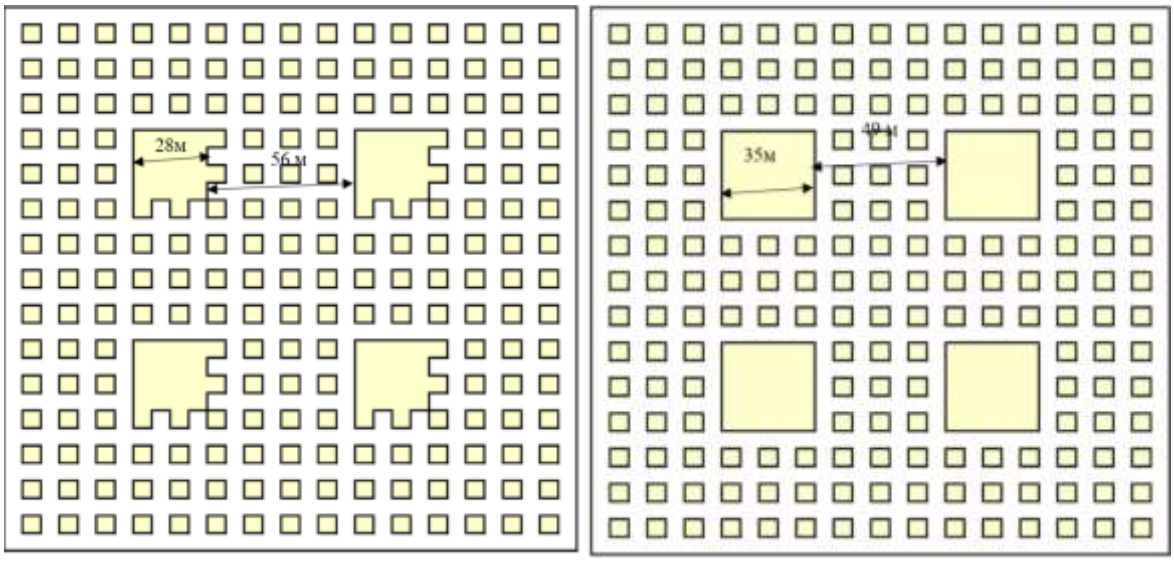

Figure 2 – Optimal parameters of a development system with massive pillars at a space height of 6 m and 12 m

To obtain the degree of Doctor of Philosophy (PhD) in the specialty 6D070700 - "Mining", a doctoral dissertation was defended on the topic "Geomechanical support for the development of flat ore bodies by systems with an open treatment space."

Research group:

1. Balpanova Merey Zhumagalievna – scientific supervisor, M.Sc., researcher at the KazMIRR Institute.
Researcher ID – AGM-4593-2022;
ORCID - 0000-0002-1513-5317;
Scopus Author ID – 57218699653.
https://www.scopus.com/authid/detail.uri?authorId=57218699653

2. Kozhogulov Kamshybek Chonmurunovich - scientific consultant, Ph.D., professor, director of the Institute of Geomechanics and Subsoil Development of the National Academy of Sciences of the Kyrgyz Republic.
Researcher ID - AHC-5431-2022;
ORCID - 0000-0002-0813-8907;
Scopus Author ID – 57193738833.
https://www.scopus.com/authid/detail.uri?authorId=57193738833

Publication list:

1. M. Balpanova, A. Zhienbayev, Zh. Asanova, M. Zharaspaev, R. Nurkasyn, B. Zhakupov Analysis of the roof span stability in terms of room-and-pillar system of ore deposit mining // Mining of Mineral Deposits, 2023, Volume 17 (2023), Issue 1, p. 129-137, Scopus 71%.
https://doi.org/10.33271/mining17.01.129

2. M.Zh. Balpanova, D.K. Takhanov, A. Zhienbaev, G. Zhunusbekova Jaman Aibat Kenornynd Zhazyk Kenshogirlarda Khazu Zhyesin Geomechalynika қamtamasyz ETU // Mountain Journal of Kazakhstan, Almaty: Publishing House of the Interrini Scientific and Production Enterprise, 2023, No. 2, with 37-42, with 37-42 , KOKSNVO.

3. "Method of constructing an artificial pillar" Patent for utility model of the Republic of Kazakhstan No. 8447 dated June 20, 2023, Balpanova Merey Zhumagalievna, Takhanov Daulet Kuatovich, Balabaev Oyum Temirgalievich, Patent of the Republic of Kazakhstan.

4. Resource-saving technology for the development of ore deposits ensuring complete extraction of minerals. Takhanov D.K., Balpanova M.Zh. Certificate No. 30113 dated November 8, 2022

5. Theoretical foundations for the development of Methods of Forward alculation of Ground Subsidence above Mines Takhanov D.K., Balpanova M.Zh. Certificate No. 31487 dated December 29, 2022

Information for potential users:

The results of the project make it possible to increase the level of industrial safety at mining enterprises developing flat and inclined deposits, and to create the prerequisites for economical technology for the development of ore deposits in order to increase the completeness of mineral extraction.

Also, as a result of the implementation of the project, based on the results of a set of studies (theoretical and full-scale), including an assessment of the stability and destruction of the massif around the support pits and mined-out spaces, a new technological scheme for mining ore bodies will be developed, which will ensure the stability of the quarries at the stages of reconstruction.

Application area **-**mining industry.

Information update date: 05.07.2024.