AP23489856. Resource-saving technologies development for mining mineral deposits that ensure the mining facilities safety in regions with high tectonic activity. sc.sp. – Musin A.A.

Relevance

After the development of deposits, up to 40-50% or more of the explored reserves of coal, ore, potassium salts, etc. often remain in the subsoil. The chaotic abandonment of supports of various load-bearing areas in the mined-out space leads to a geodynamic hazard in the operation and construction of mining enterprises in areas with abnormal natural geodynamic activity of the block massif and intensive mining operations. Significant losses of raw materials at a number of mining enterprises in the Republic of Kazakhstan predetermine the need to strengthen the resource conservation policy.

At the state level in the Republic of Kazakhstan it is noted that in order to preserve solid minerals for future generations, today it is necessary to use the latest technologies for the most complete extraction of useful raw materials.

Problems of developing ore deposits associated with great depths and increasing mining, geological and mining engineering risks significantly complicate design solutions and reduce the efficiency of mining production.

The forecast of subsidence of the earth's surface during its development is a pressing problem of mineral development, associated with the negative impact of the displacement process on the developed buildings, structures, utilities and natural objects. The problem has become most important in the last decade due to the involvement in the repeated development of the abandoned reserves of minerals in supporting pillars, as well as in relation to deposits developed by the room-and-pillar system, in which the loss of minerals reaches 20-30%, and sometimes 40%.

Due to the depletion of reserves and the lack of growth of new ones, resource conservation is achieved through a comprehensive geomechanical justification of the effective and safe parameters of the structural elements of the development, depending on their mechanical condition, there is a need to solve the urgent scientific and technical problem of geomechanical justification of methods for assessing the condition of the overlying rock mass and protection of structures during underground development.

Expected and achieved results:

Theoretical and laboratory studies were conducted to determine the strength and deformation characteristics of rocks, as well as to assess the stress-strain state of the massif under the influence of hazardous natural and man-made factors. Particular attention was paid to the analysis of the influence of these factors on the values of maximum tensile and compressive stresses, which allows for a deeper understanding of the mechanisms of destruction and deformation of the rock mass.

Analysis of the obtained data allowed us to better understand the mechanisms of destruction and deformation of mountain ranges, as well as their response to external influences.

As a result of the analysis of data from various studies devoted to the problem of preserving mining facilities, the key role of resource-saving technologies in the development of mineral deposits was identified.

Based on the data obtained from laboratory studies, rock strength certificates were developed according to the Coulomb-Mohr and Hooke-Brown criteria. The strength certificates were constructed for a qualitative transition from the strength characteristics of rock samples to the strength properties of the rock mass. The results obtained in the course of the studies contribute to a deeper understanding of the mechanisms of rock destruction and allow for better prediction of their behavior in areas with high tectonic activity.

In the course of assessing the stress-strain state of rocks, modern programs for modeling based on the finite element method were used, which made it possible to obtain up-to-date data on the behavior of rocks under the influence of various external factors.

The use of the finite element method provides the possibility of not only qualitative analysis, but also quantitative assessment of the limit states of mine workings under both static and dynamic impacts. Models built using modern software packages allow for nonlinear analysis, taking into account the plastic and elastic properties of rocks.

The use of computer modeling makes it possible to visualize the distribution of stresses and deformations of the marginal part of the working, which is especially relevant for tasks related to assessing the stability of the rock mass. Thanks to the use of numerical methods, it has become possible to identify critical stress concentration zones and analyze their potential destruction, which plays a key role in ensuring the safety and efficiency of development.

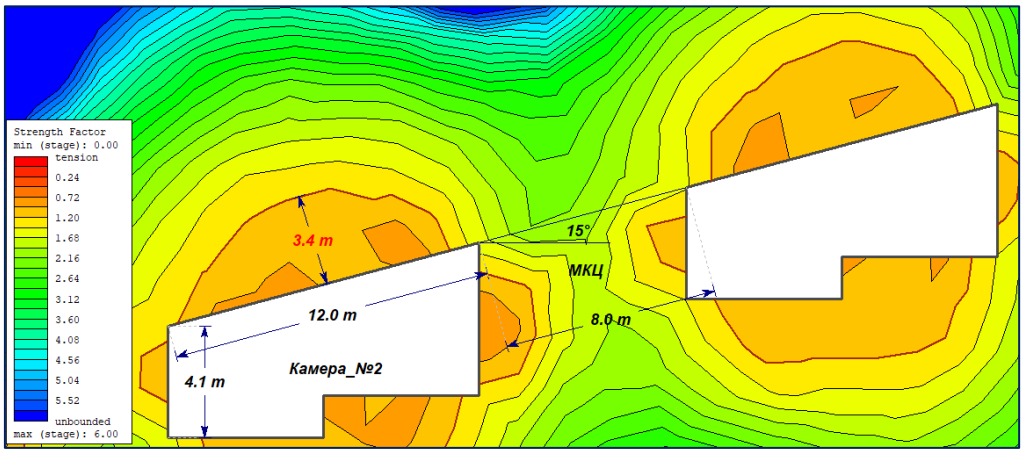

Figure 1 –Height of the zone of inelastic deformation at an angle of inclination of ore deposits of 150

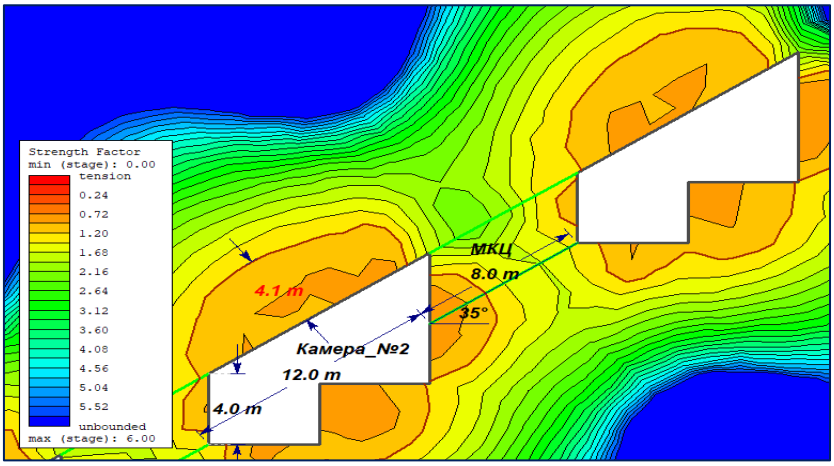

Figure 2 –Height of the zone of inelastic deformation at an angle of inclination of ore deposits of 350

As part of the project on the topic: «Development of resource-saving technologies for mining mineral deposits, ensuring the safety of mining facilities in regions with high tectonic activity», the research group took part in the international seminar «MINING AND POST-MINING ISSUES DURING THE ENERGY TRANSITION». This event was held at the Silesian University of Technology, located in Gliwice, Poland.

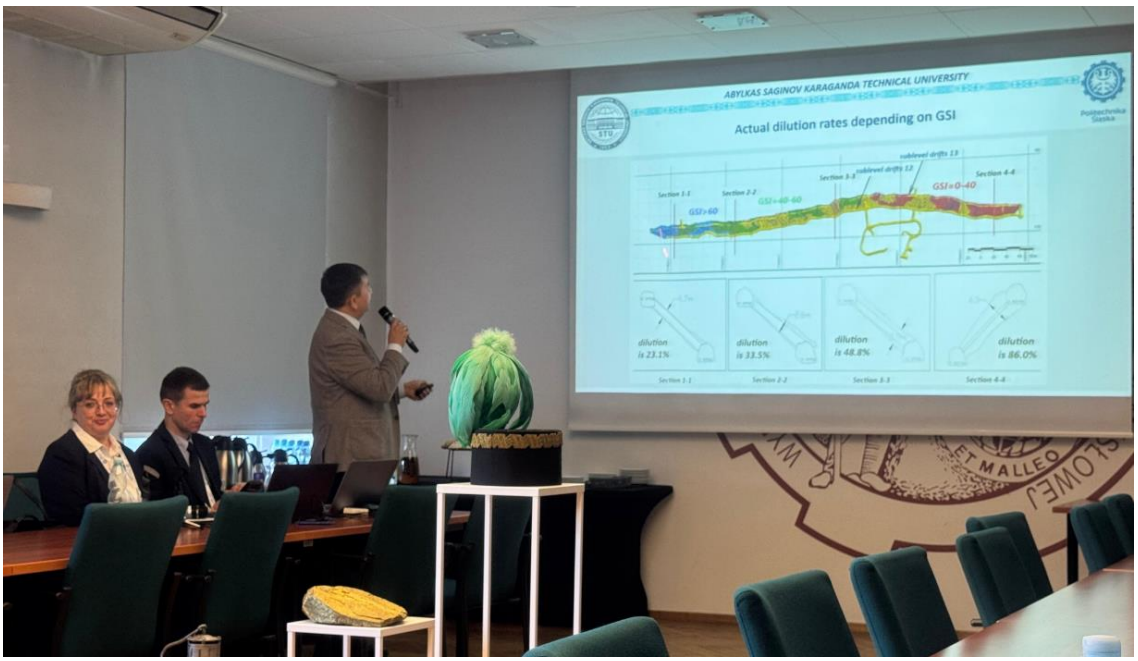

Figure 3 –Report at the international seminar on the topic: «Numerical modeling of geomechanical processes in the development of ore deposits».

Figure 4– Group photo with participants of the international seminar (Politechnika Śląska, Gliwice, Poland)

List of publications for 2024

1. A.A. Mussin, A.Zh. Imashev, N.K. Shaike, A.M. Suimbayeva «Determination of the stable state of technogenic outcrops during the development of inclined ore deposits by the room-and-pillar system» // Scientific, technical and production «Mining Journal of Kazakhstan».

- Almaty: Publishing house of TOO «Scientific and Production Enterprise Interrin», 2024. - No. 10. - P. 6-12. https://doi.org/10.48498/minmag.2024.234.10.001

2. Certificate of state registration of rights to the object of copyright No. 50908 dated October 30, 2024. Suimbayeva A.M., Mussin A.A., Imashev A.Zh., Shaike N.K. «Determination of the stable state of technogenic outcrops during the development of inclined ore deposits using the room and pillar mining system»

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Information for potential users

Based on the research conducted, in subsequent years of the project implementation, resource-saving technologies will be created for the development of deposits in regions with high tectonic activity.

Scope of application

In the mining industry, when developing ore deposits located in areas with high tectonic activity.

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