

AP14972815 “Research of geomechanical situation in conditions of unstable massifs with the choice and justification of technology of fixing of preparatory excavations” – p.m. Matayev A.K.

Relevance

At the mine zone of the Khromtau deposit serpentinites are widely developed on dunites. Serpentinite is less common on pyroxene dunites. The named types of rocks are distributed to the depth of 35÷110 m from the Earth's surface. The maximum value of the degree of drying is observed at the depth of 10-20 m. Here, the rocks were formed by fine-grained rocks and turned into a clay mass.

An analytical report was compiled based on the results of studying the choice of an effective scheme of supporting development workings. The methods of determining the stress-strain state of the rock massif were analyzed and the finite element method was selected. A numerical analysis of the natural stress field of the rock massif was performed, according to which the main principal stresses acting on the workings were determined. According to the results of the numerical analysis, the stress-strain state of the rock mass is close to hydrostatics $\sigma_1 = \sigma_3 = \sigma_z = 24.8$ MPa at the depth of 900 m (horizon -480 m). A predictive assessment of the stability margin of mine workings before and after cleaning operations was performed, according to the results of which it should be assumed that the stability margin of the driven workings in the cleaning area is below the minimum permissible, therefore, collapses and an increase in the load on the support are possible.

At the mining depth of 900 m (elevation -480 m), the support pressure on the support of the workings was calculated.

The calculation of the parameters of the lining of the workings laid at the horizon. -480 m was performed. Thus, from the obtained results it follows that at the 10 years of Kazakhstan Independence mine the lining of horizontal workings is carried out with metal arch lining SVP 22 in combination with concrete, chamber workings are supported with metal arch lining SVP 27 in combination with concrete.

Methodological guidelines were developed for identifying excess losses during the development of ore bodies of medium thickness. In order to optimize the process of developing ore bodies of medium thickness, methodological guidelines have been created for identifying excess losses. The main stages of the methodological guidelines are as follows:

1. Studying the geological structure of the deposit and its features.
2. Analyzing the data on the patterns of ore body formation.
3. Calculating mineral reserves based on reliable data.
4. Determining the degree of exploration of the deposit.

Detailed instructions on the process of identifying excess losses, as well as recommendations for their minimization are provided.

Project objective

The aim of the work is to predict the stress-strain state (SSS) in the rock massif within the influence of mining operations at the -480 m horizon using the development system, and also to calculate the bearing capacity of the types of support used in the Khromtau deposit mine.

Achieved results

As part of the studies, an analysis of the stress-strain state of the rock massif at a depth of 900 m (-480 m horizon) was carried out. The main stresses, load on the support and the predicted stability margin of mine workings before and after mining operations were determined. It was found that the stability margin of workings in the mining area is below the minimum permissible, which indicates the need to strengthen the support. Calculations of the support parameters and the supporting pressure on the support of the workings, as well as the bearing capacity of the support used in the 10 Years of Kazakhstan Independence mine were performed. It was found that anchor

and cable support had a limited effect on the stability of the workings. A technology for developing medium-thickness ore bodies has been developed taking into account the geomechanical situation and justifying the technology for supporting development workings.

A technical and economic analysis of the costs of materials for supporting the 720 m long "Strek" working has been conducted, which showed that the use of combined supports (anchors + sprayed concrete) allows reducing costs by 4,680,310 tenge (1.7 times) compared to metal arch supports.

The article "Justification and selection of support parameters for mine workings at deep horizons" was accepted for publication in the Q1 Web of Science journal. It reflects the results of numerical analysis and practical research.

Recommendations were developed to ensure the safety of mining operations, including a methodology for assessing the stability of workings and selecting support methods for the conditions of the Khromtau deposit. The methodology applies to the design and monitoring of the state of rocks, including the classification of rock massifs by Q-rating parameters, RQD, Jn, Jr, Ja, Jw and SRF.

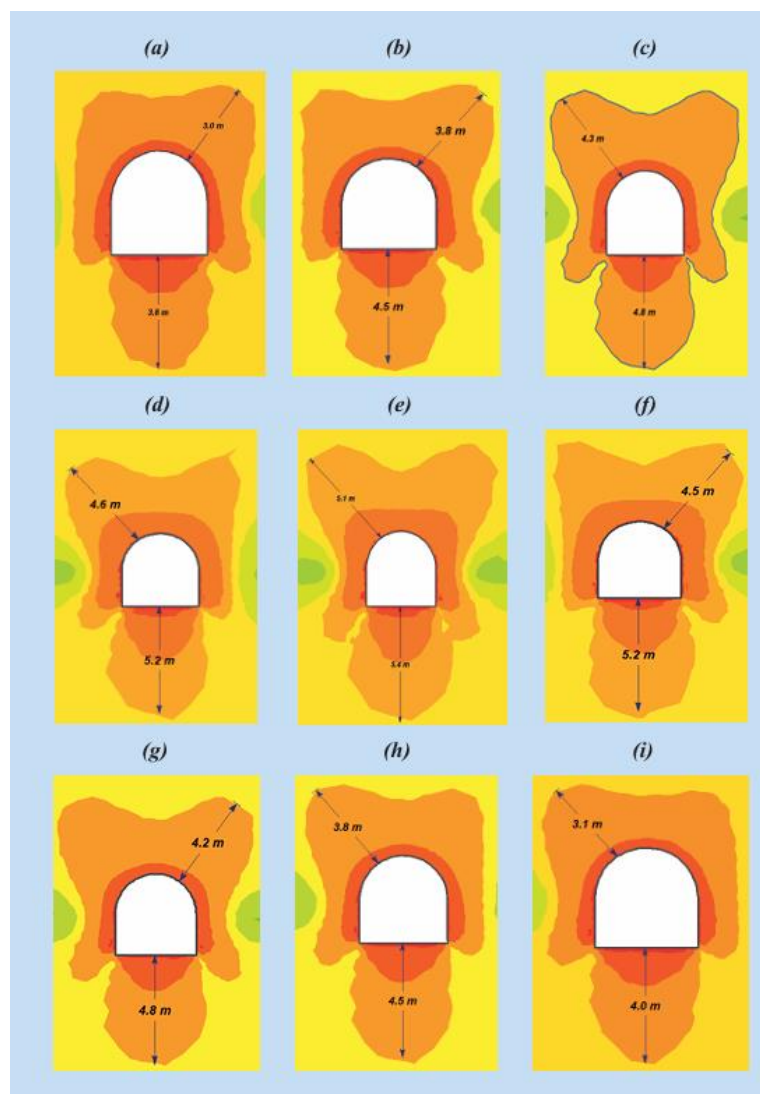


Figure 1 – Predicted zone of inelastic deformations along the axis: (a) – No. 20; (b) – No. 21; (c) – No. 22; (d) – No. 23; (e) – No. 24; (f) – No. 25; (g) – No. 26; (h) No. 27; (j) – No. 28

Research team

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List of publications in 2024

An article has been published in peer-reviewed foreign and domestic journals recommended by the CQASHE: A.K. Matayev, A.Zh. Imashev, B. Khusan, N.K. Shayke. Selection of the optimal type of support for mine workings based on modeling the stress state of underground structures" // Mining Journal of Kazakhstan 2024 No. 1. Pp-25-34

There was recommended for publication an article in journals from the first three quartiles of the impact factor in the Web of Science database or having a CiteScore percentile in the Scopus database of at least 50: Matayev A., Zeitinova Sh., Mussin R., Doni D., Shayke N., Kuttybayev A., Iskakov R. Studying mechanical properties of ore and rocks in ore deposits with assessment of natural field of stress state of the massif - in the journal Mining of Mineral Deposits.

An article was submitted to journals from the first three quartiles of the impact factor in the Web of Science database or having a CiteScore percentile in the Scopus database of at least 50: Matayev A., Mussin A., Imangazin M., Assanova Zh., Mussin R., Rabatuly M., Abdrashit A., Sarkulova Zh.: Studying the geomechanical situation in a rock mass using field measurements at ore deposits - in the Helyion journal.

An article in peer-reviewed foreign and domestic publications recommended by the CQASHE: Matayev A.K., Abeuov E.A., Zeitinova Sh.B., Shaik N.K., Lozynskiy V. Study of the geomechanical situation in the rock mass in the zone of influence of mining operations in the conditions of the Khromtau deposit mine. University Proceedingsy. Karaganda: KSTU, 2020, No. 1, pp. 53-57.

A patent for a utility model was received. Method of fastening mine workings Patent for utility model No. 8583: A.K. Matayev, A.A. Mussin, A.Zh. Imashev, A.M. Suimbayeva, E.A. Abeuov, G.Zh. Zhunusbekova.

An article in journal from the first three quartiles of the impact factor in the Web of Science database or having a CiteScore percentile in the Scopus database of at least 50: A. Matayev, B. Uakhitova, D. Kaumetova, M. Imangazin, Zh. Sarkulova, G. Issengaliyeva, R. Orazbekova. Justification and selection of support parameters for mine workings at deep horizons - in the journal Mining of Mineral Deposits (WoS Q1).

Information for potential users

Achieving the design parameters of mine workings will reduce the volume of transportation of excess rock mass, specific consumption of explosives, materials for fastening, stabilize the geomechanical state of the rock massif and improve the safety of mining operations.

Scope:

Rock massif of the underground mine Donskoy GOK - branch of JSC TNK Kazchrome, mine "10 years of Independence of Kazakhstan". The results of the studies can be used to create a geomechanical model of the deposit.

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