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Research Article

ENGINEERING AND GEOLOGICAL CONDITIONS FOR THE STABILITY OF MINE WORKINGS DURING DEVELOPMENT (FOR EXAMPLE, THE TUNGSTEN DEPOSIT KHODJADIK)

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ABSTRACT
The article provides a breakdown of the rocks in the Hodjikik field during the development. The most important factors for determining the stability of rocks at upper and upper walls of the mining operations are discussed.

Keywords: *Coefficient of Fracture Voidness, Crack, Rocks, Disturbance, Collapse, Fastening, Deformation, Fastening, Crushing, Groundwater*

INTRODUCTION
The urgent need to develop the modern level the mineral resource base of the Republic of Uzbekistan requires the commissioning of new deposits, the efficiency and safety of the development of which is determined primarily by the degree of knowledge and assessment of engineering and geological conditions (E.G.C). At the same time, it is required to reduce the time and costs of exploration by using the accumulated database and information on previously studied analogous deposits.
A feature of the Khodjadik mineral deposit is that it has various lithological types of rocks with unique structure, composition, genesis, age, varying degrees of weathering, water cut, and seasonal time.

MATERIALS AND METHODS
The main ones: 1) significant volumes of the massif in which the workings are laid; 2) rocks, on the one hand, containing the ore bodies of the deposit, on the other hand, are an integral part of the mining structure; 3) careers, adits and mines significantly alter E.G.C; the zone of their influence extends to areas exceeding the size of deposits; 4) a change in the E.G.C leads to the development of mining and geological processes.

RESULTS AND DISCUSSION
An analysis of the results of studies of the engineering and geological characteristics of rocks shows that the physicomechanical properties of lithological rocks of the same type do not change in area and depth, which is associated with fracture, fracturing, and watering of the rock mass. The rock mass, depending on the extent of tectonic disturbance and the degree of fracture, is divided into sections. Weakly fractured is characterized by a minimum density of 1-3 fractures per linear meter of core, 1-2 fractures 1x1 m^2 on the site of 1-3 fractures. The coefficient of fracture voidness (C.F.V) -0.1-0.3%. Changes in engineering and geological conditions do not occur (Ras and Chernyshev, 1970).
The medium-fractured section is located near discontinuous faults and in the zones of operating faults of a lower order that do not have a crushing zone, where the density is from 2-3 cracks per linear meter of core, 1x1 m2 to sites of 3-5 cracks. C.F.V -0.5-0.8%. Fracturing and physicomechanical properties of rocks change, new cracks form and the area of humidity around mine workings increases The highly fractured area is located directly in the crushing zone, the rocks are mainly small-block. C.F.V -1-5,0%. The following characteristics are studied: tension, fracture, physical and mechanical properties, hydrogeological conditions, the concentration of the stress of the roof of the mine workings, the reduction in the size of the blocks, the filling of cracks with water (Miraslanov, 2011).
Analysis of changes in the physicomechanical properties of rocks shows that the physical properties of rocks (metasomatite, granite, slate) vary within small limits. Specific gravity varies from 2.63 to 2.84 g/sm^3, bulk density from 2.56 to 2.83 g/sm^3.

Violation of the stability of the roof and walls of mine workings is one of the most widespread and dangerous engineering and geological processes that occur when excavating excavations for underground work.

If the collapse is mainly related to the technology of mine workings (with blasting) and is of small scale (delamination of rocks 0.3-0.5 m thick, etc.), the term "overkill" is usually used, if geological factors (intersection of large tectonic disturbance, crushing zone or increased fracturing) and on a larger scale use the term “collapse”. Enumerations complicate the construction of temporary and permanent supports, increase the cost of construction, landfalls, cause significant delays in the performance of work and sometimes cause loss of life. The probability and extent of the outfalls depend, on the one hand, on the shape, size, depth of the structure, and on the other, on the bedding conditions, the nature of the bedding, the thickness of individual layers, hydrogeological conditions, the physicomechanical properties of the rocks, the presence, size and nature of the occurrence of tectonic disturbances, fracturing of rocks and many other factors. Rock outfall is the most common type of engineering and geological process in underground mining. On the Khodjadik section, drift No. 5 from PK-17 to PK-19 in the weakened areas where a series of faults intersect them, mining and tunneling works are carried out with rock fastening. In the same weakened zone, rocks that have fastenings, rock fall occurred on the roof of the mine workings with a volume of up to 0.3-0.5 m^3. Here, the rocks are represented by metasomatites, quartz, and there are several series of cracks intersecting at the points of deformation. The rock outfall was formed instantly, under the influence of an explosion during the excavation of mine workings. Partial mass of deformation is fixed by the fastening structure (photo 1).

Figure 1: Dump on the roof of mine workings after sinking

In the zone of large crushing, rock collapse occurred on the right wall of the mine workings of adit No. 3 drift No. 5 PK-38. The place of their formation is confined to areas mainly in fracture crushing zones and to highly fractured rocks. The rock is crushed in the form of clay mud, waterlogged, but there are no groundwater outcrops, since the rock mass has infiltrated all groundwater available in this interval. Perhaps the collapse of the upper part (right wall) of the mine workings will occur (photo 2).

Rock caving is installed on the left wall of the mine workings with a small volume of about 1-1.5 m^3. The rock is weakly strong, medium-fissured, collapse intersect at the edges of two cracks with dip angles:

∟410; ∟620. The collapse was formed under the influence of an explosion during the excavation of mine workings.

Figure 2: Caving, confined to moistened crushing zones in the right wall of mine workings

The stability of the roof and walls of the mine workings is evaluated qualitatively and quantitatively. A qualitative assessment is based on an analysis of the identified factors affecting the behavior of rocks after mining. These factors are mainly due to an unfavorably oriented system of cracks and discontinuous faults, weakened zones and sections, mining relations, as well as weakened rock mechanical properties, water cut and the presence of karst voids filled with water. In addition, in the intensity of development of various types of deformation and changes in equilibrium within the rock mass, mining and development conditions, type, size, speed, method of sinking, etc. are of great importance (Miraslanov and Zakirov, 2015).

Rock collapses are installed on the left wall of the mountains. A quantitative assessment of the stability of underground mine workings is based on the classification of their roof according to the conditions (signs) of stability or collapse, which correspond to the coefficient of potential stability, not fixed roof in the mine workings (S).

This coefficient is determined by the formula:

$$S = \frac{m * Rc * R}{H * p * q},$$

where, m− is the thickness of the layer or reservoir separately, which has the least connection with other blocks; $Rc -$ is the compressive strength of rocks in a natural or water-saturated state, MPa; R− is the reciprocal of the number of square meters of exposed and loose roofs ($1/m^2$); H− is the depth of the rocks (block under consideration) from the surface of the earth, m; p − average density of rocks lying above the roof, g/sm^3; q− is the coefficient of fracture of the rocks, equal to the square root of the density of cracks (number of cracks per $1/m^2$).

According to the typification of Vasiliev and Malinin (1970) the following sustainability categories are distinguished according to the "S" values (Table 1).

Table 1: Mining Roof Sustainability Categories

Sustainability category	**Value Potential Stability Factor "S"**
Highly unstable	to 0,8
Unstable	0,8-1,1
Medium resistant	1,1-2,0
Very stable	2,0-3,0
Highly stable	3,0-5,0

To calculate the stability of the roof of the mine workings, characteristic areas are selected with respect to the disturbance of the rocks and the most weakened areas, as well as the possible locations of the operational mine workings.
Calculations show that to a depth of 378 m from the surface of the slope, mine workings will be stable, sometimes unstable at different times of the year.
In the area under consideration, the ore body is located at various absolute (from 1272 to 1650 m) and altitude (relative to 57 to 378 m, from the earth's surface) marks. Thus, for the Khodjadik site, 1 horizon was chosen, the calculated values of the engineering and geological characteristics of the rocks. Note that all lithological types of rocks intersect in vertical and horizontal mines. Therefore, the calculated values are given for each type of rock horizontally, which are accepted in the natural (dry) state of the rocks.

Table 2: Estimated values of engineering and geological properties of rocks in adit No. 3

Production	Rocks	Layer thickness "m", (m).	Average rock density, γ (g/sm^3)	Breaking Strength, Rc (MPa)	The coefficient of fracturing of rocks, q (%).	The coefficient of fracturing of rocks, q (%).
1	2	3	4	5	6	7
Horizon +1272m	Quartz diorites - porphyrites	2.2	2.68	94.6	2.5	10
	Metasomatitis	3.0	2.82	71.5	2.7	10
	Skarn garnet-pyroxene composition	2.7	2.72	79.3	2.5	10

Geological exploration at the fields has been carried out for several years. During this period, deformations occurred: caving in, outfalls, freezes, etc. The conditions for their formation in most cases are associated with the geological space adjacent to the mine workings (adits). The types of deformations, shape and dimensions are determined by the lithological and petrographic composition and properties of

the rock mass, as well as the location of tectonically disturbed zones relative to the mine workings. For all types and types of engineering-geological processes (E.G.P), the zone of formation is tectonically disturbed, fractured, fragmented, highly modified, mineralized rocks and contacts of different types, as well as interlayers and weakened strata; the combination of these parameters with each other and with the mine workings determines the heterogeneity, the scale of the E.G.P.
In the fields, engineering and geological processes formed during long-term operation and newly formed, according to the conditions of formation and the development mechanism, have no differences, they differ only in volume (much less) and the frequency of formation.

Table 3: The calculation results for the category of stability of the roof of the mine workings adit No. 3.

Absolute elevation mining	Rocks	"Low mountains": depth and thickness of deposits from the surface of the earth to underground mine workings	Value Potential Stability Factor **«S»**	The value of the stability coefficient	"Low mountains": depth and thickness of deposits from the surface of the earth to underground mine workings	Value Potential Stability Factor **«S»**	Workability roofing stability category
Horizon + 1272 m	Quartz diorites-porphyrites	57 m	5.4	Highly stable	378 m	0,8	Unstable
	Metasomatitis	57 m	4.9	Highly stable	378 m	0,74	Highly stable
	Skarn garnet-pyroxene composition	57 m	5.5	Highly stable	378 m	0,82	Unstable

In the natural state of the ore field and in stationary sections of the mine workings, disturbed and unstable rocks are the regional zone of the formation of the geological mine, and the location of the mine workings relative to these zones determines the local types and types of the geological mine. Accelerating elements are rock hydration and dynamic forces from blasting and mining operations.
The calculation results show that in all the horizons under consideration in the most stressful areas, the stability of the roof of the mine workings is mainly very unstable. Possible deformations (collapses, collapses) are expected in stressed areas, i.e. around ore bodies with mine workings.

Conclusion

Thus, roofs in accordance with traditional estimates of stability can be divided into unstable, medium stability and sustainable.
Unstable include immediate roofs that allow only small outcrops and require fixing immediately after the extraction of the mineral. Typically, such roofs are in a state where even insignificant changes in conditions that contribute to their unbalance lead to the impossibility of successful mining operations due to the very intense collapse of the rocks.
Roofs that allow exposure, but a relatively large area without mandatory fastening immediately after excavation, are considered medium-resistant. They are not characterized by massive rock collapse and the more typical block and block outfalls, "beating" are strong.

Sustainable are direct roofs that allow significant exposure. Their shift in the workings usually occurs in the form of a smooth or stepwise lowering.

The above definitions of stability cannot be considered quite satisfactory, since they are only of a qualitative nature and leave room for an inaccurate or subjective engineering-geological assessment of direct roofs. Ensuring sufficient certainty and objectivity of estimates, as always in such cases, requires the use of quantitative indicators. The selection of such indicators can be based on patterns of rock movement known from mining experience and established because of special studies. As can be seen from the formulations used for the qualitative characterization of stability, some rocks collapse already at a relatively small and others at a larger exposed surface area. In this regard, the conclusion follows that it is advisable to use for the quantitative assessment of the stability of roofs the area of the exposed surface, in which they pass into the so-called “critical” state, which manifests itself in a sharp acceleration of the roof attaching, intensive cracking of rocks the appearance of numerous cracks in them, as well as in accelerating the lowering of individual blocks (Vasiliev and Malinin, 1970).

The stability of direct roofs is one of the most significant engineering and geological factors for the efficiency and safety of underground mining. A significant number of serious accidents and most severe accidents can be associated with unexpected collapses. With such development methods, engineering and geological processes occur. Rock caving is the most common type of IHP. By forms of confinement to the mine workings, formation conditions, they are different. Collapses formed in the face of the roof of the mine workings passing in the fault zones cover the entire roof of the mine workings, where the rocks are highly fractured, unstable, waterlogged.

Rock outfalls mainly develop in the roof and, less commonly, the walls of underground workings. According to the mechanism (Lomtadze, 1977) of formation, dumps have three types: persistent, non-faulty and semi-resistant. The first two are formed in the roof of the mine workings. In addition to these types, heaps formed on the sidewalls are interconnected with the collapse. Among these types, dumps of an immaculate type with the formation of domes are more dangerous. Their shape is triangular, polygonal, cup-shaped and shapeless (Lomtadze, 1977).

To develop recommendations, the mine workings of the adit horizons of the Khodjadik deposit should carry out long-term monitoring (3-4 years) of groundwater and mine workings, carry out detailed engineering and hydrogeological studies on the structural and tectonic structure of the ore field to establish the relationship of surface and underground cracks and their impact on mountain development of deep horizons, as well as analyze and summarize engineering and geological information from the beginning of exploitation (industrial development) of the field Dénia Khodjadik. This will allow you to draw up a plan of mathematical, geomechanical and mining operations, which will be the main development.

Thus, the effective development of ore deposits to ensure reliable and safe operation, stability of adit horizons is carried out on the basis of comprehensive consideration of engineering and geological factors and their comprehensive study during geological exploration.

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