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Research Article

HYDROGEOLOGICAL AND ENGINEERING-GEOLOGICAL PROCESSES IN "KHANDIZA" DEPOSIT

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ABSTRACT
The hydrogeological conditions of the Khandizinsky ore field are directly dependent on the surface watercourse, the geomorphology of the terrain, the lithological composition of rocks, tectonics, and atmospheric precipitation. According to the conditions of bedding feeding, circulation and unloading, ground the fractured-water and an aquifer zone of fissuring of Paleozoic rocks are distinguished. Water inflows into mountain workings are formed, mainly, due to the drainage of fractured waters. Underground waters exert a double influence on the state of mine workings: due to the moisture of the rocks, the strength parameters decrease, and the physical properties increase.
The regularities in the formation and propagation of engineering-geological processes in horizontal and inclined mine workings are revealed: the most common types of deformations are collapse, dumps, screes (with rockfalls) of rocks. They occur in areas where the presence of crossing rifts and large gaping cracks located across and along mine workings and in the disturbed zones. In the future, the development of the Khandiza solid minerals deposit will be carried out underground to a depth of 1500 m. In this context, the requirements for a comprehensive study of hydrogeological and engineering-geological processes in the mine workings of solid mineral deposits grow up.

***Keywords**: Crack, Rocks, Water, Food, Mining, Collapse, Scree, Deformation*

INTRODUCTION
Movement of rocks. The largest deformations of buildings and structures occur when the rock masses shift. Under the shift is usually understood the deformation of rocks lying directly above the mine workings (or used areas). On this site in the massif there is a bending of the seams or a disorderly collapse of rocks, and the surface of the earth curves and falls together with the structures. A section of the earth's surface that has undergone a shift is called the displacement sheave.
The development of the displacement processes depends on the properties of the rocks composing the thickness over the mine workings, and primarily on their strength and ability to plastic deformations. In such strong, but non-plastic rocks as sandstones, limestones, conglomerates, the shift occurs with significant space development over the area, but it will develop rapidly in the form of collapse with the formation of cracks and dips on the earth's surface.
The terrain of deposits largely determines the complexity of engineering and geological conditions for their development. Flat or plain-hilly relief (usually platform areas) is characterized by small excesses of its individual elements (small depth of dissection) and weak or medium, less often considerable horizontal separation (distance between depressions, hollows, erosive cuts - ravines and gullies). Surface runoff here is slowed down, intersected by streams and rivers; the horizons and zones of rocks containing the mineral are often located at lower levels than the basis for erosion of large rivers and reservoirs (Lomtadze V, 1977).
The hydrogeological conditions of the Khandizinsky deposit, as noted above, are considered as a factor negatively affecting mining operations, from this point of view, the role of hydrogeology in the development of engineering and geological processes in the exploration and development of deposits is assessed. Surface water, including atmospheric precipitation in all parts of the ore field, is the main source in the supply of groundwater. Underground waters in Quaternary sediments (alluvial, deluvial) are unloaded in the form of springs and flow along the tributaries. They also significantly affect the condition

of cropped slopes and on the walls of the industrial site (the mouth of the tunnel, etc.). Other types of groundwater are directly involved in the penetration of underground mine workings. The degree of their influence mainly depends on the nature of the watering of the mine workings. In the humid area zones, large deformations are formed (occurs in portions). In places (areas) in the concentrated outcrops of groundwater, small deformations are noted, and occurs more often. The mechanism of formation of these deformations also depends on the nature of the moisture of the rocks. Thus, underground waters in the process of mining do not act as force acts, but are an accelerating element due to soaking contacts (reduce contact strength) and moistening rocks (reduce strength properties).

MATERIALS AND METHODS

Classification of natural waters by their chemical composition according to O.A Alekhin (Reference book,1962). This classification combines the principle of division by prevailing anions and cations with division by the relationships between ions. All natural ions are divided by the predominant anion (by equivalents) into 3 classes: hydrocarbonate (and carbonate) (HCO3 + CO3), sulfate (S04) and chloride (Cl) waters. Each class is divided into three groups according to the prevailing cation: calcium, magnesium and sodium. In turn, each group is divided into 3 types of water, determined by the ratio between ions in mg-eq.

The first type is characterized by the ratio HCO3> Ca + Mg. Waters of this type are formed with a significant participation of igneous rocks containing large amounts of Na and K - as a result of which Na and HCO3 ions appear in the water. They can be formed in some cases and in the exchange of Ca on Na contained in soils or rocks (for example, glauconites, alkaline clays). The waters of the first type are often not very mineralized, but the drainless lakes accumulated by these waters accumulate HCO3 and CO3 in very large quantities.

The second type is characterized by the ratio HCO3 <Ca + Mg <HCO3 + S04. Genetically, this type of water is associated with various sedimentary rocks and weathering products of bedrock, being predominantly mixed waters. This type includes most of the rivers, lakes and ground waters of small and moderate mineralization.

Underground waters have a double effect on the state of mine fields: due to the moisture of the rocks, the strength parameters decrease, and the physical properties increase, while the shearing forces may exceed those that hold and are the focus of the formation of engineering-geological processes (EGP). When comparing the EGPs formed in the fields of Uzbekistan with the processes of other regions of the CIS, (Miraslanov, 2011) determined the level of the EGP in our country and abroad. The result showed that the South Uzbekistan mining region is unexplored. In connection with this, the EGP was studied in detail at the Khandiza deposit in order to be applied to other deposits. The total water inflow is determined by the analogy method, and according to the coefficient of water abundance. Thus, according to the conditions of occurrence and spread of the Khandizinsky deposit, A.T. Rakhimov distinguishes aquiferous horizons and complexes. M.M. Miraslanov worked out the typification of engineering and geological processes developed in underground mine workings by the method of geological comparisons, the method for assessing the conditions for the development of the massif and the factors that are manifested in the development of the factors, the calculation methods necessary for the studied issues: the conditions of formation and the mechanism of development of each process; the factors and reasons for the formation of the EGP were revealed.

The analysis of long-term observations of the development of engineering and geological processes on explored and exploited deposits of solid minerals and their comparison made it possible to identify factors and causes of the formation of IGP. It should be noted that the factors and reasons for the formation of IGP in the exploration and development of solid minerals in all deposits are the same, regardless of location (mountain, foothill, flat, desert, etc.). They mainly depend on the geologic-tectonic structure of the rock massif, the method of development, mining conditions and the duration (operation) of the existence of mine workings.

The engineering geological processes (EGP) developed in the exploitation and exploration mines of the Khandizinsky ore field are studied and regularities in the formation of the EGP are determined depending on the spatial location of the deformed mass in the plane of the mine workings, in the formation of EGP in underground mine workings, and also established criteria and estimated parameters that determine the dynamic, scale and danger of the EGP. The EGPs developed on the deposits of solid minerals of Uzbekistan were analyzed, interfacing with the processes at the Khandiza deposit. In scientific, practical, methodical and methodological terms they are given a detailed study of engineering and geological processes in horizontal and inclined underground mines.

RESULTS AND DISCUSSION

Among the explored and developed deposits of the South Uzbekistan mining region, the Khandizinsky ore field is the most unique in terms of geological conditions. The deposits are located in the central part of the Surkhantau Mountains (south-eastern branch of the southwestern spurs of the Gissar Range) in high-altitude, complex geomorphological conditions with complex hydrogeological and engineering-geological conditions. The deposit represents a high-mountain, highly forested area, the absolute marks of which range from 1300 to 1800 m. The relative elevations of the mountains over the valleys and bays of the Sais reach 500-600 m. The mountains have steep slopes; river valleys and Sais are narrow, V-shaped. Strong dissection of the relief predetermines the development of various exogenous geological processes or contributes to the uneven distribution of surface and groundwater.

Hydrogeological conditions of the territory can be characterized as favorable for the formation of groundwater, which is due to the following: in the geologic section there are well permeable limestones, sandstones, gravels, pebbles, sands belonging to the Mesozoic-Cenozoic group of rocks, widespread prevalence of weathered, fissured sedimentary and magmatic rocks of the Proterozoic and Paleozoic; a multitude of aquifers and complexes; the presence of overflow between complexes by stratigraphic and tectonic contacts, and also through fragmented and disturbed zones. Proceeding from the above, we will consider in more detail the aquifers and complexes, which significantly influence the development of the deposit.

According to the conditions of occurrence and distribution, the following aquifers and complexes are distinguished at the Khandiza deposit (Khomenko, 2003):

- According to the conditions of occurrence and feeding, the structure of voids (pores, cracks) and hydraulic properties are the following types of groundwater are separated:

1. Groundwater: (pore and water zones open fracturing of the modern crust of the rock outcrop)
2. Artesian water (porous - aquifer Cretaceous deposits, b) fissured waters of deep horizons; c) aquifers of Jurassic deposits; d) cracked waters from Carbon.
3. Effusive volcanogenic and sedimentary rocks (basal conglomerates, gravelites, sandstones, schists, and limestones, dolomites, siltstones).

Aquifers of the Quaternary age deposits, which form the floodplains and terraces of the Khandiza and Sangardak rivers, are composed of pebbles and boulders with a gravel-sand aggregate, sands with gravel and pebbles, covered with a thin layer of sandy loam and loam (0.2-0.3 m). Total thickness of the deposites is 30-40 m. The groundwater refers to non-pressure water circulating in pebbles, boulders and sands. The depth of occurrence of groundwater is the least in floodplains of rivers (0.2-0.3 m). The thickness of the aquifer and complex is 25-30 m. The nature of their formation, as in other regions, is related to the geological, structural, geomorphological and climatic conditions of the area under study. In the valley of the rivers Sangardak and Khandiza, loose sediments contain fresh water with mineralization up to 0.5 g / l; by the classification class OA. Alekhin, they refer to hydrocarbonate, calcium, magnesium of the second type. These waters significantly affect the formation of exogenous geological processes on terraces and river floodplains.

Groundwater is formed due to the inflow of groundwater from the sides of the valley.

- Aquifer of alluvial-proluvial sediments is developed in the basin of the Maliana River; it is represented by pebbles, sands, loess like loams up to 15-20 m thick. The coefficient of filtration of loess-like loams amounts to 0.22 m / day. The depth of groundwater creep is the smallest in floodplains - up to 1.0 m., the mineralization of water is 0.3-0.5 g / l, water of hydrocarbonate-calcium and sulphate-calcium type.

- Aquiferous complex of Lower-Middle Jurassic sediments (J2-3) is represented by sandstones, conglomerates, gravelites, siltstones, mudstones. The interlayers of these rocks are not sustained in thickness and strike, the rocks are fractured. The springs are quite numerous, inclined bedding contributes to the infiltration of atmospheric precipitation. The water availability of the complex is average, the flow rates of springs equal to tenths l/s prevail, springs with a flow rate of 1.0-17.0 l/s are less common. Fresh water with mineralization 0.2-0.5 g/l of hydrocarbonate-calcium I and II type.

- The aquiferous thickness of the fracture of Carbon deposits is exposed in the core of the anticlinal structures of Baysuntau and Surkhantau, forming small areas. They are represented by limestones, quartz porphyries, tuffs, conglomerates and schists with interlayers of conglomerates and sandstones. Total power 1600 m. Fresh water with mineralization 02-.0.5 g / l of hydrocarbonate-calcium I and II type. Water availability is rather high 0/5-13/0 l/s.

- The aquiferous thickness of the fracture of Cambrian deposits. The rocks are represented by quartzites, crystalline schists, gneisses with a total thickness of up to 1200 m. The rocks are complicated by tectonic disturbances, exposed to weathering cracks. Underground waters are wedged in the form of springs with costs from 0.1 to 7.0 l / sec. The mineralization of groundwater is 01.- 0.5 g / l of hydrocarbonate-calcium II type.

- The aquiferous thickness of the fracture of Proterozoic. They are represented by gneisses, schists, quartzites, marbles. Naked in the core of anticlinal structures, the rocks are strongly cracked, especially in the near-surface part and are flooded. Groundwaters are developed above the basis of erosion and in places where the massifs are crossed by the hydrographic network they are wedged out as rare springs with discharge ranging from 0.3 to 0.4 l/s, mineralization of hydrocarbonate-calcium II type.

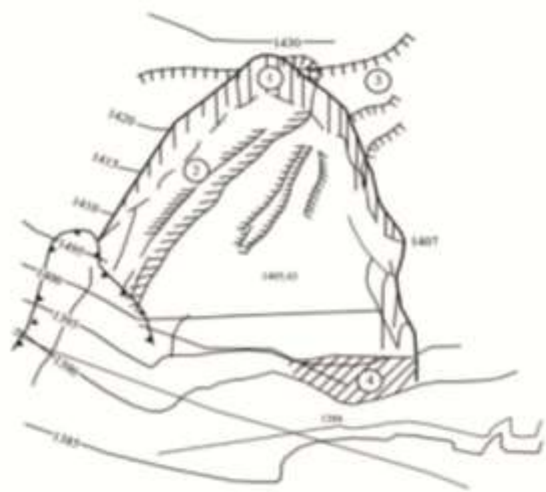

Figure 1: The landslide plan (April 25, 2008) (according to Niyazov R.A.)
1-separation wall; 2-grabenoidal reduction; 3-cracked liquefaction; 4- slope zone trimming

- The aquiferous thickness of the fracture of Paleozoic intrusive complexes and dykes. Intrusive rocks are developed in the core of the anticlinal structures of Baysuntau and Surkhantau. Presented by fissured granite-gneisses, granites, quartz-porphyry, diabases. Underground waters are wedged out in reduced areas with flow rate and from 0.4 to 10.0 l / s. The mineralization is equal to 0.1-0.3 g / l, which is explained by the extreme stability of rocks of agrarian formations to dissolution and the proximity of feeding areas to places of groundwater discharge. Chemical composition of water is hydrocarbonate-calcium I and II type.

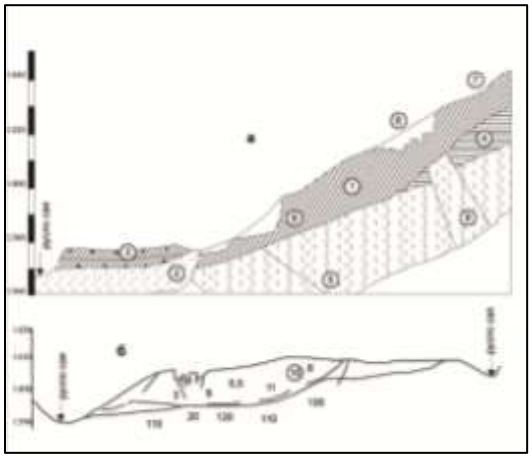

Figure 2: Geological profile of the Khandizin landslide; a-longitudinal; b-transverse (according to Niyazov RA)

Figure 3: Troughs of subsidence (dips) over underground excavations (photo by A. Anorbaev)

Anomalous contents of heavy and radioactive elements are observed in the underground waters of the Khandiza ore field. Spectral analysis of the dry residue of water samples from the Chinarsaai and Maidansai rivers revealed insignificant content of lead, silver, titanium, lithium.

Aquifers of modern alluvial-proluvial deposits have no direct effect on the formation of engineering and geological processes in mine workings; they supplement and expand the areas of the watered zones of the lower horizons. In addition to these, other aquifers and zones affect the intensity of different types of deformation and, in general, the stability of mine workings.

In the ore field under consideration, the conditions for the formation of groundwater are closely interrelated with atmospheric precipitation. Sharp surges on the increase of water inflow in mine workings are not observed. The main increase in water inflow is observed in the spring period (March-April, and also in the autumn time (November).) The maximum inflows into the mine workings coincide with the atmospheric precipitation. In 2012, 540 mm fell and, accordingly, the inflow of water into the mine workings increased, reaching 40 l / sec (Fig. 1). The gallery №10. The absolute mark of the estuary is 1353.7 m, the length is 4951 m. The average annual inflow amounts to 2.1 l / sec M = 0.04 g / l, HCO3Na I type. The gallery №10a. The absolute mark of the estuary is -1358.5 m, the length is 3332 m. The gallery №10b. The absolute mark of the estuary is -1473.5 m; the length is 2654, 1m. Within interval 54-78 m (24 m) strong dripping. Total inflow 1.6l/s, M=0.4g/l. The gallery №5. The absolute mark of the estuary is -1620 m, the length is 985.5 m, within interval 32-43 = 9 m sandstones, aleurolites, cracked rocks. Water inflow in the zone of tectonic cracks in tuffs of liparite porphyrites in the form of jet wedging (16 m dry). The average annual inflow is 0.23 l / s, it is formed mainly from fissured waters of the Paleozoic sequence, and in the mountain 1620 it is 40-50 l / s. At a length of mine workings about 3.0 km. On the horizon -1954.6 m at a length of mine workings of 420 m, the water inflow is 20-25 l / s. The specific linear water inflow along the horizontal is:

ql = (40-50):3=13,3-16,7 l/s /linear km , horizon -1620 m

ql = (20-25):0,42=(47,6-59,5l/s /linear km , horizon -1954,6 m

According to the chemical composition, fractured waters are hydrocarbonate-sodium, magnesium, calcium of the first and second type, mineralization up to 1.0 g / l. Summing up the results we can state:

1. The site of the water inflow into the mining workings is limited to rocks of different lithological composition in zones of intense fracture and tectonic disturbances;
2. Water inflows into the mine workings are insignificant (0.2-2.0 l / s) and do not increase with increasing mining workings length. Hydrogeological observations should be continued in order to determine the conditions of water inflow more fully.
3. In most cases, the water manifestation is confined to the roof and wall.

Conclusion

Hydrogeological characteristics of Khandizinsky ore field: level regime, chemical composition, water flow in wells and water manifestations in mine workings, nature and degree of moisture with graphical material. Analyzing the hydrogeological conditions of the Khandizinsky ore field, that underground and surface waters are one of the main components that determine the engineering and geological conditions for the development of deposits of solid minerals. They have a significant impact on the properties of rocks, the development of geological and engineering-geological processes, the stability of mine workings, the conditions for producing safety of mining, etc. Given these circumstances, the issue of hydrogeology, in general, is considered neither as a factor requiring special drainage measures, but as a factor negatively affecting the state of the rock massif. Proceeding from this provision, the evaluation and generalization of hydrogeological materials is aimed at solving engineering and geological problems.

This article reveals only part of my thesis. In the future, based on the obtained results, it is planned to study the South Uzbekistan mining area more deeply, to compare several deposits from the point of view of geological and engineering geological conditions, to assess and predict the disturbance and fracturing of rocks and their impact on the stability of underground mine workings.

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REFERENCES

Abdullaev BD, Mavlonov AA and Sherfedinov LZ (2012). *Geology and mineral resources: Actualization of the vision of groundwater deposits* Issue 2, Tashkent: SE “SRIMR” 52-55.

Abdurakhmanov BM (2013). Influence of faulty fracturing of rocks on physical and mechanical properties, stability and hydrogeological conditions. *Republican Scientific and Technical Conference materials collection*, October 8th, Tashkent 94-97.

Ivanov IP (1990). *Engineering geology of mineral deposits*., Moscow: Nedra 92-125.

Khomenko VD (2003), *Regularities and forecast of suffusion processes.* Moscow: Goes., 216 p.

Kuznetsov MA, Akimov AG, Kuzmin VN (1971). *Shift of rocks in ore deposits*. Moscow: Nedra 112-115pp

Lomtadze VD (1977) *Engineering geology. Engineering geodynamics*, Leningrad: Nedra, 479 p.

Miraslanov MM (2011) *Engineering geology, hydrogeology of places of solid mineral deposits in Uzbekistan.* Tashkent: SE “SRIMR” 6-10.

Miraslanov MM and Zakirov MM (2015) *Engineering geological processes developed on deposits of solid minerals of Uzbekistan: Evaluation and forecast.* Tashkent: SE “SRIMR” 72-74.