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ENVIRONMENTAL PROBLEMS IN THE DEVELOPMENT OF ORE DEPOSITS ANGREN - ALMALYK MINING DISTRICT (UZBEKISTAN)

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Annotation
The high environmental impact of mining industries is particularly pronounced in developed mining areas around the world. The article considers the environmental situation on the example of Angren-Almalyk mining district.

Keywords: ecology, ore deposits, water pollution, depletion of water reserves, methods of prevention, hydraulic veil, closed cycle.

Introduction

Environmental situation. The Angren-Almalyk mining district is located in the middle of the Angren district of the Tashkent region (Republic of Uzbekistan). The valley is located between the Chatkal and Kuramin Ranges and belongs to areas with intensive mining development. Within its limits (valleys and mountainous parts) a number of ore and non-metallic deposits are being developed, which have a negative impact on the natural environment in the form of pollution of the atmosphere, hydrosphere, soil and alteration of landscapes [1].

All ore deposits of the region are located in the basins of small rivers - tributaries of the river Angren, where hydrochemical pollution of surface and groundwater occurs on the areas of deposits and adjacent territories. Pollution originates from mining waters discharged into surface waters [2].

Within the mined ore deposits, the upper groundwater aquifers are drained to form a sufficiently powerful technogenic aeration zone, resulting in the development of oxidation processes of ore minerals and the mineralization of groundwater. Mine waters are therefore characterized by increased mineralization (~6.4 g/l), increased overall hardness (~46.5 mg - ecv/l), anomalous content of certain chemical elements and compounds (~523 mg/l chlorides, sulfates ~ 1844 mg/l, nitrate ~ 22 mg/l)

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increased micronutrient content (Fe ~ 0.64 mg/l, Mn ~ 6 mg/l, Cu ~ 15 mg/l, residual Al ~ 52 mg/l, Sr ~ 8mg/l). The values given are significantly higher than the maximum permissible concentration (MAC) of these elements [3].

It should be noted that surface and groundwater of many small rivers are used for domestic technical water supply. Only wastewater treatment plants cannot completely prevent the contamination of watercourses. Mine water and other industrial effluents should be fully utilized in the reverse water supply (closed cycle).

Methodology

The objective of this work is to show, on the example of a specific deposit, how best to use the contaminated mine water in the reverse water supply, and thus to prevent groundwater and surface water pollution and depletion. In order to do this in practice, the use of a hydraulic barrier [4.5] is proposed for open-pit mining.

The essence of the method is that the water pumped from the mine workings is returned to the original aquifers through wells passed around the quarry. This creates a local ring recharge area for the aquifer, within which there will be a drainage zone. The hydraulic barrier makes it possible to sharply limit the impact of the discharge from the mine on the aquifer complex containing the rock, «disconnect» these discharges from the hydrogeological environment, and thus:

1) Avoid depletion of centuries-old groundwater reserves;
2) Do not discharge contaminated mine water into rivers;
3) Eliminate possible uneven precipitation of the day surface by draining large areas.

The hydroveil method would help to solve this type of problem in the open ore deposits of the region. One of the major ore objects in the described area is the Kalmakyr copper-molybdenum deposit.

Geology of the deposit. The deposit is located within the Almalyk ore field, in the lower reaches of the Nakpai and Almalyk rivers. The area of the deposit occupies the port side of the valley. Almalyk and stretches along it for a distance of more than 3.5 km. The geological structure of the deposit involves a complex complex complex of intrusive and sedimentary formations (xenolites of limestone D2-3), represented by quartz porphyries D12, andesito-dacite porphyries D13, dolomites and limestone D2-3; diorыts and sienitos - diorites C2; granito porphyres C3; subeffusion-like and stock-like bodies and granodiorite porphyry dykes.

The main ore settling rocks are syenito - diorites, diorites and quartz porphyries. The rocks forming the deposit are highly fractured, broken down by numerous fractures of a low (IV) order - local character (Fig.1).

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The field has the development of cracked-ground and cracked-core waters. The depth of cracked - groundwater, depending on the nature of the fracture, relief and geological structure, varies from 2 to 100 m. The movement of cracked - groundwater occurs mainly in tectonic disturbances of different thickness and direction and contact zone of rocks. The general direction is downward from the south-west to the north-east.

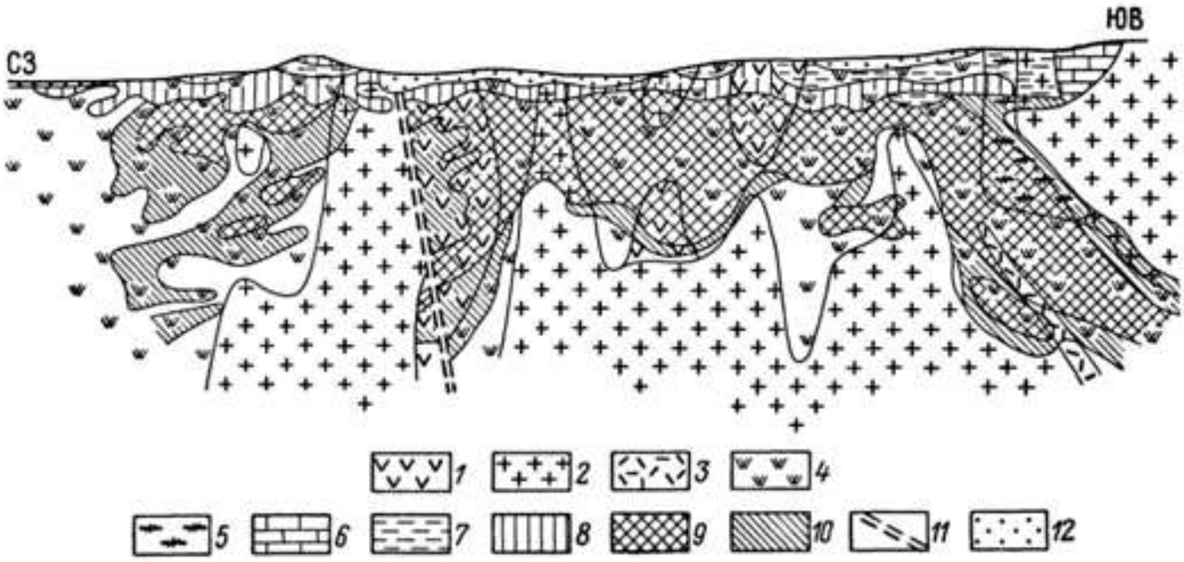

Fig 1. Geological section of Kalmakir field (by E. Butova, V. Dedy, S. Denisov, etc.) [6]

1- Syenito-diorites; 2-granodiorite porphyries; 3-core granodiorite porphyries («black»); 4-altered sienito-diorites (secondary quartzite); 5-quartz porphyries; 6-limestone; 7-zone of elevation; 8-ore oxidation zones and secondary sulfide; 9-ore enrichmentordinary and rich, 10-poor; 11-zone of the Kalmakyr Fault; 12-woods.

During the exploitation of the deposit (open-pit) there was a change in hydrogeological conditions. The natural level of the cracked groundwater of the mining zone has dropped by 120 m. An asymmetrical funnel of depression with a radius of about 2,000 m formed around the quarry.

Fractured groundwater of the deposit according to the chemical composition of sodium-potassium-sulphate in the upper parts, and with the depth changes to chloride-sodium-potassium [7,8].

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Results

Consider the possibility of using the hydroveil method for the copper-molybdenum Kalmakir field, which is being developed in an open way. The application of the method yields the following results (fig. 2):

1) the funnel depth at the center of the depression is 120 m;
2) the conventional width of the quarry is 500 x 500 m;
3) cracked groundwater filtration rate of 0.25 m/day.

Using the Dupuis formula, we get the following:

$$Q= \frac{\text{Кф}\text{x } S^2}{\lg(R+r)-lgr}$$

A. In the case of absorption wells located around the quarry at a distance of 1,000 m:

$$Q= \frac{\text{Кф}\text{x}S^2}{\lg(R+r)-lgr} = \frac{0.25 \text{ x}120^2}{\lg(1000+500)-lg500} = \frac{0.25 \text{ x}14400}{\lg(1000+500/500)-lg500} =$$

$$= \frac{3600}{\lg 3} = \frac{3600}{0.48}\ 7500 \text{ м3/сут}$$

B. In the case of absorption wells at a distance of 750 m around the pit:

$$Q_2 = \frac{\text{Кф}\text{x}S^2}{\lg(R+r)-lgr} = \frac{3600}{\lg(750+500)-\lg 500} =$$

$$\frac{3600}{\lg\frac{(750+500)}{500}} = \frac{3600}{\lg 2.5} = 9000 \text{ м3/сут}$$

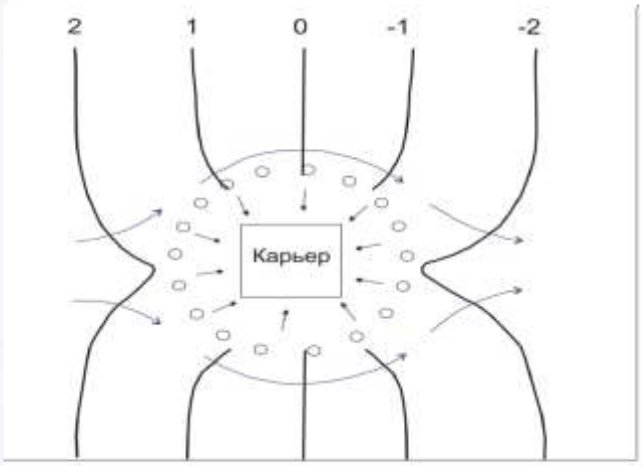
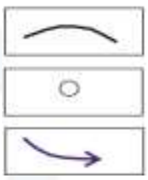


Figure 2 Schematic layout of boreholes and groundwater levels

Notation keys



1. isogypsum of groundwater
2. Wells Downgrading
3. direction of groundwater movement

With the installation of absorption wells around a 1,000 m radius, the water abundance (Q) will increase to 7,500 m3/day, and with the installation of absorption wells around a 750 m m radius, the water abundance will increase to 9,000 m3/day. The closer the absorption wells are located around the quarry, the greater the water content. But this problem is technically solvable. The main and most important is a closed cycle, the preservation of the natural water level, the preservation of groundwater from depletion and the prevention of the discharge of polluted water into the environment (rivers, groundwater, springs).

Negative phenomena with formation of processes of suffocation, karstic formation for Kalmakir field do not pose any particular danger.

Conclusions

Thus, the method of hydroveil is quite applicable, and will be very useful for the solution of the very urgent issue - the protection of waters from pollution, depletion and, ultimately, the safety and health of the population, living in unfavourable environmental conditions around the Kalmakir field.

This method can be applied to other opencast Angren-Almalyk mining area deposits where hydrochemical contamination of surface and groundwater occurs.

Literature

1. Fidayev D.T., Ulyanovskaya E.V. Environmental problems of mining industry
2. Uzbekistan and the Russian Federation and innovative perspectives on environmental protection measures
3. (on the example of Angren-Almalyk mining district and MMC «Nornikel»
4. g. Norilsk). CENTRAL ASIAN JORNAL OF THEORETICAL AND APPLIED SCIENCES Volume: 2 2021 Pages 38-47.
5. Borodin R.V. Groundwater of interiors valley of river Angren. Tashkent,
6. SAMGU, 1960, 118c
7. Grandfather V.Y. Oxidation zone of Kalmakir field, Tashkent, Fan, 1971, 128 s
8. Korotkevich G.V., Kurilenko V.V., Tukalo A.M. Application of new security methods
9. groundwater during the development of the Pokrovsko-Kureevsky fluorite deposit.
10. Hydrogeology and Hydrochemistry. Ex. LGU, 1976
11. Korotkevich G.V. Methods of protection of groundwater in mining.
12. Bulletin of the LWU, 1963, 2 p.32-43.
13. Cut-out of Kalmakir field (by E. Butyeva, V. Dedy, S. Denisov, etc.).

WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 3, Issue 3, Mar., 2022

14. Drawing from the book Ore deposits of the USSR. T.2. Gl. ed. V. I. Smirnov. - M.,
15. Nedra, 1978. 399 p.
16. Questions of the hydrogeology of the noosphere / SAIGHIS, ex. 2. Tashkent, 1977, 106 c
17. Questions of the hydrogeology of the noosphere / SAIGHIS, 3. Tashkent, 1978, 106 c