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Eureka Journal of Geoscience, Materials & Resource Engineering (EJGMRE)

ISSN 2760-4985 (Online) Volume 01, Issue 02, December 2025

https://eurekaoa.com/index.php/9

JUSTIFICATION OF EFFICIENCY OF COMPLEX USE TECHNOGENIC DEPOSIT

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Abstract

The article deals with the use of man-made deposits formed as a result of open mining and methods of storage of waste processing of mineral raw materials. Research and experience of the largest quarries on complex use of tailings of enrichment, dumps, waste of production in the form of overburden and processing of tailings of hydrometallurgical plants which are typical technogenic deposits and which can be considered as reserve sources of mineral raw materials are resulted.

The results of researches on complex use and geotechnological support of formation and development of hydraulic laying of waste of wet enrichment of granular phosphorites of Kyzylkum phosphorite complex are covered in more detail. It is determined that the method of storage of waste in a mined-out quarry provides integrated processing of technogenic fields with minimum environmental pollution, and the regularities of particle deposition in hydraulic stacking the tailings storage facility allow us to conclude that the concentration of the enriched product in a particular layer of sediments allows to consider such tailing as anthropogenic deposits, development of which is possible in the future.

Keywords: Open-pit mining, mining, quarry, technogenic Deposit, dump, tailings, mining waste, hydraulic laying, mineral raw materials, overburden, pulp, phosphoplast, environment.

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Introduction

The technogenic deposits that have appeared in recent decades are the result of intensive development of the mining industry. Technogenic deposits are accumulations of mineral substances on the surface of the Earth or in mine workings, which are wastes of mining, processing, metallurgical production and are suitable in quantity and quality for further industrial use, which becomes possible with the development of technology of its processing and changes in economic indicators. With the increase in mineral extraction, the amount of waste began to grow faster than the output of the final product, as the content of useful components in ores decreases, the mining and geological conditions of field development become more complicated. However, at the same time a large amount of waste processing of industrial ores are stored in dumps and silos.

Being unsuitable for industrial use, mineralized raw materials in dumps and tailings dumps with the improvement of enrichment technology already today have or may have in the near future a great industrial importance. It should be borne in mind that tailings, as a storage of waste processing of various ores, are among the environmentally hazardous engineering facilities. Taking into account the lack of free territories and funds for the construction of new tailings dumps in most cases, the solution of the issues of placement and subsequent development becomes particularly relevant. At the same time, especially important in the formation and development of dumps and tailings as technogenic deposits is their geotechnological support, the main tasks of which include:

- establishing the value of waste as a source of secondary mineral raw materials;
- management of the spatial and qualitative structure of the formed object on the basis of coordinated extraction from the subsoil and placed in the technogenic massif of mineral raw materials;
- determination of engineering and geological properties of waste as mineral raw materials;

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- determination of engineering and geological characteristics, composition and properties of waste for the formation of man-made arrays with parameters that ensure their rational development in the future;
- modeling of man-made massif in the form suitable for planning the development of man-made deposits.

The main problems of the study and development of technogenic deposits are associated with a large heterogeneity of the material composition, low content of valuable components in them and the need for a comprehensive comprehensive assessment. These features determine the choice of rational technology of formation and development of technogenic deposits.

One of the most important mining areas of Uzbekistan-Almalyk, produces 100 % copper, molybdenum, lead and zinc, more than 15% gold and silver accompanying it, as well as a significant number of rare elements, sulfuric acid, fertilizers, building materials and other valuable products.

In recent years, AGMK has achieved significant results in the integrated use of ores. Processing of own molybdenum-containing concentrates with obtaining of molybdenum production and rare elements (osmium, rhenium, etc.) is organized. At the lead-zinc factory, the processing of copper smelter slags with the extraction of copper and gold contained in them, as well as the use of enrichment tails as iron-containing raw materials was started [1-3].

More than 140 million tons of off – balance ore, including oxidized -35%, mixed -19% and sulfide-46% with copper content in them, respectively 0.35, 0.34 and 0.23%, are in the dumps of Almalyk MMC. For a long time conducted research on the processing of man-made waste.

Every year, the slag dump receives 44 thousand tons of slag with a content of iron up to 35-40 %, copper up to 0.7 %, gold 0.2-0.4 g / t. a Very large volume of slag containing valuable components formed during the processing of copper ores determines the relevance of their rational use. When conducting research at the experimental processing plant conducted a series of laboratory and pilot tests

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results, the developed technological regime and scheme of flotation in mixtures of Converter, waste slags.

Another potential source of valuable components can serve as copper clinkers, which to date has accumulated in the amount of about 680 thousand tons in order to solve the problem of their disposal was developed the technique of geological mapping, studied the composition and distribution of the metal throughout the volume of the dumps of clinker, identified the speciation of metals in laboratory conditions, carried out technological tests to remove.

The analysis of mining and geological conditions of the Muruntau gold Deposit shows that during its development, complex in structure with an uneven distribution of minerals in the mountain range and in the absence of natural boundaries between ore and rock, a significant amount of off-balance ore is formed.

Preliminary studies [3,4] established that the waste of mining (overburden) and processing ("tailings hydrometallurgical plants) of gold ore are typical technogenic deposits that can be considered as reserve sources of mineral raw materials. Among such technogenic deposits, the most interesting are the dumps of the Muruntau quarry, in which ~2 billion tons of overburden rocks have been accumulated and which were formed from its different zones, so overburden rocks containing gold are mixed in them.

In the process of open-pit mining of the Muruntau gold Deposit, a significant amount of rock mass is sent to off-balance ore warehouses of various quality and to waste rock dumps, whose area is 13.5 km2, and their height varies from 35 to 180 m.

Warehouses of off-balance ores and dumps of the Muruntau quarry in a certain situation can be used for further processing. The design and development of the Muruntau Deposit is carried out alternately with a consistent decrease in the content of commercial ore. Moreover, in order to obtain a quick return during the construction of the first stage of the quarry in the initial period of development of

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deposits, ore of higher quality was sent for processing, and ore of lower quality was accumulated in warehouses.

Preliminary assessment showed that in these dumps from 25 % to 40 % of the rock mass, contains gold in an amount sufficient for cost-effective processing. However, in order for such prerequisites to become a reality, the tasks of exploration of technogenic deposits, justification of development parameters, creation of transport links, preliminary enrichment, etc. must be solved.

The development of deposits of sedimentary origin of granular phosphorites of the Kyzylkum phosphorite complex (KFC), whose ore is mined in an open way and formed as a result of technogenic accumulations in the form of tailings are also technogenic deposits, which appeared in recent decades

Enrichment waste is more convenient for disposal than dumps, because they are, firstly, more homogeneous, and secondly, are already crushed, sometimes fractionated material.

Let's consider geotechnological support of formation and development of hydraulic laying of waste of wet enrichment of granular phosphorites of KPK [5] stored in the developed space of the career "phosphorite", which includes:

- study of mining and geological features of the structure of the Deposit;
- study of technological peculiarities of the development of the field;
- analysis of engineering-geological conditions of placement of wet enrichment waste in the worked-out space of the quarry;
- determination of the conditions of placement and parameters of the tailings in the developed space of the quarry;
- geological and technical mapping of objects with the allocation of statistically homogeneous areas of distribution of useful components;
- allocation of geological and technological zones taking into account the target orientation of processing and environmentally safe storage of ore enrichment waste;

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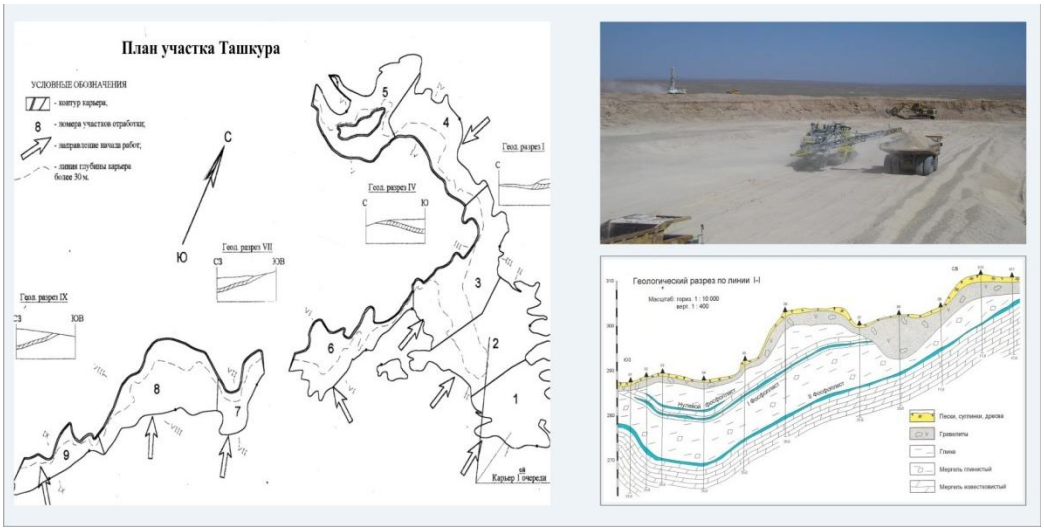
- determination of the method of development and justification of the parameters of the technological scheme of mining operations.

The Tashkent field is divided into nine quarry fields, which are put into operation as they are developed. The advance of the mining front is projected from South to North. The original mining sites are quarry fields Nos. 1,2 and 3 (Fig.1), because, in this part of the field the most favorable conditions for development in terms of overburden volumes. 47 % of the reserves of the Tashkent field are concentrated here.

Overburden rocks are conditionally divided into external and internal overburden. Breed external overburden located above the first festplatten, breed internal Stripping – between the first and second Festplatte. Overburden rocks are represented by sand-clay rocks, bentonite clays and marl of varying degrees of carbonate content.



Rice. 1. Geological conditions and technology development geroy-sardaryinsky phosphorite Deposit.

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The fractional composition of phosphorite ores depends on the method of loosening, and when dredging ore harvester, the size of the pieces does not exceed 50-80 mm (this fraction is 10-20% of the reservoir volume).

The volume density of phosphorite ores is 2.02-2.05 t / m3, the average coefficient is 1.42 (CR=1.42). The moisture content of ore in natural occurrence is from 2.5 to 5.0%, on average 3.8%.

The thickness of the I and II layers is almost the same (0.5-0.85 m), and the content of P2O5 averages 14.57% and 18.16%, respectively.

During the development of the field, the Technology of works with internal dumping was adopted. The extracted ore is sent to the enrichment " wet " method. To accommodate the enrichment waste, it was originally planned to build a tailings dump 18 km from the concentrator with the construction of a dam (volume ~ 3 million m3) and a permeable base. The total cost of such a tailings facility was estimated at ~ 5bn sums. The high cost of construction and a large amount of earthworks, as well as the need to allocate land made it necessary to find another solution. Such a solution was found. It provided for the use as a waste container of part of the developed space of the Tashkent quarry.

The water received as part of the pulp is partly evaporated, part will be associated with the sludge and part will be filtered into the rocks of the base and dam of the storage facility. The liquid tailings pulp fed to the tailings storage facility is a dispersion system consisting of a dispersion medium (water) and a dispersion phase (crushed ore).

For this purpose, part of the quarry space is not filled with internal dumps, but is allocated for the placement of waste "wet" enrichment, which are placed in a separate place by gravity hydraulic transport. The decision was preceded by studying the characteristics of rocks located below the pit bottom are the basis of the tailings and rock dumps – protecting dams of tailings ponds.

The study of the placement of the tailings was conducted in the process of engineering-geological works, the purpose of which was: to assess the

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applicability of clay soil dumps of overburden of the quarry for the device impervious screen design of the tailings; evaluation of seepage properties of rocks composing the bottom of the reservoir.

During the engineering and geological works on the tailings storage, drilling of engineering and geological wells with a depth of 8 to 30 m was carried out with sampling to study the physical and mechanical properties of the rocks composing the bottom. The distance between the wells was 100-160m drilling was carried out by the machine UGB 50M column method " dry " with a diameter of 160mm with full core selection. To assess the suitability of soils for the device of the anti-filtration screen, a survey of internal dumps was conducted, from which samples were taken to determine the physical and mechanical characteristics of the soil. Natural humidity and volumetric weight, maximum density and optimum humidity were determined from the samples taken.

In the process of engineering and geological tests it was established that the rocks in the bottom of the tailings are represented by marl with different amounts of clay, and the rocks of dumps are sand-clay rocks. It was found that upon contact with water rocks swell, reducing the filtration coefficient. Therefore, the rocks in the bottom of the tailings are a good water barrier, and the rocks in the dumps used as enclosing dams require additional compaction. Characteristics of rocks in the bottom and sides of the tailings are presented in table. 1.

Table. 1 Content of chemical compounds in clays

Components	Content,%			Components	Content,%		
	От	до	среднее		от	до	среднее
SiO_2	25,0	56,8	40,9	Na_2O	0,4	1,2	0,8
Al_2O	6,5	18,2	12,3	K_2O	0,91	2,66	1,79
TiO_2	0,23	0,85	0,54	P_2O_5	0,05	0,44	0,25
Fe_2O_3+FeO	2,38	7,45	4,92	SO_3	0,2	25,4	12,8
MgO	1,32	3,4	2,36	П.п.п	10,61	19,66	15,14
CaO	0,78	19,48	10,13	H_2O при 105° С	2,08	10,73	6,43

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When assessing overburden rocks found that they are represented by Quaternary loess loams and Sands with layers of sand and gravel material, Eocene clays, marls and phosphorites of the basal and zero layers.

This placement of the productive zone is explained by the fact that as the tailings reservoir is filled, the velocity of the pulp in the particle deposition zone will be constant. Therefore, only depending on this speed at a certain depth of the layer will be planted first larger and then smaller particles. And since it is known that the main productive mineral is concentrated in particles from 0.05 to 0.040 mm, such particles will occupy a well-defined place in the sediment thickness, represented by a horizontal layer of zinc enrichment.

Since 2008, it is planned to store sludge and wet enrichment waste in the waste space of the phosphorite quarry. The storage facility is designed for 5 years of operation after which a new storage facility is constructed in the waste space. The old storage to prevent dusting is preserved by dumping over the sediments of the overburden rock layer, with a capacity of not less than 0.5 m.

Enclosing dams storage off-balance ore 1 and 2 stages are solid rock width of 50.0 m, which is enough to ensure their stability when filling the storage. The storage is limited to the pillars on three sides completely, and on the fourth, taking into account the fall of the phosphorite layers, partially. The height of the pillars for the 1st and 2nd stage is up to 12 and 20 m, left in the process of mining. The facilities also include: trunk polovod with a diameter of 250mm. The inception of top their slope made 1:2, which is necessary for the device on the slope of the impervious screen used clay extracted during the Stripping career. The thickness of the screen is 4 m. the construction of the screen is made by horizontal layers from the bottom up with the sealing of the layers.

The basis of the storage of off-balance ores is the soil of the II phosphoplast, which is underlain by marls-a rock with sufficiently low filtration properties. According to the calculations, only their soaking to a depth of not more than 40

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m will occur during the operation of the storage. Pollution of aquifers lying at a depth of about 100 m below the bottom of the quarry will not occur.

Thus, the developed method of storage of waste processing in the developed space of the quarry provides a comprehensive use of man-made deposits with minimal pollution of the environment. In addition, the revealed regularities of particle deposition during hydraulic laying in the tailings reservoir allow us to conclude that the concentration of the enriched product in a certain layer of sediments allows us to consider such a tailings reservoir as a technogenic Deposit, the development of which is possible in the future. The main task today is to create such a field with parameters that ensure the availability of a useful component.

Thus, the experience gained in the development of technogenic deposits, allows us to conclude that their development should be approached in the same way as to deposits of natural origin (operational exploration, study of technological and consumer properties of the rock mass, technological mapping, determination of the method of extraction of conditioned raw materials, the choice of parameters of ledges and mining equipment).

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