New technology development of ore deposits by underground mining (in order of discussion)

Mining

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Traditionally used technological scheme of mining and ore processing involves the rise to the surface, transport to the processing plant, located typically a few kilometers from the mining and enrichment of the ore produced at the factory mass.

Consider the technology used in the historical, developmental aspects of the mining industry, characterized by a continuous decrease in the content of useful components in the ore, an increase in the production of metals, and even more so the volume of ore under a continuous decrease in the level of mining. In the future, these trends will continue.

Despite the development of some of the new rich deposits of all branches of mining there is a significant decrease in metal content in the mined ore. Thus, the iron content in extracted ore is reduced by an average of 1% per year. It can be assumed that within 20-25 years will require more than 2-pa

to increase the number of mining and processing of ore [1].

The share of underground mining in the future will be in the main sectors of rudodobyvayuschih apparently not less than 35%.In this case, if the total ore production may increase by about a factor of 2, then the underground mining of iron ore will increase by 1.8 times, non-ferrous metals - by 2.4 times, potassium salt - 2.2 times, and the phosphate raw material - almost 3.5 times [2]. ,

Produced at the present time, the mass of ore contains at most a few tens of percent of the useful component for ferrous metals, non-ferrous metals, the content of the unit and the fraction of a percent, while the remaining part of the most up waste rock.

Enriched 90% of the extracted iron ore, almost all of the ore mass in non-ferrous metals, all the potash and phosphate raw materials.

The increase in mass of enriched ore with a low content of useful component significantly increases the cost of its processing costs. High material costs require ever-increasing volumes lifted and transported from mines to preparation plants of rock mass, in which about 80% of waste rock. After separation at the processing plant, they are transported to the tailings, the content of which is very expensive.

The construction hvrstohranilisch spent 10 - • 50% of total investments. In addition to the alienation of large areas of valuable land, waste disposal of mining and processing industries has resulted in significant changes in the environment [1].

Mining annual decrease by an average of 10-25 m with increasing depth of mining and ore output is complicated by the problem of rock pressure control. Localisation of voids at greater depths will be carried out mainly by filling out space with inert materials and various kinds of hardening mixtures, which are served by the existing technology in the underground workings from the surface. It creates a paradoxical situation: on the one hand, from the ground surface, along with the ore is given a large number of barren rock, on the other hand - to locate voids in underground workings must be submitted breed, much of which is mined in open pits • special.

Obviously, the technology in the historical aspect of the mining industry was justified at a time when rich and extracted in a relatively small volumes of ore deposits, located near the surface. But in the future, when the change for the worse the above conditions, a flow chart of mining and ore dressing may be inappropriate.

In order to avoid unnecessary costs - labor and capital to move, process (and in some cases to return to the underground workings) species, it is necessary, if possible, completely separate them in underground conditions and issue to the surface and then to the processing plant is not the whole mass of ore, and crude concentrate (middlings), obtained by dividing the weight of the ore mining on a commodity raw materials and waste in underground conditions.

At present the mines in order to create favorable conditions for lifting the skip is a large underground ore crushing up to 200 - 300 mm. The proposed flowsheet is necessary to provide a further refinement of ore to the stage, providing the maximum possible extraction of useful component in predkontsentrat underground.

On the possibility of such a solution to some extent, the positive experience of placing the first stage of ore under the ground in Sweden, Canada, USA, a full cycle of enrichment - in Peru, Italy, the province of British

Columbia in Canada. The first stage of ore processing is basically the process rudopodgo-tovki. Two-and three-stage crushing of ore under the ground is carried out at the mines, "Strass", "Kiruna" (Sweden), "Geke and Gaspe" (Canada), "Udid" (USA) [3].

Partially used underground workings for processing complex in the central section of the mine "Kiruna" in Sweden. Pithead is combined with the processing plant and held below the two tunnels that serve to transport goods factory. Concentrates from underground bunkers are loaded into the tunnel to the rail cars. Roughly similar scheme is available factory dry magnetic separation of ore at the mine "Malberget" (Sweden) [3].

The full cycle of enrichment is carried out mainly in the non-ferrous metal mines. So, on mine mednotsinkovom "Madrigal" (Peru), the entire cycle of enrichment of crushing up to the flotation is carried out in underground mines [4]. The resulting concentrates are filtered and condensed and under, and then loaded them into trucks and transported to the surface.

In the lead-zinc mine "Salafassa" (Italy), placed in the underground facility for crushing and ore beneficiation in heavy suspensions. When dressing is removed 50% of the waste rock in the form of light fraction [4]. Waste rock and ore-rich dump trucks transported the tunnel, respectively, on the breed and dump processing plant. Placement of underground shops preliminary concentration reduced the cost of building processing plant and the cost of transportation of the rock mass.

Copper Mine "Sonro" (Province of British Columbia in Canada) was commissioned in 1962 [4]. Concentrator capacity of 1.35 tons / day, located in underground mines, which is economical, since placing it on the surface it would have been due to the steep terrain, at a distance of more than 2.5 km from the mine. The technological scheme includes three-stage crushing plant, two-stage grinding and flotation of the copper loop. All equipment is housed in two underground chambers the size of 46X9, 2X6, 6 m and 70X12, 2X6 m

Concentrator gold mine "Midlofian" (Canada) will be placed under the ground [4]. It is believed that the location of the factory under the earth contributes to the rapid development of the mine, requires less capital investment, eliminates the need to use the surface for the construction of buildings factories, facilitates the work of the factory in the winter.

Experience placement processing plants in the USSR under the ground there. But the known studies conducted in the Dnepropetrovsk Mining Institute in cooperation with the USSR Minchermetom, institutions and Yuzhgiproruda Mehanobrchermet to address the problem of creation of underground mining and smelting enterprises on the basis of the Kremenchug deposit of magnetite quartzites [5].

Tsentrogiprorudoy were carried out study design of the underground enrichment plant at 20 million tons of crude ore per year, according to which capital investment to get a ton of concentrate will make £ 35.59., the cost of mining 1 ton of ore - 1.726 rubles., the guild cost of concentrate - 9.873 rubles ., the corresponding figures for draft processing plant, located on the surface, are as follows: capital expenditures - 31.37 rubles / ton, the cost of production - 2.008 rubles / ton, the cost of guild concentrate - 9.960 rubles / ton

Cost of concentrate in both cases - the same order, but the underground enrichment on the surface waste rock dumps are absent, tail and body enrichment plants.

For the conditions of Abakan Mine , taking into account the situation when the finalization of the Main ore-body systems with caving to go to perfect nizhezalegayuschih ore bodies systems with a bookmark, the authors were made pre-design to place on the underground complex

• Pre-enrichment. Tails of dry magnetic separation is supposed to place in the goaf, without lifting them to the surface, strengthening the latter produced cementitious materials filed with the surface.

Comparative costs and total production costs of 1 ton of ore are shown below.

Показатели	Предлагаемая схема	Обычная схема
Капитальные затраты, руб.:		
сооружение камер подземного комплекса предварительного обогащения	2 700 000	—
проведение рудоподъемного ствола	—	2 343 000
углубка рудоподъемного ствола	986 000	—
Итого	3 686 000	2 343 000
Эксплуатационные расходы, руб.:		
подъем руды	—	2 548 000
подъем промпродукта	1 656 000	—
подъем хвостов	382 000	—
Итого	2 038 000	2 548 000
Количество добываемой руды, т/год	4 000 000	4 000 000
Капитальные затраты, руб/т	0,921	0,575
Эксплуатационные расходы, руб/т	0,509	0,637
Приведенные затраты, руб/т	0,647	0,725

The calculation results show that the proposed development plan in the first approximation gives the economic effect of 0.078 rubles / ton

The positive international experience and research of Soviet scientists say the correct formulation of the problem •.

Let's see how the new technology will affect the basic technological solutions of underground mining and ore processing.

The system development. Field development must be carried out with a bookmark out space. The most widely used, apparently, find a chamber system with a bookmark with a different sequence of extraction of ore reserves in the blocks, as well as system design horizontal layers with a bookmark with a descending and ascending notch ■ ore.

Bookmark, depending on the methods of enrichment can <be dry or oil. If necessary, in both cases it can be done by injecting hardening or pre-mixed with astringent solutions, supplied from the surface.

System with a massive collapse of the ore and host rocks in the modern constructive and technological performance can be applied only when working out • blind ore bodies, while stowing mixture should be applied to the breed pillow, in other cases the design of the system must change so that it is possible to place in goaf waste rock. It is imperative to use as a bookmark in aggregates tailings underground preliminary concentration.

Autopsy. Schematic diagrams of the opening, apparently, did not significantly change. However, due to a decrease in the volume issued at the surface of the rock mass, possibly reducing the number of ore-trunks or decrease the area of their section. At the same time increase the volume of chamber workings okolostvolnyh yards to accommodate the processing equipment.

Problems opening deposit must be addressed in conjunction with the rise of predkontsentrata on the surface, which may be made either by conventional means (crates, skips), or through the pipes - a hydraulic method. The use of hydraulic lifting method will reduce the ore-sectional area and the number of trunks.

Underground pre-enrichment of the (preliminary). The underground complex of preliminary concentration should be placed in an area completely eliminated the influence of mining activities, ie, outside the shear zones of rocks, directly or • the seismic impact of technological explosion.

During the construction of the complex must proceed from the minimum capital expenditure for the maintenance of the complex workings of chamber, bunkers, bypass, transportation galleries, to ensure removal of dust and gaseous products of the underground complex with the full **observance of sanitary** norms, provide a reserve of working space for a possible increase in future production capacity of the mine .

Preliminary concentration of ore in the ground conditions should be carried out, apparently, by the simplest technological schemes. Although, as we see in overseas mines and flotation is applied. Here, along with the usual well-known methods of enrichment (magnetic and gravity separation, enrichment in heavy suspensions, etc.) is great interest in special methods of enrichment. First of all, this radiometric method based on the difference in the intensity of the emission or absorption of radiation ore raw materials wide range of wavelengths from gamma to radio waves, and photometric, based on the different color characteristics of waste rock and ore.

Preliminary tests established that this method gives good results in the enrichment of most of the ore crushing stage. The development of technology and equipment for the institutions involved in this method, USSR

Ministry of Geology, Mintsvetmeta USSR Academy of Sciences of the USSR, the USSR and other Minpribor Soon, this method will be introduced into production, which will immediately after crushing to separate more than half of the waste rock, and thus dramatically improve the efficiency process for further processing at the processing plant and metallurgical processing.

Of considerable interest is also radio-predkontsent lump ore by jigging, since it is known that the capital cost of installation jigs is much less than when using the machines for enrichment in heavy suspensions.

And finally, the first stage of testing and refinement of individual elements of the new technology is a promising process of preliminary concentration of iron ore magnetic netitovyh by dry magnetic separation after secondary crushing. Ore after crushing weight of alkali-sound grinder, available under the earth in almost every major mine come in additionally mounted cone crusher, and then on a magnetic separator. As a result, the separation can be separated by up to 50% of the waste rock.

The new technology of underground mining with preliminary concentration of ores in underground conditions has several advantages and disadvantages in comparison with traditionally used technology.

Advantages of the new technological scheme: reducing the cost of extraction of ore and concentrate to obtain due to reduction of energy consumption (energy technology), labor and funds for underground and surface transport, the rise of the mineral, as well as dumping facilities;

complex use of ore, as implemented, not only concentrated, but also waste for laying out space;

decrease in the area of land alienation under tail-storage, waste rock dumps and case processing plants;

able to apply more efficient ways to lift middlings and delivery of waste rock - and hydrolift hydrotransport;

will flow more stable enrichment process due to the greater homogeneity predkontsentrata ore and more content in it a useful component;

accommodation shops preliminary concentration (enrichment) under the ground will greatly facilitate his work in the winter, which is especially important for mines located in the northern parts of the country;

dramatically decrease the negative impact of mining on the environment, as the volume is reduced on the surface storing waste enrichment process.

However, it must be noted shortcomings, which include:

increase in the volume of chamber workings okolostvolnyh yards and the cost of their construction;

increase in the number of underground workers, zadalzhi-Vai on the processing of ore and waste rock disposal;

there may be some increase in the loss of valuable components in the tails of pre-enrichment.

Number of studies found that when pre-enrichment of the radiometric methods, despite some increase in losses in the tails, the total extraction of useful components of the light extraction at the processing plant, even a slight increase [6].

Conditions for high use of new technology available in many mining enterprises of ferrous and nonferrous metallurgy.However, its successful application to solve some difficult problems, which requires specialists in the field of mining, ore dressing, rock mechanics, geology, economics, and many others.

Specialists of the mountain of the case to decide issues of technology development, ensuring efficient operation of the underground workshop preliminary concentration, as well as the use of waste rock for laying out space, dresser - to develop a new highly effective methods of enrichment using small but high performance devices and instru

ditch, rock mechanics - new setup for hydraulic and TRIM ore at high altitude, geology - to develop a classification of the ore on the structural and tekstrukturnym grounds to justify the subsequent separation processes of mineral components from the waste rock, the economists - to determine the structure and amount of costs for existing and new technologies and etc.

To address these issues is necessary to include in the plans of the USSR and the SCST target comprehensive program on the issue of "Development and implementation of technology development with preliminary concentration of ores in underground conditions."

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