6rd INTERNATIONAL SCIENTIFIC AND TECHNICAL CONFERENCE

"INNOVATIVE DEVELOPMENT OF RESOURCE-SAVING TECHNOLOGIES AND SUSTAINABLE USE OF NATURAL RESOURCES"

PETROȘANI, ROMANIA
NOVEMBER 16, 2023

BOOK OF ABSTRACTS
- edition 6/2023 -

https://www.upet.ro/cercetare/manifestari/

Universitas Publishing
Petroșani, 2023

UDC 622:658.589(063)=111

Recommended for publication by Board of Directors of the University of Petrosani, Minutes № 7328 as of October 16, 2023

6nd International Scientific and Technical Internet Conference “Innovative development of resource-saving technologies and sustainable use of natural resources”. Book of Abstracts. - Petroșani, Romania: UNIVERSITAS Publishing, 2023. - 185 p.

ISSN 2734-6935
ISSN-L 2734-6935

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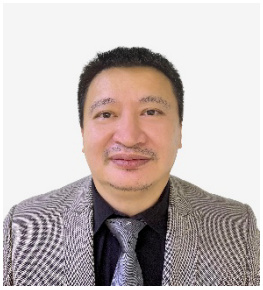

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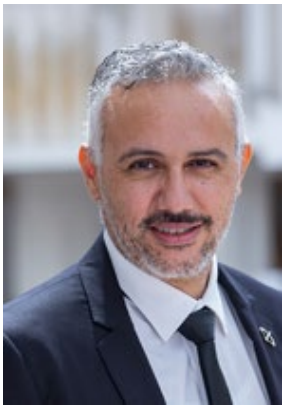

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S.M. CHUKHAREV, Candidate of Sciences (Engineering), Associate Professor, Department of Development of Deposits and Mining, National University of Water and Environmental Engineering (NUWEE), Ukraine
S.V. PYSMENNYI, Candidate of Sciences (Engineering), Associate Professor, Department of Underground Mining, Kryvyi Rih National University, Ukraine
A.V. PEREMETCHYK, Candidate of Sciences (Engineering), Associate Professor, Department of Mine Surveying, Kryvyi Rih National University, Ukraine

USING A FLOATING CEILING TO IMPROVE ORE EXTRACTION

A mandatory requirement for the comprehensive development of mineral deposits is the most complete extraction of minerals from the subsoil. Consequently, the issues of reducing losses and dilution during the development of ore deposits remain relevant.

The Krivoy Rog iron ore basin is a unique deposit with huge reserves of iron ore. Most of the deposit is mined using caving systems for ore and host rocks. Such technologies predetermine large losses and dilution of mineral resources.

As the level of mining decreases, rock pressure increases and mining conditions worsen. This predetermines the need to introduce new technologies and technical means.

In recent years, scientific research has been actively carried out on a technology that will significantly improve ore extraction rates. Considering that the main problem area is the upper ore-rock contact, it is necessary to reduce the influence of this contact during ore release. This can be achieved by creating an artificial or natural overlap located at this contact.

Three options for such overlap are considered in the scientific literature:

- a protective layer of over-crushed ore at the ore-rock contact;
- flexible metal ceiling;
- an overlap made of a rock or ore monolithic block, cut from the hanging wall rocks at the ore-rock contact.

To determine the effectiveness of the protective layer of re-crushed ore, studies were carried out that considered the option of a sub-level caving system with diamond-shaped panels with a protective layer of re-crushed ore [1].

The influence of four technological parameters was analyzed: the granulometric composition of the overlying waste rock, the thickness of the over-crushed ore layer, the coefficient of primary loosening of the ore and the height of the produced ore layer.

Research has shown that ore dilution depends mainly on the ratio of the granular composition of waste rock, the thickness of the over-crushed layer, as well as the coefficient of primary loosening of the ore and is almost independent of the height of the produced layer. With an equal ratio of the diameter of a piece of the re-ground layer, dilution begins after the release of 32% of pure ore and reaches 59% when 74% of the ore mass is extracted. When the ratio of the diameter of the average piece increases to 0,5, dilution begins after the release of 89 and 96% of pure ore, while the di-

lution is 9 and 4%, respectively. And with an increase in the thickness of the protective layer of over-crushed ore, the loss of ore in the block is significantly reduced [2].

The development of the theory of protective overlap was the technology with flexible overlap. In this case, the block is processed in two stages [3].

At the first stage, a protective covering is formed in the form of a flexible metal shield made of strip iron. The second stage included work related to the excavation of all cuttings and the carrying out of clearing work. Due to the significant labor costs and long installation time of the flexible metal ceiling, and the impossibility of dismantling it after completion of the block, this option has not found proper application.

The most promising is the use of a “floating” ceiling, cut from the hanging wall rock mass by fans of deep wells. With a sufficient thickness of the ceiling, after the destruction of the ore mass and the sections of the ceiling from the rock mass, its integrity is preserved and the ability to perform the functions of a protective ceiling for the entire period of mining of the block [4].

Sublevel mining and floor release of ore through the outlet workings allows you to adjust the size of the exposure of the “floating” ceiling, intensify the release process, move the ore to the outlet workings through the use of gravitational forces, reduce delivery costs by 2 times and the share of preparatory cutting work by 2,5-3 times [5].

Mining steeply dipping ore deposits using a system with a “floating” ceiling has its own characteristics. A problem can be uneven lowering and overturning of the ceiling in the cleaning space. For stable movement in the clearing space, the “floating” ceiling is made with a height no less than the thickness of the mineral deposit and can have thickenings in the middle part, forming a body of equal resistance to movement [6].

Another way to ensure uniform lowering of the ceiling is to leave a temporary ore pillar, which will ensure that the ceiling is given a horizontal position [7,8].

Thus, the overlap, cut off from the rock mass of the hanging wall, will significantly improve the extraction of minerals and ensure comprehensive development of the deposit.

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VU TRUNG TIEN*, Dr (mining), main lecturer
DO ANH SON, Dr (mining), lecturer
NGUYEN HONG CUONG, Msr (mining), lecturer
Hanoi University of Mining and Geology, Vietnam
*Email: vutrungtien@gmail.com; vutrungtien@humg.edu.vn

THE CONTROL SOLUTION FOR WEAK ROOF IN THE FULLY MECHANIZED MINING LONGWALLS IN QUANGNINH COALFIELD, VIETNAM

The phenomenon of roof falling of the weak roof rock in the fully mechanized longwall is one of the main reasons affecting on the safety and efficiency of longwall mining process. Therefore, the analysis of causes for the phenomenon of roof falling in order to find out the proper preventive solutions, strengthen the roof control, reduce the falling roof accidents is very essential.

Regarding to the real issues in the work of coal mining and work of roof control, the authors researched and analyzed the main reasons leading to collapse of the roof rock near the face in the fully mechanized longwall and proposed solutions to prevent roof, contribute to the management and control of the weak roof rock reasonably.

The basic of controlling roof rock in the fully mechanized longwall is to control and protect the roof rock near a longwall face, because the roof rock near the longwall face above shield, basically it is not supporting area and the roof rock area are cracked, soft rock which belongs to the roof rock which are controlled in the mining longwall. At the area, combining just has moved past to mining in the immediate the roof rock are exposed and strain state also changed dramatically. However the shield has not moved forward promptly to support the roof rock here. If the roof rock in the area is type of soft and loose rock, it will tend to fall in space of the longwall, there will have the roof convergence. This issue causes the failures in the longwall and many difficulties of support works even though it may cause of the accident to the work.

During the coal mining process at the longwall faces, the roof rock is exposed immediately, at the same time the stress state here also changes drastically. But now, the shield still has not timely moved forward to hold roof rock near to the face. If it is weak and loose rock, it tends to fall to

Scientific edition

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First publication

Chief editors **Sorin-Mihai RADU,** Professor, Ph.D.,
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Signed to print 03.11.23. Format A4.
21 conventional printed sheets.
The printing run is 60 copies.

UNIVERSITAS Publishing, Petroșani,
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