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THE SCIENTIFIC BACKGROUND OF METHODS FOR INCREASING SUSTAINABILITY UNDERGROUND MINING WITH THE USE OF ANCHORING

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Annotation. *An analysis of a large number of literary sources on the practice of constructing underground structures shows that it is the type of support, technology, and mechanization of its construction that predetermine the speed of mining and greatly influence the quality of tunneling work.*

Key words: *workings, stability, anchor, support, rocks, deposits, layer, strength, penetration.*

Currently, in order to increase the stability of rocks and maintenance-free maintenance of workings, the creation and implementation of new structures of support with greater bearing capacity and lower metal consumption are being carried out. In this regard, over the past few decades, a new type of combined support has begun to be used, which consists of roof bolts.

On the other hand, the insufficient development of methods for assessing the stability of workings leads to the use of ill-founded, sometimes completely unfounded design decisions when determining the types of support used for workings. This, in turn, leads to the above-mentioned large expenditures of material resources and time when excavating mine workings. To summarize, it can be noted that, despite the available results, the problems of assessing stability and forecasting are far from being solved and are an urgent problem at the present time.

Anchor support, as an independent support, has been used in mining practice for a long time not only for securing underground mine workings, but also for holding steep slopes in mountainous areas and the sides of quarries during open-pit mining. By absorbing tensile and shearing forces, anchors help increase stability and thereby increase the bearing capacity of rocks and provide support for the unstable part of the massif.

When choosing a specific type of anchorage, factors such as:

- structure and physical and mechanical characteristics of rocks,
- development depth,
- distance between layers,
- degree of disturbance and water content of deposits,
- configuration, dimensions,
- purpose and service life of the mine,
- conditions of its operation,

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- expense, cost,
- scarcity and strength properties of roofing materials.

Therefore, calculating the parameters (length of anchors and density of their installation) of anchor support, taking into account these factors, which ultimately leads to savings in material resources and installation time, remains relevant today.

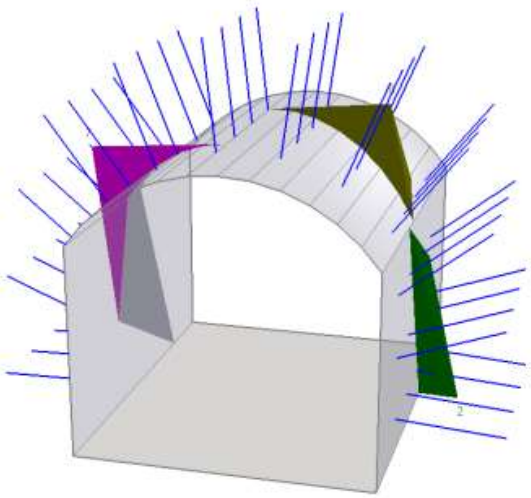

Fig.1. An excavation secured with anchors and shotcrete with designed and calibrated model parameters

The stability factor of the formed wedges exceeds the regulatory requirements, which indicates their stability and safe mining operations in this area when securing the rock wedges using one of the proposed methods.

On the other hand, the scope of application of anchors as individual support is currently limited by a number of geological, technical and economic factors [2].

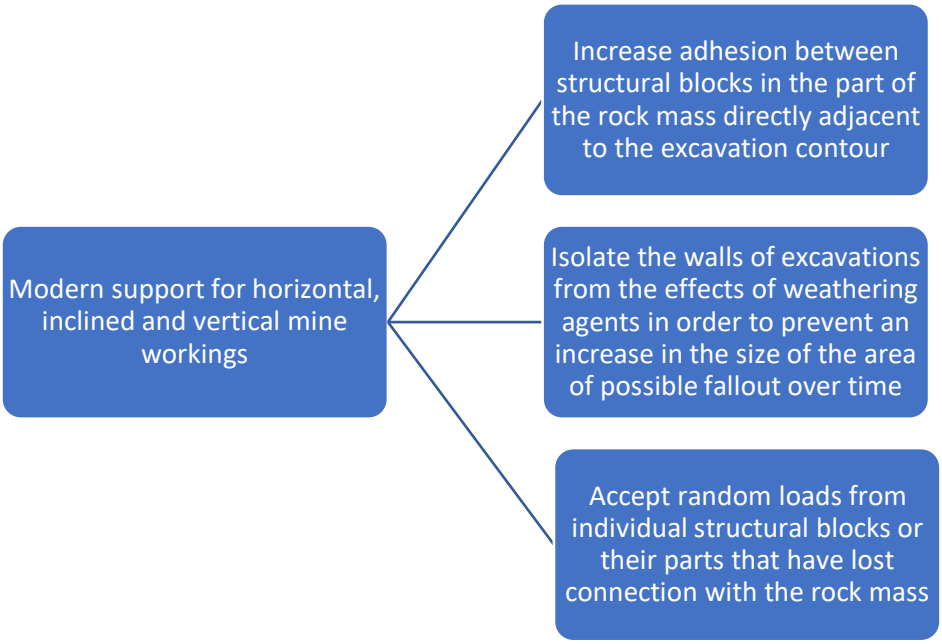

Fig.2. Modern support must meet the following requirements.

Rock bolts do not protect mine workings from the action of a humid mine atmosphere and water seeping into them. In highly fractured rocks, the installation of anchors with the density accepted in practice does not provide fastening of individual parts of the fragmented massif, and, therefore, does not contribute to the formation of the load-bearing capacity of the structure. All these disadvantages dictate the use of anchor support in combination with other supports that contribute to the formation of a load-bearing structure, in particular, shot concrete.

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