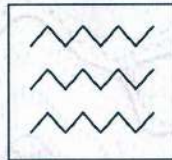




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This certificate is presented to

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National University of Water  
and Environmental  
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AND TECHNICAL CONFERENCE

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TECHNOLOGIES AND SUSTAINABLE USE OF NATURAL  
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In [8] it was noted that the influence of the degree and quality of filling natural cracks with natural materials on the strength of the mountain mass should also be taken into account, as its characteristics can be decisive in determining the coefficients of structural weakening.

In [9, 10] the analysis of methods for determining the coefficient of structural weakening of the rock mass is given, which shows that the above factors influencing the strength of rock inhomogeneous rock mass are partially taken into account when determining the coefficient of structural weakening.

Almost all formulas for determining  $K_s$  are based on the fracture modulus of the rock mass and only a few take into account the angle of incidence of natural cracks, the minimum size of the structural block in the rock massif and rock diversity. Comprehensive consideration of all the above factors influencing the strength of the mountain massif has not been identified. This can be explained by the complexity and diversity of these factors.

Thus, despite the knowledge of most of the factors that affect the strength of the mountain range, to establish their actual role and numerical value is quite difficult.

Therefore, the question of determining the real value of the coefficient of structural weakening of the array remains relevant and requires further study.

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### **THE PROBLEMS OFTEN HAPPENING AT THE FULLY MECHANIZED LONGWALL IN QUANG NINH PROVINCE AND METHODS OF SURMOUNTING**

After analyzing current state and exploitation process of some of the fully mechanized longwall in Quang Ninh province, as well as analyzing the geological conditions, the paper has synthesized and analyzed some of the problems often happening at the fully mechanized longwall. At the same

time, mention the shortcomings of existing fully mechanized longwalls are applying at some mines in the Quang Ninh. As a result, the paper proposes appropriate for technical and technological solutions to surmount the problems often happen at the fully mechanized longwall. These technical and technological solutions after application in practice has achieved good results. They are effective in the problems surmounting with specific geological conditions. The faces can be exploited safety, from there, to formulate important technical and technological methods to surmount the problems at the fully mechanized longwall in Quang Ninh province.

Currently, there are many fully mechanized mining longwalls being exploited in a number of coal mines in Quang Ninh coalfield [1]. During the exploitation process, the initial assessment shows that these longwalls have brought remarkable results. However, these longwalls also often have problems due to many different reasons, when an incident occurs in the longwall, it will interrupt the production cycle of the longwall, reduce labor productivity and reduce efficiency, as well as the safety problem in the longwall oven is threatened [2-5]. In order to continuously operate the fully mechanized mining longwall and bring efficiency in the use and operation of synchronous equipment, problems need to be handled quickly and promptly.

In the fully mechanized mining longwall, due to the operation of many machinery and equipment, in addition to the changing and complicated geological conditions of the longwall, so incidents may occur. Among the incidents at this longwall, the most common incidents are such as: the phenomenon of face spall and roof falling; the phenomenon of subsidence of support and the phenomenon of the shearer plugged into the floor [6-8]. Before proposing solutions to handle the problem, it is necessary to clearly analyze the cause, on that basis, select the right and timely solution to ensure the safety of the longwall. Through analyzing the characteristics of the mechanized longwalls being exploited in some underground mines in Quang Ninh, the article also analyzes the causes of the incidents in each longwall, thereby synthesizing some effective solution that is being used to handle this problem. Through testing for a number of malfunctioning longwalls, each solution is effective, contributing to improving safety and efficiency when exploiting the fully mechanized longwall [9].

**\* Incidents in the fully mechanized mining longwall in Quang Ninh coalfield**

+ The phenomenon of face spall and roof falling in the longwall [9].

This is the most common problem in the fully mechanized longwall today. The face spall is the phenomenon of coal being separated from the original coal seam and overflowing into the space of the longwall, which affects the activities in the longwall. When exploiting coal seams with soft, loose, high pressure and unreasonable mining techniques, the phenomenon of face spall will occur more frequently and continuously. When the phenomenon of face spall occurs, the roof loses its support, if it is soft rock, it will tend to fall into the space of the longwall, which can cause impacts

and incidents, this is called the phenomenon of the roof falling of the longwall during the mining process. This phenomenon occurs in a large space, leading to the hollow roof of the longwall, which affects the quality of the support, the shield may be tilted, even the shield will fall and become unsafe for longwall. In the longwall, the process of face spall may occur first, the next by the phenomenon of roof falling. When the longwall operates stably, the phenomenon of face spall and roof falling occurs in turn according to the process of the movement in the direction of the longwall.

+ The phenomenon of subsidence of support in the longwall

The incident occurred because the floor is soft rock, the support has a large load and is under great pressure. At that time, the support was subsided to the floor, it difficult to move the support to the new web, sometimes it can't be done because the support is too deep. This incident occurred at the longwall in coal Seam 7 at Ha Lam Coal Mine, Khe Cham III Coal Mine and Duong Huy Coal Mine.

+ The phenomenon of the shearer plugged into the floor

This incident occurred because the geological conditions of the longwall were too complicated, during the cutting process, there was a fault in the longwall, causing the coal seam to change in lying position, and the control of the shearer was incorrect. This phenomenon occurs at the longwall Nga Hai Coal Mine, Quang Hanh Coal Company.

#### **\* Solutions to prevent face spall and roof falling in the fully mechanized mining longwall in Quang Ninh coalfield**

+ To prevent face spall and roof falling

*Using chemicals to reinforce the longwall face [9].*

The solution of using chemicals to reinforce the longwall face is one of the most technically effective solutions. In some countries such as China, Poland, Australia, this solution is widely and popularly used to solve the problem of face spall and roof falling, this solution is not only used to handle face spall and roof falling in the longwall, but also used to handle the problem of the roof falling when digging the roadway in the soft coal seam and rock. The essence of the solution is to force-pump chemicals directly into the longwall face through drilled holes, from which chemicals pass through the cracks in the coal mass and bond into a solid block. At the mechanized longwall in the coal area of Quang Ninh, Vietnam, in order to handle the roof and coal with face spall and roof falling, drill rows of holes with a diameter of 42 mm in the section of the longwall need to be reinforced, each hole is drilled from 2.5 m deep, the distance of the holes drilled in the slope direction is 3 m, then the chemical mixture is force-pumped through the drilled holes into the cracks for reinforcement. After each force-pump chemical, the longwall face will be stable for about 5 web cuts, equivalent to 3.15 m (the depth of one web cut at the fully mechanized longwall is 0.63 m). Currently, the chemicals used to reinforce longwall face have many different types and their prices are



also different. The mechanized longwall in Quang Ninh coalfield often uses Chinese chemical DMT-601A/B or some longwalls use Polish chemicals to reinforce.

*Using the method of pumping water into the coal seam*

One of the effective solutions to handle the phenomenon of face spall is to force-pump water through the drilled holes into the coal mass in the longwall, this is a very effective solution in terms of economy, however, in locations where the phenomenon of the face spall and roof falling are heavy and strong, this solution cannot be handled. The essence of this method is to drill holes (short, medium and long) into the coal seam and use those holes to force-pump water into the coal seam to increase the humidity of the coal until it reaches the limit request. The scientific basis of this method is that when the humidity of coal increases to a certain extent within the limit of unsaturation, it will change the physical and mechanical properties of the coal such as the adhesion force between coal particles increasing, the plasticity of the coal increases, the brittleness of coal decreases, so when forcepump water into the coal seam, it will be effective for maintaining the monolithic nature of coal. Currently, the longwall in Seam 14-5 of Khe Cham III coal mine and the longwall in Seam 7, Seam 11 of Ha Lam are using this solution. The evaluation shows that, if the phenomenon of face spall in the longwalls does not occur too much, this solution is relatively effective.

**Conclusions**

Analysis of the causes and rules of the phenomenon of face spall when mining at soft coal seams shows that, this phenomenon is mainly due to the effect of self-weight and mine pressure on the coal mass in front of the longwall face, causing the form of cut break and the form of tensile break. Therefore, the study of minimizing the influence of mine pressure or changing the mechanical properties of the coal mass in front of the longwall face are the two main research to reduce the incident of face spall and roof falling. The force-pump of water, the force-pump of reinforcing chemicals into the coal seam are two of the effective solutions to prevent face spall because water and reinforcing chemicals can increase the cohesion and reduce the brittleness of the coal mass, so it improves the stability of the coal seam. The above solutions are applied to the actual fully mechanized longwalls in Quang Ninh, Vietnam. Applicable results have also affirmed that force-pump of water and the forcepump of chemical solutions reinforced on coal seams meet the requirements of the ability to prevent face spall and roof falling. In addition, the application of these solutions also contributes to improving mining output and labor productivity and improving working conditions in the longwall. In exploitation, the problem of increasing the linkage of coal mass is mainly done by force-pump chemical methods and recently the force-pump water method. In these methods, the method of force-pump water into coal seams to increase the coal's association although effective is not high with force-pump chemical, but it has many advantages such as simple construction work, can be used available equipment and supplies of mine for implementation, low cost, can contribute

to improving working environmental conditions. For longwalls with mirror surroundings, rendering large, frequent, frequent occurrence, solutions of the force-pump water into coal seams is not effective, the method of the force-pump of chemical must be applied in order to ensure safety for longwall, although the cost of this method is relatively high for the conditions of underground mines in Vietnam today. Combined solutions such as increasing the speed of moving the shear, the longwalls are supported promptly, force-pump water and force-pump chemical reinforcing into coal seams are also applied in mechanized longwall to increase the effect of preventing the phenomenon of face spall and roof falling.

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### **ANALYSIS OF TECHNOLOGICAL PARAMETERS OF HYDROMECHANICAL AMBER MINING**

Today, amber mining requires the latest technologies and the improvement of technical and technological means to intensify the production process, which achieves higher productivity and efficiency, as well as reducing the negative environmental impact on the environment. The most rational is the implementation of a hydromechanical method of amber extraction, which does not require expensive geological exploration and reclamation works. It is characterized by minimal capital and operational costs and has the prospect of improvement by controlling the speed of amber floating from sand deposits by changing the airflow and the frequency of oscillation of the working body. When applying the hydromechanical method, there is an effect of mechanical vibrations of the working body and saturation of the sand massif with water and air.