

TECTONIC FACTORS IN THE ASSESSMENT OF THE
GEOMECHANICAL STATE OF THE STABILITY OF CARRIER BOARDS
EFFECT ANALYSIS.

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Abstract: *The article examines the influence of tectonic factors on the stability of the quarry face. When assessing the geomechanical state of bench stability, the types of tectonic processes occurring in the lithospheric crust were studied. The influence of tectonic processes on the occurrence of deformation in the quarry face massif is presented. In addition, the influence of surface and groundwater on the massif through fractures, which are a product of tectonic factors, on the geomechanical state of the side has been covered.*

Keywords: *stability of quarry sides, tectonic factors, tectonic processes, deformation zones, landslide zones, cracks.*

MAIN PART

Ensuring the stability of quarry sides is one of the most important technological and safety measures in the development of deep quarries. Assessment of the geomechanical state of quarry sides plays a key role in ensuring the stability of the sides, since this includes the analysis of the physical and mechanical properties of rocks, the study of deformation and stress processes. In this case, tectonic factors play an important role. Tectonic forces and movements affect the structure of rocks, leading to their deformation, displacement, and the formation of fractures. Consideration of these factors is very important when assessing the stability of quarry sides. Proper assessment of the geomechanical state of quarry sides prevents various hazards during the extraction process in quarries.

Tectonic factors refer to processes associated with the compression, stretching, fracturing, and other mechanical impacts of lithospheric plates in the Earth's interior and rocks in the Earth's crust as a result of seismic movements. As a result of these tectonic processes, stresses arise between rocks and layers, which affect the mechanical properties of rocks. Determination of tectonic factors when assessing the geomechanical state of quarry sides can lead to deformation of the sides, redistribution of stresses, and, as a



consequence, an increase in the risk of sliding of the side massif. The influence of tectonic factors on the stability of quarry sides depends on:

The first is the movement of plates, and as a result of the movement of lithospheric plates, various levels of stress arise in the rock mass. As a result of such movements, rocks deform and react differently to their natural stresses. If the quarry side is located in a high tectonically active zone, this can negatively affect the stability of the side. In such cases, it is necessary to regularly monitor tectonic factors to ensure the stability of the quarry side.

The latter are fractures and landslide zones, and due to tectonic processes, fractures and landslide zones appear in rocks. These fractures and landslides can lead to the loss of rock stability, as a result of which the stability of the quarry side is weakened. Faults reduce the cohesion between rocks and disrupt their monolithicity, altering the stress distribution, which can lead to the displacement of the massif.

The third is the zones of deformation, in which, as a result of tectonic processes, such deformations as tension, contraction, and bending occur in rocks. Such deformations change the natural structure of rocks and reduce their mechanical strength, directly affecting the stability of quarry sides.

The fourth is seismic activity, and tectonic factors are often associated with seismic activity. Earthquakes transfer a large amount of energy to the rocks, which poses a serious threat to the stability of the quarry sides. As a result of seismic tremors occurring in seismically active areas of quarry sides, the back-of-the-wall massif can slide or collapse. In addition, blasting operations carried out to prepare the rock mass for extraction also have a certain degree of seismic impact on the quarry side, especially today the increase in the number of blasting operations in quarries indicates the need to take this factor into account. Oscillations caused by seismic vibrations, due to the possibility of displacement of rock masses relative to each other, reduce the safety factor of bench stability and make it difficult to maintain the stability of the sides. Therefore, seismic hazards should be studied separately when assessing the geomechanical state of the beam's stability within the framework of tectonic factors.

The reason for the dependence of the stability of quarry sides on the system of fractures in rocks is that in the fractured massif, one can encounter cases of deformation. Due to cracks, stresses are unevenly distributed between the rocks of the massif, which increases the risk of landslides on the quarry sides.

Tectonic cracks increase the permeability of rocks and can weaken the stability of the quarry side. The location and direction of such fractures are



determined by geological research. The amount of water reduces the angle of internal friction of rocks, which increases the tendency of sides to slide. The movement of groundwater along cracks and its dispersion into the massif reduces the stability of the quarry sides, which can lead to large landslides and landslides. Therefore, when analyzing samples of rocks in a naturally moist, absolutely dry, and watered state separately, it was established that there is a significant change in the values of strength properties. Therefore, taking into account cracks and hydrological characteristics, the angle of inclination, height, and other technical parameters of quarry sides and benches can be changed.

If tectonic forces act parallel or perpendicular to the quarry side, the sides are prone to landslides or deformations along the fracture zone, as well as landslides. During geological studies, due to the accurate assessment of the direction of tectonic forces and the factors influencing them, the volume and direction of tectonic deformations are taken into account as the main factor in the structure of quarry sides. In this case, it follows that tectonic forces and factors are significant in the correct selection of other elements or parameters of the quarry side and bench slope angle, height.

In areas with zones of tectonic deformations and fractures, the angle of inclination should be selected based on the safety factor of stability. The perpendicularity of the angle to the desired slope increases the risk of landslides. In areas with high tectonic activity, measures should be taken to maintain the stability of the face massif by reducing the height of the quarry face. With this method, the pressure on the lower horizons of the quarry side is reduced, and the safety factor of stability is increased. In deep and deepening quarries, it is advisable to divide the side into several sides by height to reduce the side height.

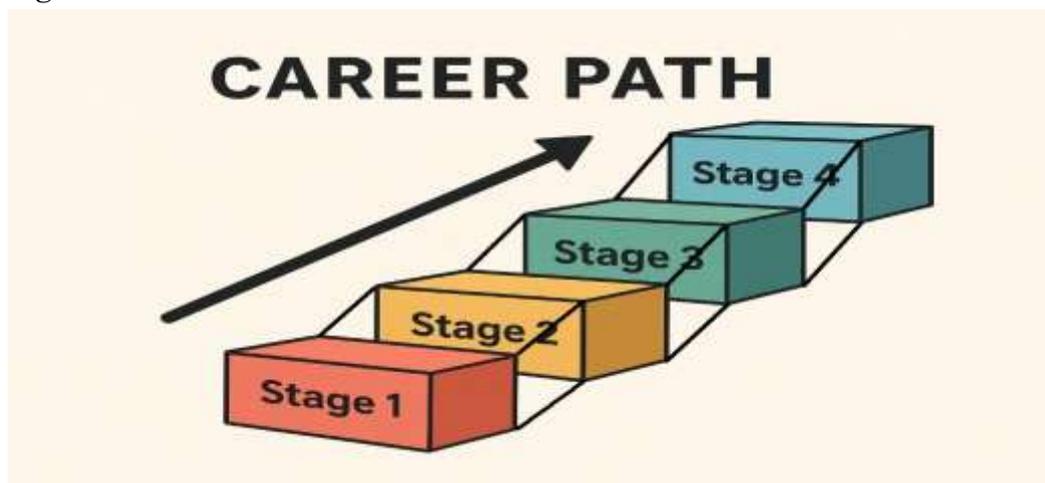


Figure 1. Division of the quarry side into several blocks



Consequently, when assessing the geomechanical state of the stability of quarry sides, the study and monitoring of tectonic factors are of particular importance. Tectonic processes significantly affect the physical, mechanical, and strength properties of rocks due to their displacement and deformation relative to each other, which requires serious attention in maintaining the stability of quarry sides. Proper assessment of tectonic factors and the selection of bench parameters based on them reduces the risk of their collapse, which ensures the safety of mining operations. In this case, of course, the calculation of the safety factor for the stability of the quarry side is of great importance. The safety factor of the quarry bench stability is stable at $k > 1$ and unstable at $k < 1$. In most cases, in order to ensure safety, the safety factor of the quarry sides is usually required to be higher than $k = 1.2$, however, this value can vary depending on the properties of the deposit. The safety factor for the stability of the quarry side is determined as follows:

$$k = \frac{\sum F_m}{\sum F_s}$$

In the above formula, F_m - forces of adhesion and internal friction, ensuring the strength of the side, F_s - tangential forces, causing displacements on the side. Consequently, when calculating the safety factor of the stability of quarry sides, it is determined by the ratio of the forces of internal friction and adhesion, which ensure the strength of the sides, to the tangential forces causing the sliding. Strengthening clutch and internal friction It turns out that when the forces are greater than the tangential forces causing the sliding, it is possible to ensure the balance of the side stability.

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