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# PROCEEDINGS

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# GEOTECHNICAL PROBLEMS RELATED TO NATURAL HAZARDS

# FEATURES OF PHYSIO-MECHANICAL PROPERTIES OF METAMORPHIC BREEDS IN THE ESTIMATION OF STABILITY OF SLOPES

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ABSTRACT: Kyrgyzstan is located in the northeast of the Central Asia belong to mountain-folded system of Southwest Tjan-Shanja, and with a concern of landslides activity similar to number of countries in the region. In the mountain-folded areas, the geological structure of a slope has distinctive feature of formation and activation of landslide displacement. These activities depend on the active tectonics of region, height of slopes and disturbance breeds composing them.

## 1 INTRODUCTION

Mining is one of the priority sectors of the Kyrgyz economy, of which is currently the gold industry occupies a leading position. Typically, gold deposits are mountainous Kyrgyzstan, located in zones of tectonic disturbances, mainly of faults and joints that lead to disruption of the stability of pit walls and underground workings, both during construction and during the operational phase. In order to ensure the safety of operations at mining operations at the design stage you need to set a career or underground workings, in which will ensure their sustainability. Safe operation of upland career are defined by the geological environment. The geological environment regarded as a complex nonlinear self-organizing system in which physical processes in the Earth's crust are essential (Nikonorov et al., (2004).

The main factors of the geological environment, which significantly affect the steady state pit wall stability massif and safety of mining operations include: terrain, rock properties and the array, the presence of outputs groundwater and permafrost, natural and manmade gravitational processes. Active structure-forming elements of the geological environment are tectonic faults and cracks that are present in any mountain range and in any territory (Geology of the USSR 1972).

Kyrgyzstan's gold deposits are confined to the major boundary and regional faults, various faults, discharges and thrusts. Host rocks in these areas are presented metamorphosed rocks shear, thermal (volcanic) and thermal-shift of origin (Figure1) (Spivakov,1989).

The main host rocks of gold deposits in Kyrgyzstan are heavily fractured metasomatic rocks represented by quartz-tourmaline, quartz-carbonate, quartz-sericite, gneisses, amphibole schist, silicified sandstones, diorite, etc. According to the results of laboratory experiments the authors found that these rocks are characterized by low porosity of 0.3-0.6%, low water absorption from 0.26-4.52% compressive strength of rocks to order more of the same rock strength in tension. Species usually brittle rocks embrittlement coefficient is in the range 24-25.
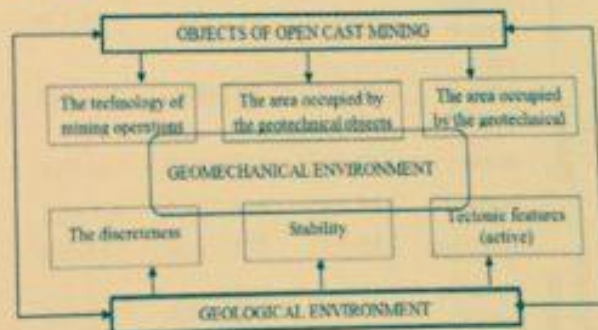


Fig. 1  Scheme of interaction of the geological environment and geotechnical object

Strength characteristics of virtually all of the rocks after they are completely full water saturation is reduced to 30%, indicating a decrease in the strength of the rocks in flooded areas of the quarry or mine workings. Clutch species decreased by 1.2-1.3 times, the angle of internal friction of rocks practically unchanged. As a result of intensive grinding, chipping and grinding of the original rocks, formed at the contact zones clay friction strength properties which the natural moisture on average: internal friction angle of 7 to 280, and the clutch from 0,001 to 0,06MPa, and at a humidity of more than 18% broken connectivity of

this species breed. Based, on the analysis result of the properties of rocks of different genesis us a table 1, of values of physical and mechanical properties of rocks occurring mainly in the areas of influence of tectonic disturbances.

As follows from the results shown in the table, the highest densities have breed of thermal metamorphism. The highest values of the compressive strength of rock have dynamo thermal metamorphism, quartzites and schists, the tensile strength of rock thermal metamorphism the contact hornfels and skarns. A distinctive feature of rock deposits in the zones of tectonic faults is that the depth of the well is observed variations in the strength characteristics, and set pattern of change of the strength characteristics of the rocks on the depth of the hole is not possible. (Fig. 2)

Table 1 The average value of the physical and mechanical properties of rocks, occurring mainly in the areas of influence of tectonic disturbances.

| Types of metamorphism | Name of rock | Properties of rocks | | |
| --- | --- | --- | --- | --- |
| | | Density γ, t/m³ | Compressive strength σ_c, MPa | The tensile strength of σ_r, MPa |
| Dislocational | granitoids | 2,46-2,73 | 50,7-292,5 | 2,02-11,70 |
| | sandstone | 2,48-2,67 | 59,0-292,5 | 2,36-1170 |
| | tectonic breccia | 2,41-2,71 | 68,1-192,5 | 2,72-7,70 |
| Thermal | the contact hornfels | 2,68-2,73 | 48,1-68,6 | 9,1-18,3 |
| | skarns | 2,85-3,45 | 63,5-259,9 | 7,8-23,4 |
| | gneisses | 2,51-2,82 | 46,6-167,5 | 4,5-15,3 |
| Dynamo-thermal | quartzites | 2,50-3,21 | 75,8-231,6 | 3,03-9,26 |
| | crystalline schists | 2,59-2,63 | 75,0-155,0 | 3,0-6,2 |

Tectonic faults in the form of thrusts, change the structure, composition and physical properties as the surrounding rocks, and rocks mineralized zone, ascending rock fracturing, which in turn leads to changes in geomechanical environment, which is reflected in the decrease in the stability of geotechnical objects on a slope. [3]

Consequently, given that the rocks of Kyrgyzstan are subject to shear metamorphism, should take into account when assessing the properties of stability pit walls and slopes, roads on the slopes while crossing the track of tectonic disturbances. Geomechanical classification of rock masses are the basis of the empirical approach to evaluate their resistance and are

widely used in the design of various objects. approach to evaluating the stability of pit underway rating geomechanical classification called "systems of quality assessment of the environment."
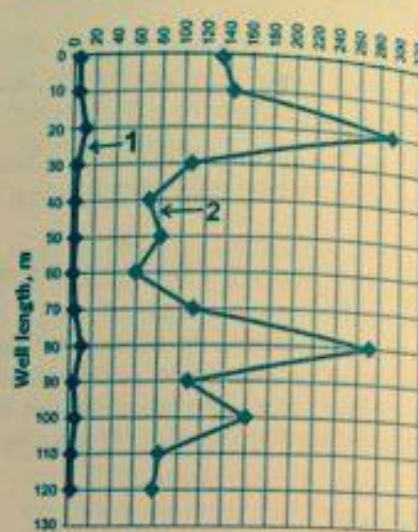


Fig.2    Changes in strength properties of rocks with depth: 1 - The tensile strength of; 2 – Compressive strength;

The main areas of improvement are records of tectonic stresses in a massif of rocks, and the development recommendations for choosing the design parameter of the open systems development based on the assign rating. (Fig. 3)
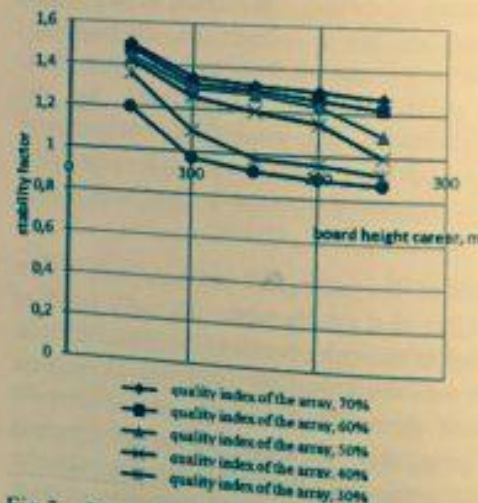


quality index of the array, 70%
quality index of the array, 60%
quality index of the array, 50%
quality index of the array, 40%
quality index of the array, 30%

Fig.3    Depending on the angle of stability fact   of the slope and the quality index of the array

Development of upland fields open metho     mposes certain features of the parameter assignment o    er the maximum depth and the angle of the general     walls For these quarries of great economic im    rtance general slope angle side: a decrease of 2-30 le    to an increase in the total volume of overburden from     to 10 mill.m³ per kilometer perimeter of the quarry d    th of

about 150-200 m, an increase in the cost of work on the extraction and transportation of rock mass.

## 2 CONCLUSIONS

Thus, the height of the edge of the pit (depth) at which ensures its stability, the development of upland fields open pit should not exceed 300m.

Exceeding this value leads to disruption of the stability of the board in the form of talus, windfalls blocks breed some cases, the loss of the overall sustainability of the board. However, as follows from the dependences of the stability of the height of the board and its angle of repose, the dominant parameter is the angle of pit walls. A distinctive feature of the massif is, what rock has high compressive strength but low tensile strength, which indicates their high brittleness

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