Geomechanical parameters and petro graphical investigate the tunnel rock mass of Chehelkureh copper mine

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Abstract: Chehelkureh copper mine project at hand is about 110 kilometers northwest of Zahedan. Because of the depth of the bulk of the ore mining, underground mining method for extracting it has been selected. Firstly, geomechanical parameters of rock mass using in situ experiments and empirical formulas obtained. The results show that by increasing the mineral quartz, uniaxial compressive strength trend is clearly upward. This also applies to the mineral calcite but irregular trend exists and is equal percentages of different compressive strength. Iron oxide reduces the compressive strength but less than 10 per cent of their impact resistance loses. Feldspar minerals appear only in specific cases and in some cases increased the compressive strength was not impressive. Clay minerals causing downward effect on the charts and uniaxial compressive strength decreases. Modulus increases with increasing quartz. Modulus increased with an increase in the percentage of the mineral calcite is between 20 and 25, the connection is lost and high modulus changes.

Key words: *Tensile strength; Petrographical characterization; Geomechanical parameters; Chehelkureh mine; Uniaxial compressive strength*

1. Introduction

Mine works geological knowledge base. In exploring geology, exploration and mining has an important role. However, without knowledge of the geological past (as of today) small amounts of mineral exploration and mining geology and mining but today are impossible to separate from each other. Furnace deals. Understanding the physical properties, mechanical engineering and rock engineering projects is the basic requirement. Although primarily on engineering projects, one of the most important parameters of uniaxial compressional resistance is required. But the tensile strength of rocks as well as one of the engineering properties of rocks is important. For example, the tensile strength of the rock tunnel after a great influence on the stability of the tunnel. There are generally three methods for determining the tensile strength of rocks are determined by direct pull tensile strength of rock, Brazilian test time point, the last two as an indirect method to determine the tensile strength of the rock. Because of the difficulty and high cost of direct method to determine the tensile strength, usually indirect methods are preferred.

Chehelkureh Copper because of various rocks and tectonic forces at the regional and local scale has been selected for the study.

The geographical location of the study area:

Chehelkureh copper deposit in south eastern Iranian province of Sistan and Baluchestan, Zahedan

is located 120 kilometers North West. The average height of 1600 meters above sea level is. As can be seen in Figure 1, access to the area is via paved roads Zahedan to Bam, which is 51 km, in an area called Black Hill, on the north side of the isolates and 25 km to the mine and further away from the village, 44 km to the mouth of the garden continues.

2. Research Methodology

This thesis is based on library studies, field and laboratory, which this study is based on maps, aerial photos, reports and research papers on the subject have been conducted. The field visit of the site and plans for a full review of data for the start of the study was carried out. Based on the collected samples, 5 samples were taken from the tunnel. The thin sections were prepared for microscopic examination. Samples were prepared to study engineering characteristics and mechanical tests in the laboratory of Rock Mechanics and Soil Mechanics Laboratory of Zahedan University of experiments were carried out. The results of these experiments were analyzed and concluded.

3. Geology:

The area under study is part of the flysch is always a mixture of ophiolite East. Profile on the Chehelkureh 1: 100,000 map in three nearly parallel to the North West, South, South East, respectively. In the Upper Cretaceous continental rift was probably part of the area in which the gadget flysch sediments deposited, ultrabasic and basic rocks of the

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basement area is formed. Then interlace movements caused by deposits of sedimentary rocks above (flysch always) has the overall composition is affected by the fault movement. Late Cretaceous and early Tertiary eventually move is done. Paleocene

sediments are sometimes incoherent and inconsistent mix of ophiolite rocks is located on the sea at this time to indicate progress.
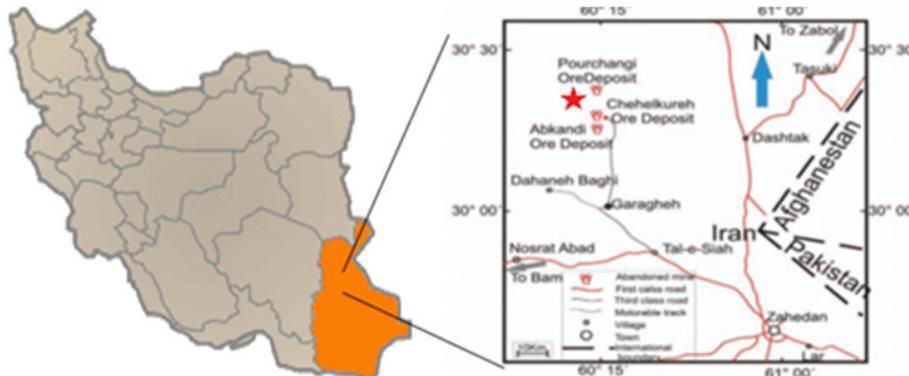

Fig. 1: Geographical location and ways to access to the Chehelkureh copper deposit

Young volcanic rocks and Pliocene conglomerates were poor as the movements of tectonic faults are more conglomerate. Big Khani fault (Neh fault the eastern branch) with the North - South and North-West-South-East Chehelkureh fault with the major faults in the region. Based on the geologic Chehelkureh 1:100,000 map (Valeh and Saeedi, 1988) outcrops of rock units within Chehelkureh Eocene and includes two units (Efl alternately green and gray shale and sandstone) and Esd1) yellowish brown sandstone (is. one of the main part of the range allocated to the second unit is located in a small outcrops (Fig. 2).
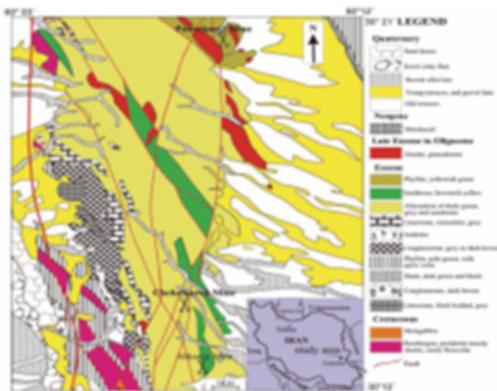

Fig. 2: Chehelkureh regional geological map (derived from the geological 1: 100,000 Chehelkureh map by Valeh and Saeedi, 1988)

4. Laboratory studies

5 examples of each tunnel parameters were selected based on lithology variations, then thin sections were prepared from each of the minerals were obtained.

5. Microscopic studies

Selected samples, thin sections were prepared and studied, then a diagnosis of refractory ores and rocks of unknown two tunnels and their influence on the tensile and compressive tests (uniaxial), respectively. The main mineral constituent of all samples, including quartz, iron oxides, calcite and clay. In most sections, granular texture was observed. Mineral quartz mostly silent wave and in some cases direct blackout. Smashing high-forming minerals indicative of too much tension in the region.

6. Geomechanical parameters of rock mass

6.1. Rock mass classification (RMR)

Geomechanical classification or rock mass rating (RMR), the classification by Bieniawski, (1972) is presented.

Table 1: The volumetric of minerals in the samples

Type of rock	Q	FL	CaCO$_3$	FeO	Mo	M-C	Total
Chertarenit	71	0	24	5	0	0	100
Quartzarenite	51	8	21	20	0	0	100
Siltstones	37	0	12.8	26	0	24	99.8
Mudstones	35	0	15	5	3	42	100
Fine grained sandstone	59	9	15	9	8	0	100
Calcareous sandstone	45	4	22	5	4	20	100
subarkos Sandstone	45	20	20	15	0	0	100

Table 2: The tensile strength and compressive samples taken from area

Type of rock	The compressive strength of sedimentary rocks	Brazilian tensile strength
Chertarenit	36.476	5.497
Quartzarenite	72.953	5.881
Siltstones	11.658	2.482
Fine grained sandstone	44.582	2.563
Calcareous sandstone	47.284	8.607
subarkos	67.549	7.916
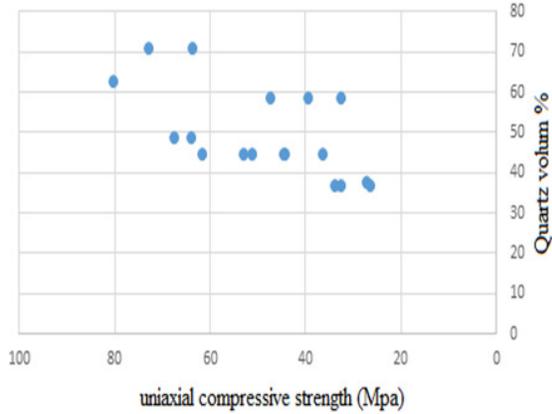
Fig. 3: Volume percent mineral quartz, the changes uniaxial compressive strength (upside is obvious pattern changes).
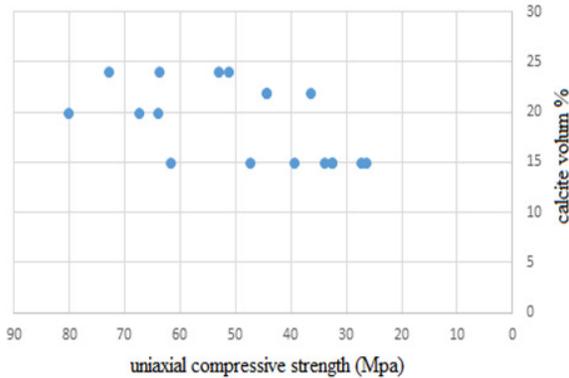

Fig. 4: Volume of percent calcite mineral, against changes uniaxial compressive strength (uptrend pattern changes is obvious).
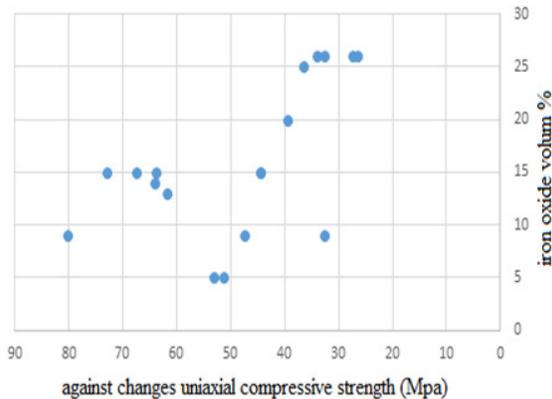

against changes uniaxial compressive strength (Mpa)

Fig. 5: Volume of percent iron oxide, against changes uniaxial compressive strength (trend change is evident).
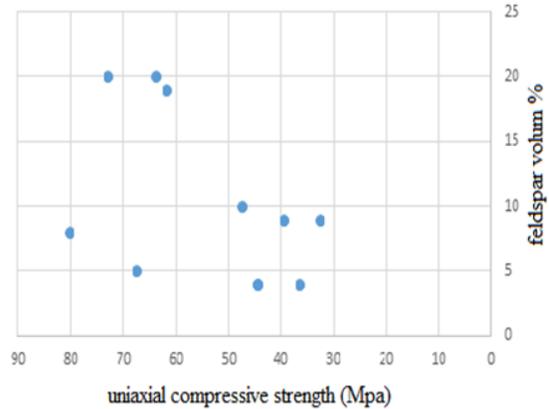

Fig. 6: Volume percent mineral feldspar, against changes uniaxial compressive strength (irregular trend changes).
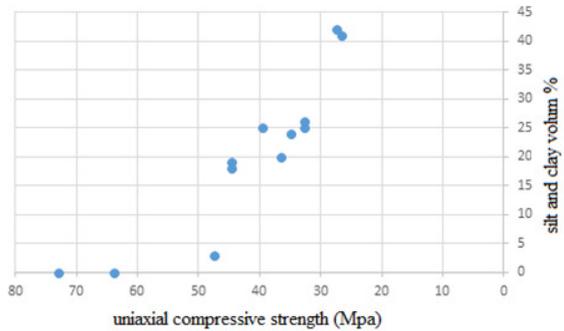

Fig. 7: Volume percent of silt and clay, the changes uniaxial compressive strength (trend change is quite obvious).
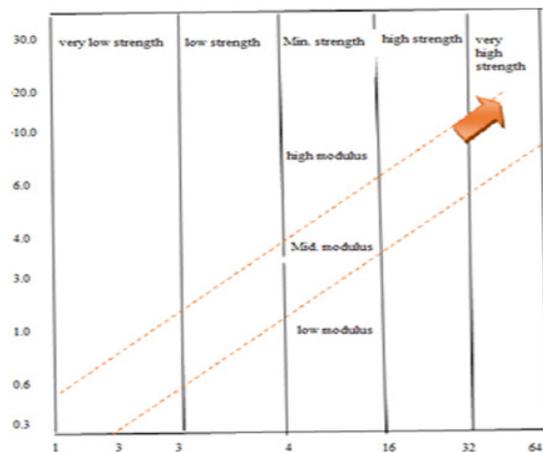
Fig. 8: Classification of rocks, represented by (Deere & Milller 1966); that the uniaxial compressive strength and

elastic modulus ratio as the ratio of the modulus is considered.

7. Conclusion

The parameter of graphs that show volumetric of minerals and rocks with compressive strength increased mineral quartz; uniaxial compressive strength of the trend is clearly upward. This also applies to the mineral calcite but irregular trend exists and is equal percentages of different compressive strength. Iron oxide reduces the compressive strength but less than 10 per cent of their impact resistance loses.

Table 3: The coefficients calculated shear strength geomechanical classification, for rock masses of the study area

Describe the type of stone	RMR	Class	Cohesion (K.Pa)	Internal friction angle (degrees)
Medium rock	53	III	200-300	25-35

Table 4: Calculation of parameters of rock masses geomechanical study area using Rocklab software

Describe the type of stone	$\sigma_{Ci}\,(MPa)$	GSI	rock mass parameters			
			$C\,(kPa)$	$\phi\,(°)$	$\sigma_{Cm}\,(MPa)$	$E_m\,(GPa)$
Medium rock	64.11	38-48	629	46.24	8.515	5.18

Feldspar minerals appear only in specific cases and in some cases increased the compressive strength was not impressive. Clay minerals causing downward effect on the charts and uniaxial compressive strength decreases. Bivariate plots of the percent volumetric change in the modulus of elasticity of the samples show here that the quartz modulus increases with the increase. Modulus increased with an increase in the percentage of the mineral calcite is between 20 and 25, the connection is lost and high modulus changes.

Reflects changes in iron oxide minerals is not lawful under twenty as the percentage increase in the percentage of the top twenty but the modulus decreases. Feldspar minerals diagram, showing the absence of law and order and disorder, indicating no effect of this mineral in the module.

References

Aghanabati, A., 2005, Geology of Iran, Geological Survey of Iran, Tehran, Iran, p.619.

Basu, A., Celestino, T.B. and Bortolucci, A.A. (2009) Evaluation of rock mechanical behaviors under uniaxial compression with reference to assessed weathering grades. Rock Mechanics and Rock Engineering, No. 42, pp73–93.

Berbrian M., King G.C.P., "Towards apaleogeography and tectonoic evolution of Iran",Conadian Journal of Earth Sciences 18 (1981) 210-265.

Bieniawski, Z. T.,1978, Determinig rock mass deformability: experience from case histories,. *Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 15:237-247.*

Camp, V. E. &Griffis, R. J., 1982, "Character, genesis, and tectonic setting of igneous rocks in the Sistan Suture zone, eastern, Iran", Lithos, Vol. 15: 221-239.

Eberhardt, E., Stimpson, B. and Stead, D. (1999) Effects of grain size on the initiation and propagation of thresholds of stress induced brittle fractures. Rock Mechanics and Rock Engineering, No.32, pp 81–89.

Miskovsky, K., Taborda, Duarte M., Kou, S.Q. and Lindqvist, P.A. (2004) Influence of the mineralogical composition and textural properties on the quality of coarse aggregates. Journal of Materials Engineering and Performance, No.13, pp144-150.

Tuğrul, A. (2004). The effect of weathering on pore geometry and compressive strength of selected rock types from Turkey. Engineering Geology, No.75, pp 215–227.

Valeh, N. and Saeedi, A. , 1988, Geologic map of the geology of the mine CHEHELKUREH,page 8050F. Vernon, R. H., 2000, Review of microstructural evidence of magmatic and solid-state flow. Electronic Geosciences, 5:2.

Vasconcelos, G., Lourenço, P.B., Alves, C.A.S., Pamplona, J. (2008) Experimental characterization of the tensile behavior of granites. International Journal of Rock Mechan- ics, Mining Science 45, pp. 268–277.