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Temporary (Short-Term) Mining Workings Stability

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ABSTRACT: Rational coal and metal underground mining methods are used and there are correlations between the mining spaces, characteristics of surrounding rocks and the mining depths. In a generalized representation, the temporary mining workings in Albanian coal mining together with the respective RLI (Rock Loading Index) values are presented. An analogue analysis of different mining workings used İn metal mines (Cr, Cu, Fe-Ni) is introduced.

Albanian mining activity over the last half century has mostly concentrated on underground metals (Cr, Cu, Fe-Ni) and coal mining. The respective mining situations and the consideration of their RLI (Rock Loading Index) in time are illustrated in Figure 1.

Such a correlation has been shown frequently (Sauku, 1992, 1994) as a more representative form for the relative stability of mining workings used as layout, development and extraction. Meanwhile, the expression of RLI is:

$$RLI = \frac{k_n \gamma H}{\sigma_c} \qquad (1)$$

where:

k_n - probable stress concentration coefficient around the working;

Y - rock mass density, kN/m3

H - mining depth, m;

a_c - uniaxial compression strength of rocks, kN/m^2.

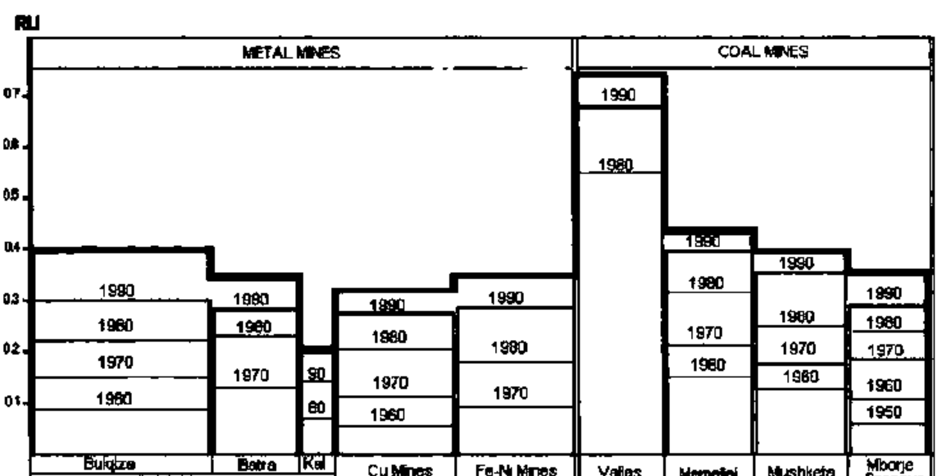

Figure I. RLI changes accordingto exploitation time in metal and coal mines (width is related to quantity of workings in each mme or mine group İn %).

For each mine, after the studied and projected exploitation methods (A.A.C.M.M., 1985), three mining methods are proposed or applied by time, in different mining conditions, determined particularly by the increase in exploitation depth.

A generalized representation of coal seam mining by coal extraction in slabs of different widths (B) shows that slabs become gradually narrower by their application at deeper levels and by their RLI growth.

As can be seen in Figure 2, using mining data for graphical expression slab width - RLI, a mathematical correlation is observed, analogue at a compression low:

$$B \times RLI = cons. = c \qquad (2)$$

Actually it is a belt of data, included in two curved delimiting Unes of two constants, ci = 1.2 and C2 = 1.5.

Such a phenomenon is also observed İn ore exploitation mines, where similar working methods by slabs are used. In each case, the slab width is reduced in higher RLI conditions.

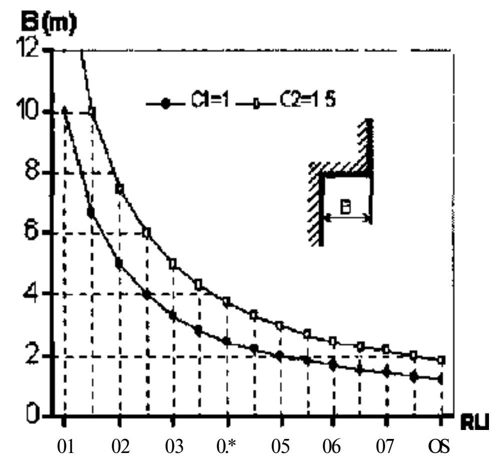

Figure 2. Adiabatic correlation B - RLI in coal mining

Meanwhile, it is observed mat for higher values of RLI (usually for RLI > 0.3), the rock mass deformability in time around the working space clearly increases.

The mechanization of coal or ore breaking and transport at the working space diminishes the time of the extraction. Hence, the same activity of the respective extraction working, or the temporary existence of the working diminishes. Such operations are indispensable for better control of the working space and of all the temporary exploitation workings used.

In support design calculations (C. Biron & E. Arioglu, 1983) (J. Lat&A. Iliev, 1993), the possible time calculation of the worked space fillings in a parallel line (in coal and metal mines) is presented. A calculation method for the probable pressures and rock mass deformations İn time is applied. The aim is to determine the reaction force and the deformations of the powered supports used.

In an advancing longwall support system for extraction with a given speed a temporary stability of all me respective workings must be ensured. Thus, it is possible to use the calculation method of the rock mass pressures and deformations developed in time (H. Sauku, 1994).

Considering the problem calculable İn an analogue way as the calculation of the "self support time" of rock masses around a working deformable in time (TS), the time of the temporary stability for the given reactive conditions may also be evaluated, as force and deformation by the support systems used (Sauku, 1995).

Commencing with the condition:

$$q_{max} > q_t > q_0 \qquad (3)$$

where:

qi - applied reaction force by time of the support system used;

qo - contact rock structural block action from roof rocks (q_0 = *y* bo, y - rock density, bo - rock block thickness;

maximal possible reaction for a higher arch raising *(b_{max})* on an exploitation working.

Table 1 Some mining characteristics İn coal mining

Coal	Mining depth, m	Slab width, m	Slab length, m	$RLI=YH/O_c$
Mborje D rénove	200	8	50^H)	0 15-0.16
Mborje Drenove	500	6	50-40	0 33-0 36
Memaliaj	200-400	6-4	60-50	0.13-0 36
Krrabe-Mushqeta	150-350	6-4	60-50m	0.14-0 30
V alias	120-160	Working space 4-2.6m	Longwall face !00-70-50m	0 6-0.8

In the case of q_t = qo, the maximal self support time of the surrounding rocks is calculated by:

$$t_s = \ln\left[(1-r_0)^{-1}\right] z^{-1} \quad (4)$$

where:

$$r_0 = \frac{q_0}{q_{max}} = \frac{b_0}{b_{max}} \quad (5)$$

Such a method of calculation was first presented in "Calculation Method of Critical Depths" with their evolution in time (Sauku, 1992, 1994, 1999), where:

$$z = k_{pl} k_n \frac{\gamma H}{\sigma_c} \quad (6)$$

for time in months.

kp] - rock mass plasticity.

An example of Ts calculation for an evaluation of the probable dispersion of the temporary stability of workings in coal and metal mines (Cr, Cu, Fe-Ni mines) by Albanian mine practice, represented by more evolved workings in depth can be given as follows:

a) calculation of representative data from different mines and workings;

b) selection and systematization of the results for r, z values and Ts calculation of different levels and workings in them;

c) calculation of the support systems useable at each temporary working;

d) a representative graph may be used for a generalized view of the mining situation in all relevant mines and another graph may by used for the workings opened at deeper levels of individual mines.

In Albanian metal and coal mines, we have the situation generalized in Table 2.

The representative graph for the situations observed and described İn Table 2 is given in Figure 3.

There are three different conditions of temporary workings in activity: low stability (Ts = 0.1 - 0.3), normal stability (Ts = 0.3 - 0.6) and high stability (Ts > 0.6 months), which indicates the low stability of temporary workings.

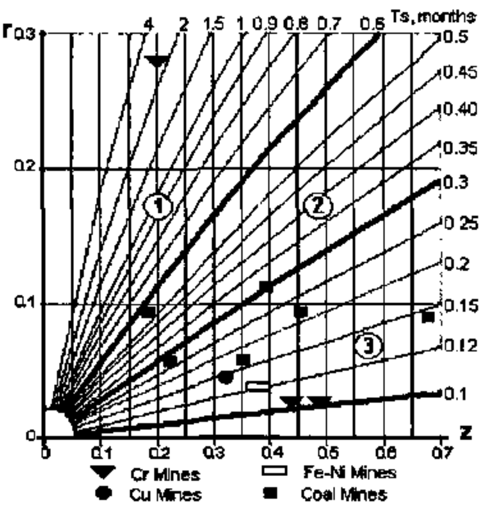

Figure 3. Temporary mining working stability: I. high stability, 2. normal stability, 3. low stability.

Table 2. General data on temporary workings.

MINES			Mining depth	RLI	Space elements, m			Parameters		T, values months
					B^x.n,	B, m	bo, m	r	z	
METAL MINES	Cr Mine	Bulqiza	800	0.37	31.7	25	1.0	0.05	0.44	0.116
		Batra	800	0.35	12.5	12	0.6	0.044	0.40	0.120
		Rragam	300	0.188	3.47	25	1.0	0.289	0.128	2.74
	Cu	Gjegjan Kurhnesh	300	0.25	5.35	5	0.25	0.047	0.33	0.14
	Fe-Ni	Prrenjas Guri i kuq	300	0.35	12.57	12	0.6	0.048	0.40	0.12
COAL MINES	Mborje-		200	0.18	8.4	12	0.5	0.059	0.216	0.15
			500	031	8.72	8	0 5	0 057	0.35	0 18
	Kiraba-Mushoeta		200	0.167	4.03	6	0.4	0.099	0.20	0.50
			350	0.292	3.61	4	0.4	0.110	0.40	0.28
			400	0.384	4Sft	4	0.4	0 0%	0 4ft	0 71
	Vali as		160	0.74	2.72	2.6	0.4	0.147	0.85	0.173

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