THE RATIONAL PARAMETERS OF THE TOP CAVING LONGWALL FACES IN THE CONDITIONS OF JIU VALLEY – ROMANIA COALFIELD

Iosif ANDRAS, Nicolae ILIAS, Sorin RADU, Ph.D., Mihael MELCZER.

Abstract: *The top caving mining method is a high productivity technology being more and more widely used worldwide. In order to implement this method in Jiu Valley coalfield, the rational parameters of faces were determined, such as: the mining height, the hanging block height, the shifting between two adjacent slices, as a function of the different categories of mining conditions (seam thickness and slope, mining depth, physical-mechanical properties of surrounding rocks and coal, the mining method etc.). The paper deals with these calculation using deterministic and FEM modeling.*
Key words: *coal mining, top coal caving, mining methods*

1. PRESENTATION OF THE SUBLEVEL CAVING MINING METHOD

In the figure 1 the conceptual scheme of the sublevel caving method is presented, a special attention being accorded to the different zones of the area of influence of the face:

In vertical plane the face cutting zone, (F) with height Hf and the caved zone, (S) with height Hs.

In the horizontal plane, the virgin coal zone (I), the cut slice zone (II in F and III A in S), the supported caved block zone (II in S), the fractured coal harvesting zone (III B in S) and the goaf zone (IV). The face empty zone (F) is the space occupied with equipment and man. The horizontal dimensions of the mentioned horizontal zones are p1, the slice width, p2 the overall face width and p3 the caving area width.

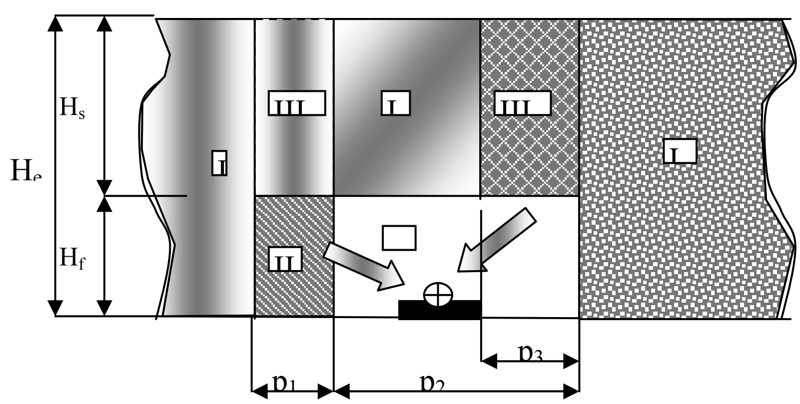

Fig.1. The conceptual scheme of the sublevel caving face

They are many versions and sub-versions of this mining method are the same. The seam (or slice I) of height H_e is mined in the following manner.

The zone II, of height H_f and thickeners p_1 is mined by conventional methods (shearer-loader or drilling-blasting method. After a few steps of conventional mining cycles, a caved block III of height H_s and thickness p_2 results, which consists of the hanging compact block III_A and the fractured block III_B.

The fractured coal from the zone III_B, of height H_s and thickness p_3 is removed into the space of the face F, supported with individual props or powered supports, and handled toward, the face end and rather towards the surface by the means of the face conveyor or an additional conveyor.

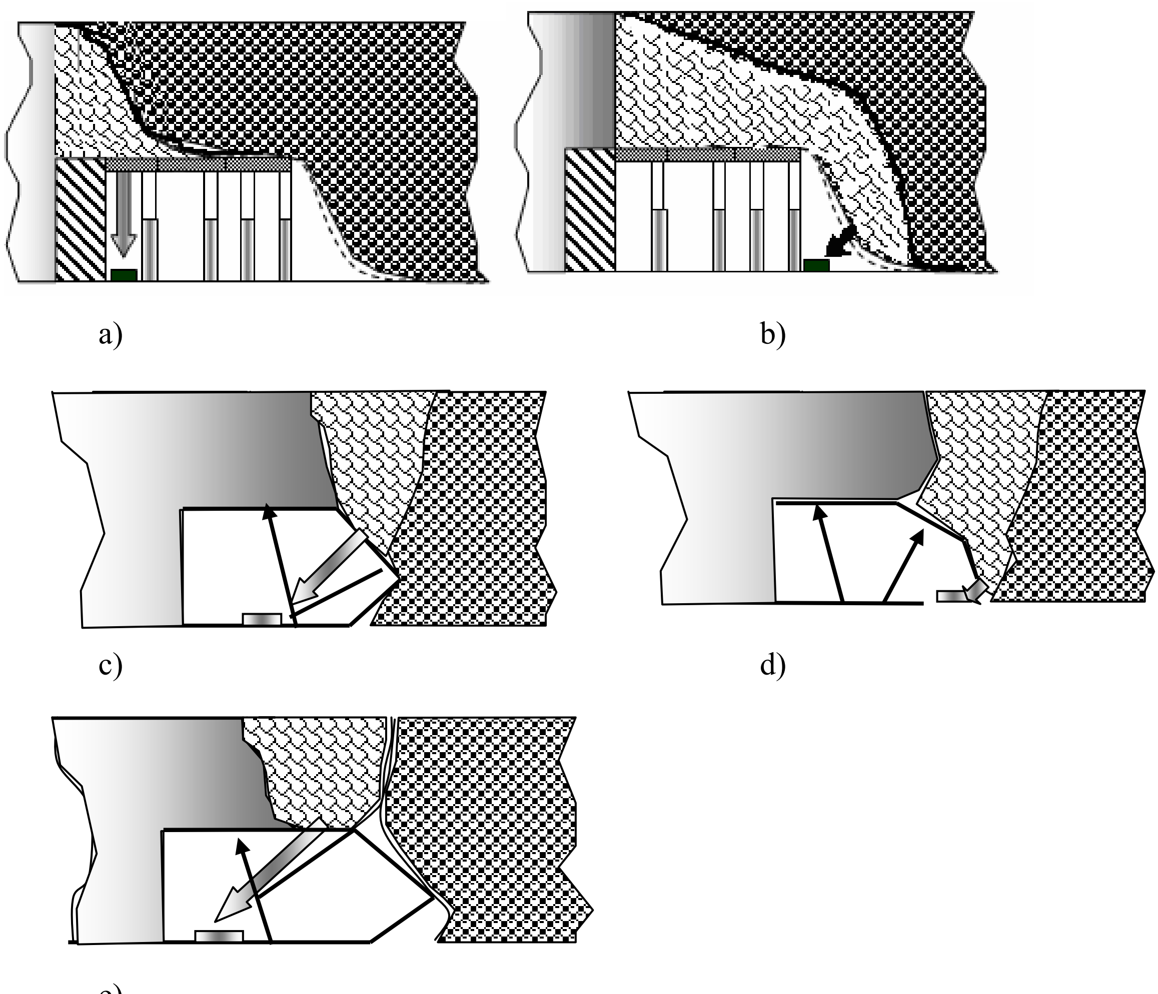

Fig. 2. Different situations of removing the coal from caved block: individual props support , coal harvesting at a) front, b)cap, powered support, coal harvesting at c)shield, d)cannopy e) under shield

Regarding the position of the fractured caving block, relative to the support and the plan of harvesting the caved coal we can have one of the following situation (fig.2).

Despite the method used, the following non-dimensional parameters are relevant:

- The ratios H_s/H_f or H_e/H_f
- The ratios p_3/p_1 and p_3/p_2.

2. APPLICATION OF THE METHOD

In the Jiul Valley coalfield, a variant of sublevel caving method is utilized, using individual hydraulic props and seteel caps, the main working stages being presented in the figure 3.

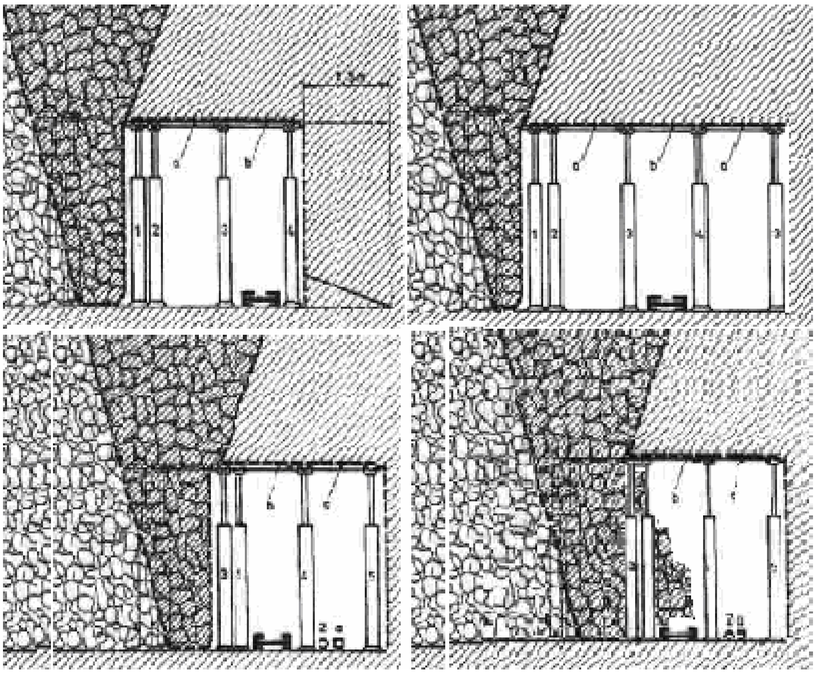

Fig. 3 The stages of Top caving method used in Jiul Valley coalfield

Stage 1 –face coal cutting, using explosives and/or pick hammers, with a web of 1.25 m (fig3, top-left);

Stage 2- supporting the mined slice roof, with hanging caps and steel props. (fig.3 top-right) ;

Stage 3- removal of rear props and caps gradually on the length of face;

Stage 4 – harvesting of top coal by windows opened in the wire grid in many points at 15 m distance interval. After dismantling and moving the scarper conveyor to the new front line, a new cycle can begin.

For the condition of Jiul Valley coalfield there were delivered two versions of the method, one for seams with slope less than 22 degrees and other for seams with slope over 45 degrees. The firs version has two subversions, for natural or artificial roof. The main characteristics of the versions are described in table 1

Table1

CONDITION of USE	**VERSION**		
	V1 (natural roof)	**V2** (artificial roof)	**V3** (artificial roof)
Seam slope	max. 22 grades	max. 22 grades	min 45 grades
Minig height Ho	max 10 m	max 12,5 m	max 10 m
Caving height Hs	max. 7,5m	max. 10 m	max. 7,5 m
Cavability	medium/high	medium/high	medium/high
Support	3 caps	3 caps	3 caps
Coal recovery grade	min 85%	min 85%	min 85%

Conclusions

The advantages of the method for the conditions of top coal caving are the following:

- it can be implemented under actual technological endowment in quasitotality of existing coal mines of the area without major investments;
- requires no special training of workforce;
- lead to improved technical economical indicators compared with the classical mining methods.

The disadvantages of the method are :

- geomechanical phenomena occur more frequently that in case of classic methods;
- loss of coal (low recovery index), increasing with the increase of caved height;
- self ignition hazard of coal reminded in the goaf.

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