УДК 622.831.322

JURAJ B.ĎUROVE, *PhD in eng. sc., professor, juraj.durove@tuke.sk*
Technical University of Košice, Slovakia
JÁN HIJJ, *PhD in eng. sc., director, jankah@chello.sk*
Regulatory Office for Network Industries, Bratislava, Slovakia

Ж.В.ДУРОВ, *канд. техн. наук, профессор, juraj.durove@tuke.sk*
Технический университет в Кошице, Словакия
Ж.ХИЖ, *канд. техн. наук, директор, jankah@chello.sk*
Офис сетевой промышленности, Братислава, Словакия

PROGNOSIS AND EFFECTIVE PREVENTION OF ROCK BURSTS IN UNDERGROUND COAL MINES IN SLOVAKIA

The mining activities in the territory of Slovakia have a long history. The mining technique got a fast development in the last centuries. This paper deals not only mining history but also investigation of stability of the rock massif by underground brown coal mining from safety raise and protection of miners' point of view and sustainable development of mining industry in the Slovak Republic.

***Key words*:** underground coal mining, prevention of rock burst, complicated geological conditions, fully mechanical support.

ПРОГНОЗ И ЭФФЕКТИВНОЕ ПРЕДОТВРАЩЕНИЕ ГОРНЫХ УДАРОВ В УГОЛЬНЫХ ШАХТАХ СЛОВАКИИ

Горно-добывающая деятельность на территории Словакии имеет длинную историю. За последнее столетие получила быстрое развитие горно-добывающая техника. В настоящей статье не только рассматривается история горного дела, но и приводятся результаты исследований устойчивости породного массива при подземной разработке бурого угля для повышения безопасности и охраны здоровья горнорабочих и стабильности развития горной промышленности в Республике Словакия.

Ключевые слова: подземная разработка угля, предотвращение горных ударов, сложные геологические условия, полностью механизированная крепь.

Concise of Slovak mining history. The mining of minerals in northeastern of the Danube River, in the territory Bohemia – Moravia – Slovakia, was knowing during the ages. Charlemagne (Emperor of the Romans) extended his influence to these areas. He received the rich silver and gold mines of Schemnitz (now Banská Štiavnica) and Kremnitz (now Kremnica), actually about 80 miles northeast of Bratislava, in present day the Capitol of Slovakia*.

The reopening old mines was the starting signal for further mineral exploration and such as new cultural trends – renaissance. As precious metal production increased, there was renewed prosperity, bringing Europe out of the Dark Ages.

So later, Georgius Agricola shows in his work De Re Metallica a great attention to the mining in the territory of Slovakia**. In the connection with the gold mining in that time it is necessary to emphasize the fact that the «Dukát» coins struck from Kremnica belonged to the most valuable and searched coins inside as well as outside Europe and they had a great influence on the economic development of Europe. Unfortunately in 1443 the first rock burst with miner victims was recorded in the Kremnica Mine.

It was short historical view, but current data of Slovakian mining industry are based on

* *Gregory C.E.* A Concise History of Mining. Bratislava: Pergamon Press, 1980. P.12-16.

** *Hercko I., Novak J., Durov J., Fabian J., Maras M.* Georgius Agricola shows a great attention to mining of minerals in the territory of Slovakia in his work De Re Metallica: further mincaral exploration and precious metal production are anticipated in the Third Millenium. 1995. Slovakia. P. 91-96.

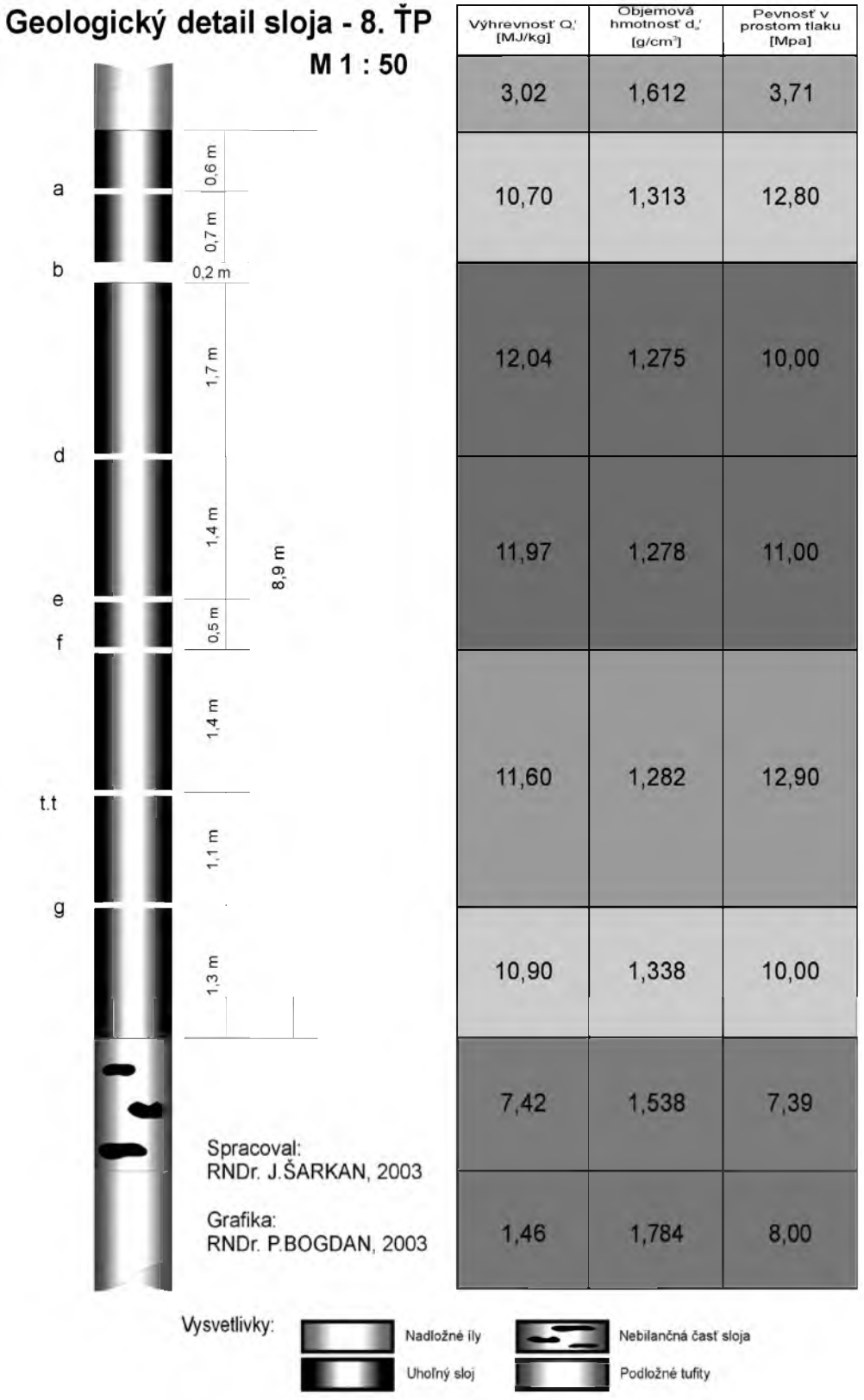


Fig. 1. Dril log of coal seam of 8,9 m thickness. The hanging – fine clay. The foot wall – tuffite (Columns: 1st – calorific value; 2nd – density moisture; 3rd – unaxial strength)

underground brown coal and magnesite mining as a surface mining of construction rocks. The negative phenomena Connected with underground coal mining, e.g. rock bursts and outbursts ranks among the factors that influence the safety of mining work.

Coal in Slovakia. The brown coal is mainly extracted in Upper Nitra Coal Basin. The deposit of coal is Miocene origin. There were coals seams created and in the next period by neovulcanics and its mechanical properties was more-less deformed and changed into various coalfields. Is needed to say that these deposits from geomechanical conditions points of view are differ of Proterozoic and Mesozoic deposits. Fig.1 illustrating coal seam features.

Thickness of sub-horizontal coal seams is between 4-22.5 m and the deep of seams is from 50 to 800 m. Basic data are: unaxial strength of coal is from 5 to 17 MPa and surrounding rocks (different types of clay or tuffite) have this strength only from 3 to 7 MPa. Present exploration works are performed between 180-420 m under surface. Into this differentness we may look for causality of rock bursts there are coming from overhead (rock ceiling). The coal seam is most strength component unit of surrounding rocks and therefore by mining is necessary to remain some part of coal in the roof of seam and clay rocks certainly yes (Fig.2). The safe of thickness of clay rock is very emergency for effective prevention of rock burst. Therefore the attention is being paid to the question of the prognosis and effective prevention of these phenomena (Fig.3).

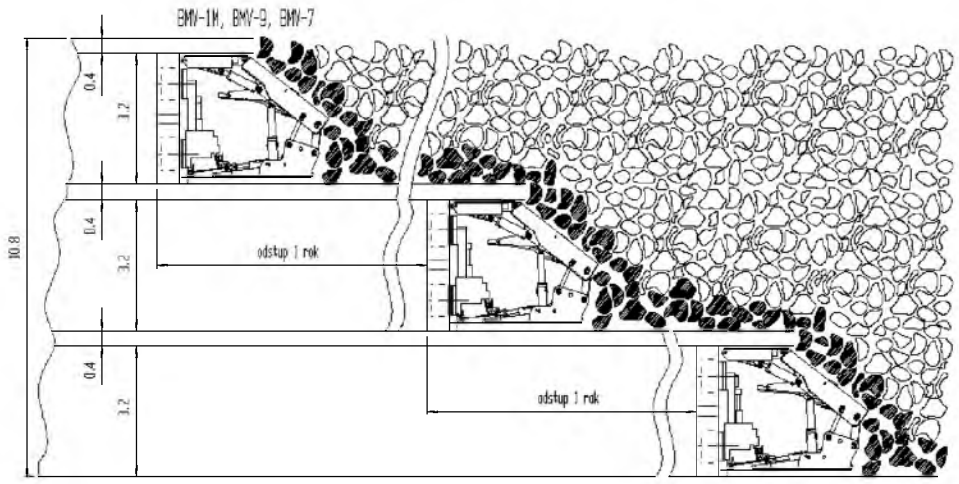


Fig.2. Long-wall mining of might coal seam using benches

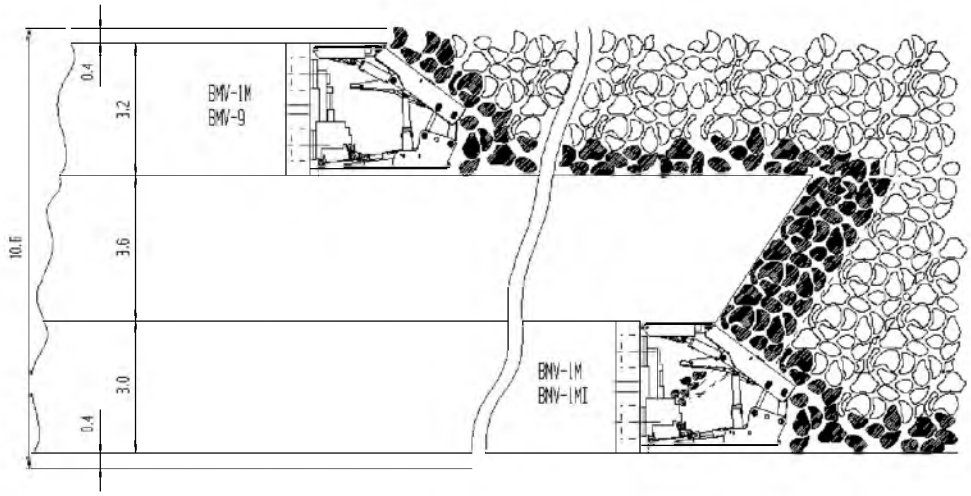


Fig.3. Long-wall mining of might coal seam by extraction of roof plate located between benches

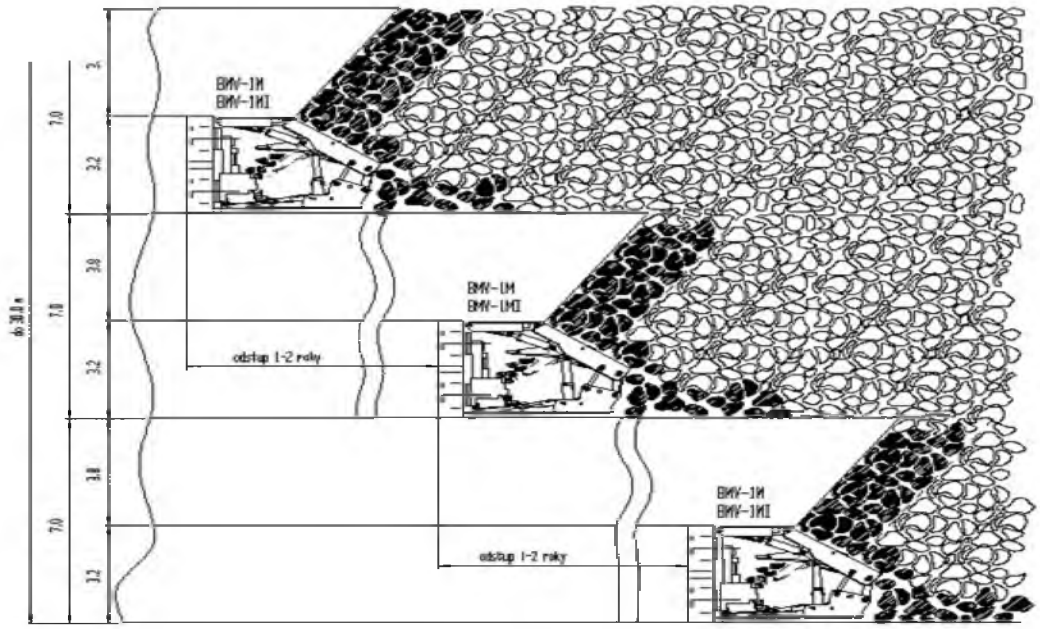


Fig.4. Long-wall mining of might coal seam by using 3 benches with roof plate of coal

Based on research and stability calculation of these phenomena in our Department was recommended of clay rock thickness in overhead 60 m. This recommendation is connected with coal mining methods as well (Fig.4).

A crucial indicator of level of extraction productivity is 18,90 tons per person in one shift. The technology is fully mechanized. Technological extraction of coal reached 83,8 % of deposits.

For policy on raw material in Slovakia two important acts were adopted. The Energy Act and amendments to the Act on Network Sector Regulation protect the environment for business activity in energy. Both legal standards judge electricity produced from domestic coal to be a product whose realization will be a priority. These documents acknowledge that extraction and distribution of coal has a future. On the other hand for future we are showing of non-traditional use of coal in Slovakia:

1) underground gasification and liquefaction of coal,

2) fluidized combustion of low-grade fuel,

3) use of brown coal and lignite for other than energetic purposes (chemistry, agriculture, etc.).

Conclusion. The prognosis of classical form of rock burst in mentioned conditions is based on:

1) geological and hydrogeological measurements in situ,

2) investigation of rocks in laboratory and in situ tests (to bore of hanging of coal seam),

3) verification of all results from risk of sudden rock burst and water point of view.

The effective protection against rock burst has been solved with:

1) use of mining technologies, which reduce the risk in dangerous working place,

2) proposal of personal protective apparatus of mineworkers.

The paper has been prepared within the MŠ SR VEGA Project No.: 1/0467/08.