



## STUDYING THE EFFECT OF STATIC STRESS TRANSFER ON THE SEISMICITY IN HARD COAL MINE

Maria KOZŁOWSKA<sup>1</sup>, Beata ORLECKA-SIKORA<sup>2</sup>, Łukasz RUDZIŃSKI<sup>3</sup>, Grzegorz  
MUTKE<sup>4</sup>

Hard coal mining conducted in Upper Silesia Coal Basin (Poland) induces strong and intense seismicity. In some mines in the region tremors reach magnitudes up to 4.0 (local magnitude derived from energy) and are thought to be of mining-tectonic origin rather than pure mining (Stec, 2007). Seismicity in the region is monitored by Upper Silesian Seismological Network and local, specific mine-oriented networks.

Seismic network of Bobrek-Centrum mine enables to detect and locate tremors occurring in this most seismic mine in the region. Currently performed exploitation of one of the coal seam crosses the axis of the Bytom syncline and induces intense and strong seismicity (Fig. 1).

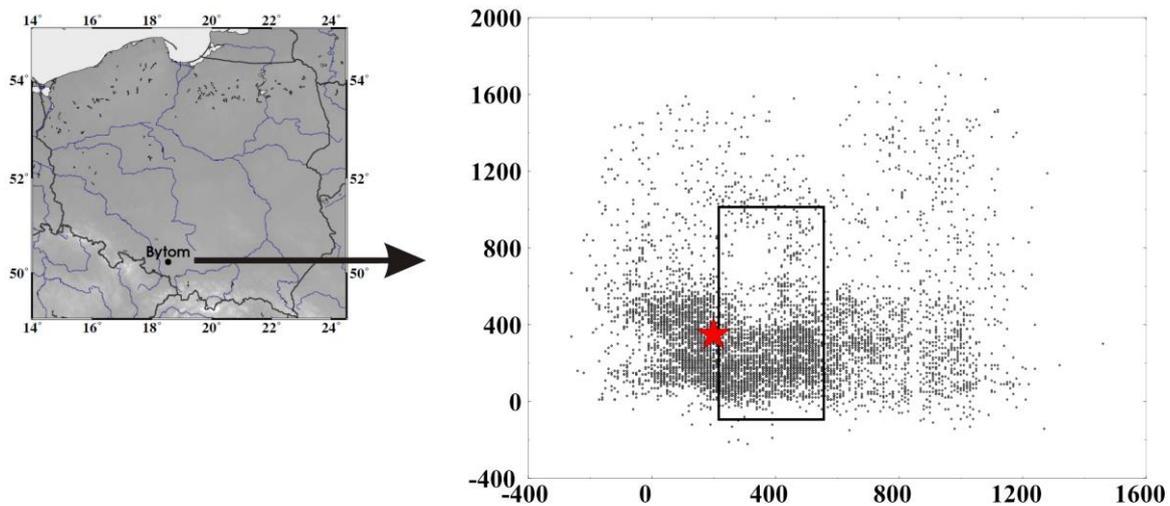


Figure 1. The distribution of seismicity in studied coal seam (right-hand picture) from 12.2005 to 07.2013 together with location of the Bytom city where the Bobrek-Centrum mine is situated (left-hand picture). Red star represents analyzed M3.7 event, black shape shows the contour of the mining wall exploited at the time when the event had occurred.

The depth and magnitudes range of tremors allow us to assume that their origin is twofold: pure mining and mining-tectonic (Marcak and Mutke, 2013). Present study focuses on the

<sup>1</sup> MSc, Institute of Geophysics Polish Academy of Sciences, Warsaw, mkozlow@igf.edu.pl

<sup>2</sup> Assoc. Prof., Institute of Geophysics Polish Academy of Sciences, Warsaw, orlecka@igf.edu.pl

<sup>3</sup> PhD, Institute of Geophysics Polish Academy of Sciences, Warsaw, rudzin@igf.edu.pl

<sup>4</sup> Assoc. Prof., Central Mining Institute, Katowice, gmutke@gig.katowice.pl

determination of primary inducing factor of the seismicity following strong event of M3.7 which had occurred in December 2009. To do this, the group of strong events, starting from M3.7 event, has been relocated. Also, the analysis of focal mechanisms of the events was performed and it indicated that events are rather of mining-tectonic origin.

The second question being studied is whether the seismicity distribution of strong events after M3.7 event is an effect of only mining-tectonic conditions or the stress transfer also affects it. To answer this question the Coulomb stress transfer analysis was performed. The analysis of the spatial distribution of strong events shows that most of them had occurred in the regions of positive stress changes following M3.7 event, which is, however, also the region a close epicentral distance from advancing mining front. The exploitation geometry and its effect on the seismicity is being studied.

## REFERENCES

- Marcak H and Mutke G (2013) "Seismic activation of tectonic stresses by mining", *Journal of Seismology*, 17:1139–1148
- Stec K (2007) "Characteristics of seismic activity of the Upper Silesian Coal Basin in Poland", *Geophysical Journal International*, 168: 757–768