DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

The underground exploitation of geo-resources has always been associated with numerous hazards depending on the type of raw material extracted, the depth of the deposits, or its geological structure and history. The specific anthropogenic hazards are also present in Legnica – Głogów Copper District (LGCD), Poland, where one of the biggest and the richest Cu ore deposit is mined. Three deep copper mines located in LGCD belong to KGHM, Polaka Miedź S.A. excavate the copper ore since the late '60s. Nowadays, one of the most important risk observed in this area is a very high seismic activity, connected with both depth of excavation level (in some mining panels more than 1200 m below the surface) and the tectonic involvement of the deposit.

Mining works in the LGCD affects stress and stability of the rock masses manifested as an induced seismicity. In LGCD more than 3 thousands seismic events with magnitude M>0.9 are recorded every year by different seismic networks. The most hazardous seismic events in mining induced seismicity are rocksburst and collapses inside mining tunnels. The nature of those phenomena are complicated and still unrecognized. To decrease the seismic activity and rocksburst hazard, several preventive methods are used. Based on long practices, the most effective procedure is the active prevention, consisting of blasting close to mining faces. It was noticed that after some time or even immediately after blasting, seismic activity increases. This established time called as 'the waiting time' - this is the time when there is no mining activity in the blasted panel. It is believed that stress realised during seismic activity in the waiting time significantly reduce the likelihood of tremor occurrence during common shift, when miners are working in the vicinity of the face. Currently, the only way to quantified the effectiveness of the stress reduction during the waiting time, is based on cumulative energy realised. On the other hand, the physical processes responsible for stress reduction during or after blasting, are still not clear. The most important question is: whether we can find any features which are common for events in the waiting time and if they exists, how they relate with physical parameters estimated for other, unexpected seismic tremors (spontaneous events occurred outside the waiting time). Our project aims at this kind of studies.

To answer the question, we are going to focus on the mining induced seismic events recorded on the Rudna mine, one of the LGCD mine. Comparing non-provoked, spontaneous tremors and the seismic sources occurred during the waiting time, we are going to find some characteristic features for both groups of seismicity. We believe that the interpretation of the results can increase scientific knowledge and the safety of the excavation process.

The studies will contain wide range of the synthetic tests with independent seismic networks and 'ideal' sources, including shear and non-sheared processes. The main part of the project will be focused on analysis of the source mechanisms and estimation of the source parameters such as: the scalar seismic moment and moment magnitude, the seismic energy, the static and dynamic stress drop, the apparent stress and seismic radius. For the calculations will be provided for events that occurred on the selected mining panels. We are going to used two different seismic systems: LUMINEOS – the surface network that belongs to Institute of Geophysics PAS, located above Rudna mine and in-mine underground seismic system operated by the mine. This approach gives an unique opportunity to describe processes responsible for seismic activity on the mining environments.

Our results will be valuable not only for mining seismology but also they will improve knowledge on the rock mass stability. Since we will be involved in the 'exotic' non-double-couple sources, which are rather specific for anthropogenic seismicity, the results could be very interesting for natural seismology, including volcano seismicity, seismicity, which also faced with non-double-couple earthquakes.