



Analysis of Pyhäsalmi mine microseismic data using EPOS Anthropogenic Hazard e-research platform applications

Jouni Nevalainen (1), Elena Kozlovskaya (1), Henrik Jänkäväära (1), and Timo Mäki (2)

(1) University of Oulu, Faculty of Technology, Oulu Mining School, Oulu, Finland. (jouni.nevalainen@oulu.fi), (2) Pyhäsalmi Mine, First Quantum Minerals Ltd. Pyhäjärvi, Finland. Person retired.

Pyhäsalmi mine, an underground copper mine at Pyhäjärvi, Finland, have experienced induced seismicity due to ore excavation for over half of a century. In the change of millennia the discovery of new VMS ore body, at a depth of 1000 meter to 1425 meters, moved the mining operation even to higher stress conditions that caused rock mechanical problems. The microseismic activity raised immediately after the construction of the new mine area began. In order to monitor the occurring seismicity, Pyhäsalmi mine acquired a passive microseismic monitoring network, designed by Institute of Mine Seismology (IMS), to automatically detect, localize and analyze seismic events. Over the years, the monitoring system has detected more than 250000 seismic events and these events have been manually reprocessed afterward for more detailed analysis. The stored seismic data includes the waveform data and calculated event parameters.

Pyhäsalmi mine data is one of the datasets that are integrated into EPOS Anthropogenic Hazard as an Episode, that is, a dataset created to describe induced seismicity phenomena in deep underground mine conditions. In addition to seismic data, the episode includes industrial data and geodata. The industrial data includes information such as mine quarry locations with time stamps, mine infrastructure and quarry blast information and technical reports. Geodata includes borehole lithology observations and basic geological information such as a bedrock map of the mine surroundings. The episode data was collected between October 2010 and March 2011.

In our study, the data of Pyhäsalmi mine Episode is analyzed using EPOS Anthropogenic Hazard e-research platform applications. These applications include variety of seismic analysis tools, ranging from basic individual seismic event analyses to statistical seismic group analyses. Our aim is twofold, firstly to determine single event parameters using the applications such as location and focal mechanism and compare those to the Pyhäsalmi mine catalog parameters which have been calculated using IMS Trace software. Secondly we make a seismic group analysis to study how the seismicity has evolved. This analysis is done for subgroups of seismic events sorted by magnitude of the events or by doing the analysis for specific time and location. One such an event of interest is a major pillar failure that occurred near the mine hanging wall on January 26th in 2011. This failure was well documented by Pyhäsalmi Mine Ltd. Aim is to determinate whether the seismic activity had any indications prior to the failure and how the seismic activity evolved after the failure. All the steps during the analysis are made using the applications in EPOS Anthropogenic Hazard e-research platform.