Geophysical Research Abstracts
Vol. 18, EGU2016-2515, 2016
EGU General Assembly 2016

Coseismic and aseismic response of the rock mass surrounding deep level mining operations

Alexander Milev (1), Raymond Durrheim (1,2), Makoto Naoi (3), Yasuo Yabe (4), Hiroshi Ogasawara (5), and Masao Nakatani (6)

(1) Council for Scientific and Industrial Research (CSIR), South Africa, (2) University of Witwatersrand (WITS), South Africa, (3) Kyoto University, Japan, (4) Tohoku University, Japan, (5) Ritsumeikan University, Japan, (6) ERI, University of Tokyo, Japan

This study is an attempt to characterize the rock mass behaviour around deep level mining excavations using high-resolution quasi-static and dynamic data. That includes: strong ground motion recorded in tunnels and stopes, tilt and strain recorded underground as well as acoustic emission events recorded close to an active fault.
The ground motion was compared to the coseismic and aseismic deformations. During the blasting time and the subsequent seismic events the strain and tilt show a rapid increase. Similar increase was observed during a strong seismic event. These were described as ‘fast’ seismic events or coseismic deformations. However, much of deformations occurred independently of the seismic events and was described as ‘slow’ or aseismic events.
The ground motion, generated by mining induced seismic events, recorded at the hangingwall of an active stopes has a maximum value of 3 m/s and was found to be 9 ± 3 times larger than the ground motion recorded in a solid rocks.
A number of simulated rockbursts were conducted underground and well recorded by dense array of shock type accelerometers placed along the blasting wall. The ground motion was found to attenuate exponentially with the distance (R) following R-1.1 & R-1.7 for compact rocks and R-3.1 & R-3.4 for fractured rocks.
During the monitoring period a seismic event of MW=2.1 occurred in the vicinity of the instrumented site. Using the distribution of the AE events the position of the fault in the source area was successfully delineated. The tilt changes associated with this event showed a well pronounced after-tilt. The distribution of the AE events following the main shock was related to after tilt in order to quantify post slip behaviour of the source. There was no evidence found for coseismic expansion of the source after the main slip. Therefore, the hypothesis of the post-seismic creep type behaviour of the source was proposed to explain the after-tilt following the main shock.