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Microseismic activity after blasting at Zinkgruvan Mine (Sweden)

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Local seismic system consisting of 18 sensors 4.5 Hz was installed in Zinkgruvan Mine (Sweden) in 2015 at depth ∼1140 m. The system is concentrated in a small area of 40 x 50 m and is able to record very small seismic events (magnitude -4 or lower) induced by the mining activity. This study is related to two larger seismic events with moment magnitudes 0.6 and 1.2 that occurred in two consecutive days and their aftershock series on July 1 and 2, 2015. The first seismic events occurred seconds after a blast and the second one during blasting. The latter one caused a rockburst and extensive damage in the mine. More than 3000 seismic events were recorded at distances up to 100 m from the local seismic system during these two days. Manual data processing was done only for the events recorded by more than 15 sensors following the larger events and 3 hours before them. In total approximately 240 events have been analyzed. Seismic event locations and other source parameters were obtained by IMS Trace software.

The aftershock areas of the two seismic events formed two separate aftershock areas, The first series (Mw -3 to -1) lasted about one hour but the second one (Mw -3 to 0) was more complicated with two larger aftershocks (Mw 0.3 and 0.7) with their own aftershock series within 90 minutes. Based on the Es/Ep energy ratio the main events were classified as shear seismic events (Es/Ep ∼10). The other events were approximately equally divided between shear and not-shear (tensile) events. No apparent correlation was found between the type of the events and the magnitude. The apparent stress of both series varied within four orders (from $6.7*10^3$ to $2.4*10^7$ Pa) with a weak trend of increase with the magnitude.

The configuration and source parameters of the aftershock series were related to the observed damage due to the rockburst on July 2, 2015. The results were used to obtain a possible mechanism of the main events.