# Possible precursors implied from acoustic emissions and strain records in deep gold mines in South Africa

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To detect small precursors of earthquakes that cannot be detected by surface observations, we have conducted strain and acoustic emission (AE) observations nearby source faults in deep mines where M2–3 earthquakes are frequently induced by the stress buildup from mining. In this poster, we introduce two observation results related to earthquake precursors.

1. Strain measurements 10 m away from a fault where an M2 earthquake occurred at a 2.4 km depth in Bambanani gold mine

We conducted 25-Hz continuous observation by a strainmeter that was installed 10 m away from a fault where an M~2 earthquake occurred. Although this strainmeter recorded many strain steps induced by seismic events, including the $10^{-4}$ step (corresponding to ~10 MPa stress drop) of the M2 event, no strain records likely corresponding to preslips were observed (Takeuchi, 2005). Meanwhile, episodic but relatively slow strain steps, whose durations were varied from 0.1–10 sec, likely corresponding to aseissmic events, were also found (Naoi et al. 2006). Some of the especially slow steps were preceded by accelerations in strain, the maximum being as large as one-third of the step.

2. Quasi-static slip patch growth to 20 m on a geological fault inferred from acoustic emission data at a 1-km depth in Cooke 4 gold mine

By using an AE network that can detect microseismic events down to Mw −5, we observed an AE activity that emerged and gradually expanded up to ~20 m on a geological fault near the mining front. The activity exhibited a sharp (~ 30 cm thick) planar distribution, suggesting their on-fault occurrence. The activity included M ~−2 repeating earthquakes and hence likely reflects a quasi-static growth of a slip patch. The *b*-values of the activity drastically decreased with time from 2.5 to 1.5, which may reflect the increase of stress level, as repeatedly pointed out by previous studies (e.g., Scholemmer et al. 2005). As the activity ceased without a large seismic event rupturing the entire region of the activity or beyond, we cannot discuss the relation to the occurrence of large earthquakes. However, the region where this activity occurred corresponds to the area where large earthquakes (Mw 1–2) in mines typically occur. Hence, the finding of the growth of a slow slip patch on this perhaps brittle fault is encouraging in terms of the possibility of preslip-nucleation of detectable size.

**References**

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