Relocation of AE hypocenters before an M2.1 earthquake in a South African deep gold mine

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There are gaps in size and frequency between laboratory experiments and earthquakes. To apply knowledge obtained by laboratory experiments for understanding the earthquake rupture, it is necessary to bridge them by observing earthquakes in detail. In a South African deep gold mine, earthquakes up to M3 are induced by stress disturbance associated with the exvavation of a gold reef. Eight AE sensors are installed along a tunnel at a depth of 3,550m to observe ruptures of several hundred meter in scale within a distance of tens meter.

An M2.1 earthquake occurred on 27 Dec. 2007. A number of AE events were observed prior to the M2.1 earthquake. Hypocenters of these AEs were located by automatic data processing. A part of AE hypocenters spread widely because of incorrect picking of the first arrivals.

We picked first arrivals of P- and S-wave manually and relocated hypocenters using homogeneous medium (Vp = 6.450 km/s, Vs = 3.785 km/s).

AE hypocenters prior to the M2.1 earthquake were located on a plane where aftershocks of the M2.1 earthquake were aligned. We could make sure that AE activity on the M2.1 fault prior to the occurrence of the mainshock is not an artifact due to poor picking of automatic processing system. AE activity concentrated on the fault plane of the upcoming M2.1 earthquake.