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Very high frequency AE (up to 200 kHz) and micro seismicity observation in a deep South African gold mine - evaluation of the acoustic properties of the site by in-situ transmission test -

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We here present a result of in-situ transmission test using an ultrasonic source. This is a part of our project which monitors high frequency acoustic emissions under mining stress, to extend the laboratory knowledge of acoustic emission to a large scale.

Initial site setup was finished in June 2007. The network has about ∼50 m spread and consists of a tri-axial accelerometer (up to 25 kHz) and eight AE sensors (up to 200 kHz). Many high frequency events (up to 200 kHz) have been already recoded. The network surrounds a contact of dioritic dyke in the host quartzite. Mining is going on 50-90 m above our site and there is a fair chance that the dyke contact will slip as a large earthquake (M∼3) in the near future.

To relate the AE activity with the geological structures and large events expected on them, we need to locate AE hypocenters accurately. To estimate the source characteristics of high frequency AE events, correction for attenuation is critical. Hence, we performed transmission tests. In June 2007, we made 28 shots from 20 different positions in a long borehole (54 m), which transects almost the entire extent of the AE network.

Using these data, We have estimated P and S velocities and Q-value of the host rock and dyke. We got the results of Q = 200∼300, Vp = 6700∼7100 m/s, Vs = 3800∼4100 m/s in dyke, and Q = 150∼200, Vp = 6000∼6400 m/s, Vs = 3600∼3900 m/s in host

rock. Recorded waveforms of the transmission tests had a good S/N in 10-120 kHz, which coincide with the target frequency of our project.

We are now preparing to upgrade the transmission system to monitor change of rock properties caused by stress accumulation. Two strainmeters have been installed at the site, one within the dyke and the other within the host rock.