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A Japanese - South African Collaboration for Observational Studies to Mitigate Seismic Risks in Mines (2)

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As we introduced at the Japan Seismological Society Fall Meeting in 2009, we are going to carry out a 5-year Japanese - South African collaborative project entitled "Observational studies to mitigate seismic risks in mines". The project is carried out under the auspices of the JST-JICA program "Countermeasures towards Global Issues through Science and Technology Research Partnership", which was launched in the 2008 financial year. It aspires to acquire new knowledge to tackle global issues like environment/climate change, infectious diseases, water shortage, natural disasters, and bio-resources. Our project seeks to advance the fundamental understanding of earthquake preparation and generation processes and use this knowledge and practical experience to mitigate seismic risks, not only in South African mines, but also in Japan and elsewhere in the world.

Following the approvals by South African Presidential Office, the Departments of Foreign Affairs and the Finance, the MoU between JICA and South African Department of Science and Technology will be undersigned in February or March 2010. This will officially kick-off every SATREPS activity.

The underground projects will be carried out at Moab Khotsong, Ezulwini, Driefontein and Mponeng mines, as well as several other mines owned by Gold Fields, Simmer and Jack Ltd, DRD Gold Ltd., South Africa. Operations to drill holes to accommodate several tens of sensors have already been planned and scheduled at some mines. The total length of all the holes exceeds 3 km, and drilling operations will continue at least a year. We will present details of the planned research activities, including:
(1) A highly sensitive microfracture monitoring system will be installed in an area of high seismic potential to identify the source fault of impending earthquakes.
(2) The mining-induced stress field will be tracked using numerical modeling and sensitive strain/tilt observations, and compared with stope closure meter. These observations may also pick up precursory activities of the fault.
(3) Near-fault dynamic stress will be monitored during the mainshock rupture to improve the assessment of strong shake, and be compared with the strong shake and damage to the excavation.
(4) Aftershocks will be also analyzed to microfracture level to delineate the mainshock rupture in detail, which is a prerequisite to assess postseismic rock stability in terms of stress redistribution by the mainshock.
(5) Seismic sources will be exhumed to probe and collect rock samples, which will be investigated in greater detail in the lab.

Observations will also be carried out on the surface. The South African National Seismic Network

is already being upgraded (using other funds) in the Central Rand region, where worked-out mines are being allowed to flood. SATREPS will fund the deployment of 10 additional strong motion surface stations in the Far West Rand region. A data center will be constructed at the South African Council for Geoscience, with functionality comparable to JMA + GSJ (AIST). This will contribute significantly to the capability of the South African National Seismograph Network. Comparison of surface strong motions with strong motions at seismic sources may contribute to better assessment of strong ground motion on the surface caused by damaging mine-related seismic events.

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Keywords: SA gold mine, Seismic AE monitoring, Strain, Strong motion, Proximate monitoring