



## Microseismic Monitoring of Open Stopping Operations at the World's Largest Gold Mine

A microseismic system was implemented at the Grasberg mine complex in Indonesia. Twelve triaxial geophones are currently in operation with plans to expand the system to thirty sensors. Similar systems are also set to be installed in the Grasberg Block Cave and Deep Mill Level Zone by early 2011.



Fig. 1: Location of the Grasberg mine complex in Indonesia.

Operated by PT Freeport Indonesia, a subsidiary of Freeport McMoRan Copper & Gold Mining Ltd., the Grasberg gold mine has the world's largest known gold reserve and the third largest copper reserve. The mine is located in Indonesia, in the province of Papua on the Western half of the island of New Guinea.

The Grasberg mine complex consists of a large open pit operation (active since 1990), underground block caving operation in the Deep Ore Zone (DOZ) and plans to expand operations to at least 5 ore bodies underground (Grasberg Block Cave, Kucing Liar, Mill Level Zone, Deep Mill Level Zone and Big Gossan) over the next 31 years.

## Background

The ore geometry in the Big Gossan deposit dictates that the ore be selectively mined using an open stoping with cemented paste backfill method rather than block caving as was used in the DOZ region. The open stoping method requires the development of drifts on various levels with stopes blasted from the top. Ore is then mined from the bottom of each stope in a certain sequence to maintain geotechnical stability. The void is then backfilled with a paste consisting of mill tailings and cement.

The open stoping method is expected to be higher in cost than the block caving operations in the DOZ mine, therefore ensuring the cost effectiveness of other operations in the Big Gossan mine are a priority for the clients.

## ESG Solution

An ESG microseismic system was implemented at the Big Gossan mine in Indonesia. An array of 12 triaxial geophones was installed in four long boreholes surrounding the volume, providing coverage at depths ranging from 2400 to 2900 meters above sea level. An additional 18 sensors will be installed throughout the volume as development drifts are excavated to complete the system.

Plans are also ongoing to install similar monitoring systems in the Grasberg Block Cave and Deep Mill Level Zone for comprehensive mine wide monitoring capabilities.

Microseismic monitoring of complex mining operations is widely acknowledged for its ability to provide continual, 3D-coverage of mine seismicity for real-time assessment. Incorporating a microseismic monitoring system to observe the open stoping operations at Big Gossan mine will allow the rock mechanics engineers and mine design team to know how the rockmass is responding to mining induced stress redistributions. This information will help the mine to operate safely and reduce operational costs by minimizing downtime.

## Grasberg District Ore Bodies

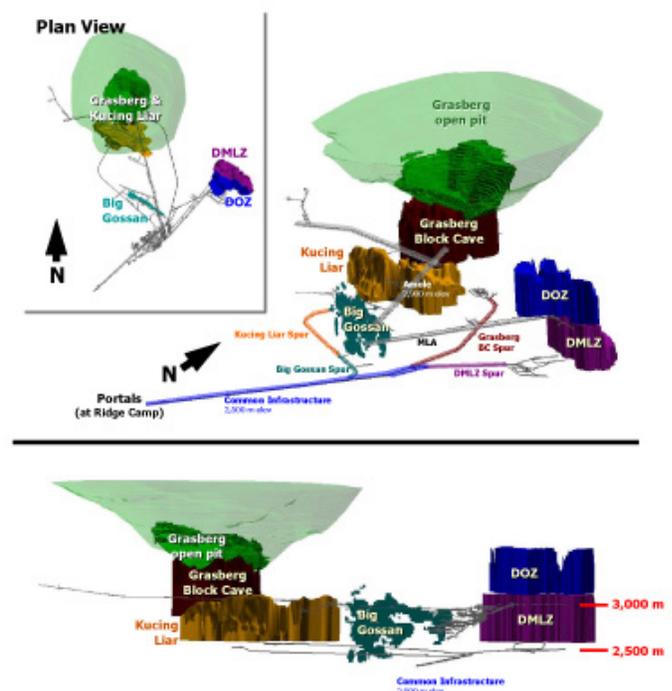


Fig. 2: Layout of the Grasberg mine complex including underground production and exploration access to the underground ore bodies. (source: Freeport McMoRan Copper & Gold)