



**C E M I**  
Centre for Excellence  
in Mining Innovation

# LECTURE SERIES

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August 25, 2011 at 4:00pm Willet Green Miller Centre  
Auditorium (Main Floor)



## Geophysics for Rockmass Characterization

The use of mine microseismic monitoring data has lagged the rest of geophysics badly: data is rarely inverted to infer the state of the rock mass in terms of physical properties such as seismic velocities, elastic moduli, degree of fracturing, stresses or other state variables. Added to this, convergence has meant other geophysical techniques can share the communications backbone of a micro seismic monitoring system. Three important opportunities for new applications are:

**Velocity structure:** Double-difference tomography and seismic emission tomography have established track records in the petrochemical and carbon sequestration industries to constrain the locations of seismic events generated by hydro fracturing reservoir treatment and infer changes in the velocity structure, permeability and stress state of the rock. There is a need to develop software for routine application.

**Phase space (beyond the b-value):** Examples of emergent (complex/self-organized critical/chaotic) behaviour abounds in mine seismic data. There is a need for robust tools to quantify and use these phenomena for routine application to operational microseismic data.

**Integration (not with modeling).** Several other remote sensing geophysical techniques have come of age in the last ten years. Particular examples are three-dimensional electrical resistivity (ERI) and microgravity. Increased computing power means that arbitrary ERI arrays can be used in almost any environment to image porosity and voids. In both cases, equipment can be run remotely over networks sharing communications backbones with seismic systems.



**Dr. Willem de Beer**

Willem de Beer is a Principal of Golder Associates. He graduated with a PhD in Theoretical Physics from the University of the Witwatersrand in 1992. He has a passion for applying esoteric concepts in mathematics and physics to practical problems and for this reason he was drawn from string theory to earthquake research, which encompasses interesting statistics, thermodynamics, nonlinear physics and complexity in a very relevant environment. Mining-induced seismicity involves similar mechanisms to some crustal earthquakes and therefore provides both a laboratory to study earthquakes and an opportunity for useful scientific applications. So after four years of teaching and research in Particle Physics he joined ISS International, a manufacturer of seismic monitoring systems in South Africa, where he did research and development in mining-induced seismicity and rockbursts in deep gold - and coal mines. In 2001 he moved to New Zealand as one of the directors of iGeo Ltd, a Geophysical and Monitoring consultancy which was subsequently purchased by Golder Associates in 2004. He is currently the Geophysics and Monitoring team leader in Golder Associates (NZ) Limited.