Aalto University

Mineral resources and material substitution

On-line Risk Management in Deep Mines (ORMID)

The deepest metal mines in Europe (1) and in the world (2) are located in Finland and in South Africa. Deep holes (3, 4) have been drilled down to 12 km. Deep mining is limited by technical, economical and safety aspects. Rapid and comprehensive analysis is needed to control the risks. **The goal is to better understand the time-dependent failure process and to control the deep mining geotechnical risks.**

Aalto University (Finland) and Council for Scientific and Industrial Research (South Africa) have identified **two missing links** in on-line risk management: the connection between geophysics and rock mechanics (**WP1**) and the development of suitable real-time research sensors (**WP2**). The project begins with the expansion of the current inversion method (**Fig. 1**) towards a real-time method. **The aim is to connect the geophysical measurements to rock mechanics.** Testing for suitable equipment for harsh environments is an essential part of this research project and a deep mine will be instrumented.

Deep mines provide a window to Earth's crust. The mining activities disturb the local *in situ* stresses and create small earthquakes (**Fig. 2**). Deep mining requires new approaches for risk management. **The research produces a new constitutive model validated in a deep mine.** Complete chain is established: real time monitoring of rock mass response, risk assessment and representation of risk levels. The **scientific potential** lies in the **connection between geophysics and rock mechanics** and **how to translate the risk levels into prevention and mitigation actions.**

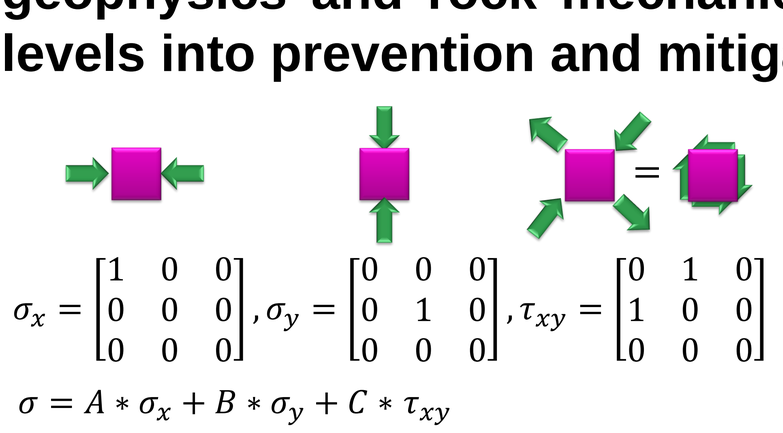


Figure 1. Stress inversion components in 2D. [1]

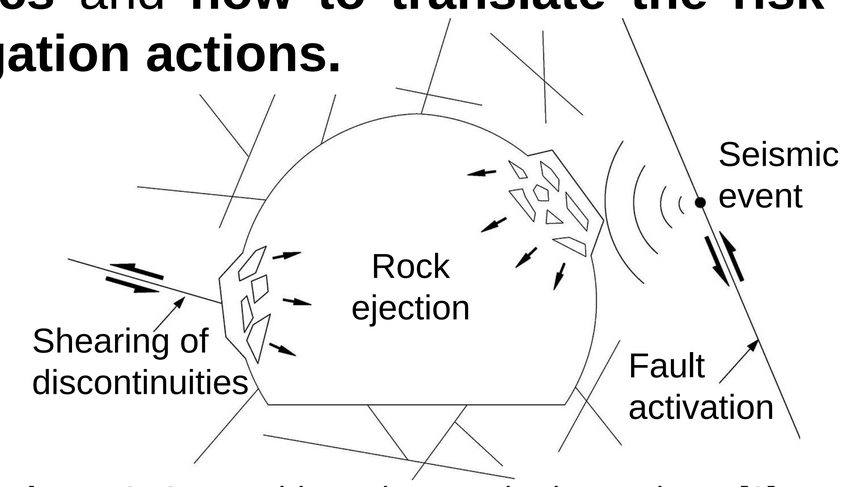
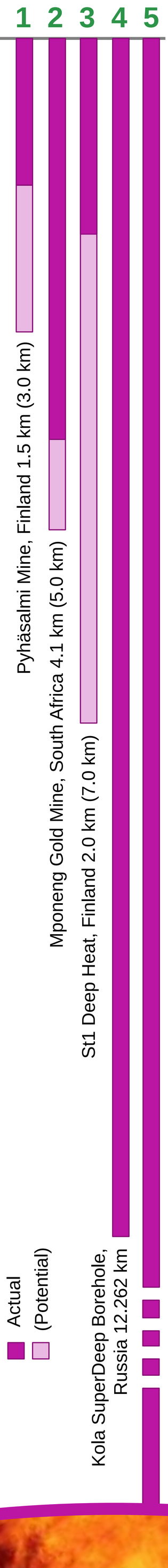


Figure 2. Stress driven damage in deep mines. [2]



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http://bit.ly/1Q4gr4D

[1] Kodeda, S., Ritala, F., Siren, T., & Uotinen, L. (2015). Real Time Stress Change Estimation using Strain Measurements. In *ISRM Regional Symposium-EUROCK 2015*. International Society for Rock Mechanics.
[2] Mazaira, A., & Konicek, P. (2015). Intense rockburst impacts in deep underground construction and their prevention 1. *Canadian Geotechnical Journal*, *52*(10), 1426-1439.

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