



Rock engineering research and creation of value



This last issue of Volume 119 of the *Journal* of the Southern African Institute of Mining and Metallurgy is a truly international one, with papers from five continents and one from the Middle East. Authors of the papers are from Chile, China, Iran, Norway, South Africa and the United States. Although this issue is a General Papers Edition, the content shows a rock engineering focus and the topics of most of the papers are relevant to direct or indirect considerations in rock engineering design, which emphasise the importance of rock engineering research. The only paper in which the rock and rock mass have no relevance is the metallurgical paper dealing with high-carbon ferromanganese and silicomanganese.

Three of the papers deal directly or indirectly with risk. The analysis of seismic event return periods in South African gold mining areas has relevance to the risk of occurrences of rockbursts; and there is an interesting comparison with earthquake event occurrences in Southern California. The use of the Analytic Hierarchy Process (AHP) to determine confidence levels in the selection of longwall coal mining methods is effectively a risk evaluation process. AHP could also be used to assess the potential for value creation. The paper dealing with the improvement in the definition of geotechnical design sectors in open pit slope design is specifically risk-based. As a result of the research in this paper, significant value was unlocked at the mine, as stated in the company annual report: an annual increase in the NPV of R10 billion (\$680 million), corresponding with an additional 50 million tonnes of ore.

Four of the papers deal with properties of rocks and rock masses: laboratory triaxial tests were carried out to determine the effect on rock strength of roughness and orientation of discontinuities. Coincidentally, these topics are also dealt with in the risk-based paper. Static and dynamic testing of rock samples was carried out to determine the effect of water content and loading rate on rock strength and deformation properties. Such tests are important because 'real' conditions in mines, tunnels and other excavations usually involve moisture contents substantially different from those applicable in standard laboratory tests. The paper dealing with quantification of rock mass weathering using spectral imaging adds to the growing value of remote scanning methods in obtaining geotechnical data rapidly and safely, from often inaccessible locations. Such scanning techniques were used to great benefit in the risk-based paper. The fourth paper analyses zonal failure around deep excavations and the influence of layered jointing. Interestingly, three of the papers in the issue are associated with layering or anisotropy.

The paper describing the design and evaluation of drawbell excavation at the famous Chuquicamata Mine may also be regarded as having risk connotations. The stability of drawbells, and their life, are extremely important to efficient production in a block caving environment. Instability could be a risk to the mining process: disruption of the draw profile, repair requirements, disruption of scheduling, and consequently, loss of production with associated costs. The paper is therefore important in providing guidance on the optimisation of drawbell excavation, the minimisation of blast damage, and hence the creation of value.

Finally, there is a paper illustrating some beneficial technologies that can be learnt from nature, in this case spiders. No doubt there are many other aspects and concepts, already well-developed in nature, that could be directly transferable to our mining technologies, and we should be on the lookout for such information.

In summary, this issue of the *Journal* provides considerable value. The huge economic value resulting from the research described in the risk-based paper leads me to recommend that ***the use of a strategic, value-based decision making criterion would be most appropriate for mining company executives - they should demand***, from their managers and operational staff, quantified answers (not opinion-based answers), to the following question: 'What are the quantified values that will be created in the short-, medium- and long-term due to the implementation of (e.g. new development; new mining method; new mining layout; further exploration drilling; mechanisation; increased or improved rock support; more detailed site investigation, etc; in fact, any proposal or change that could significantly affect safety, production, cost, etc)?' Such a criterion would result in value-based decisions rather than cost-based decisions. The latter may result in short term benefits, but often cause value destruction in the longer term.

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