Journal Comment

Job creation concepts

'An educated man or woman is someone who learns, first of all, to doubt.
At 56, I can honestly say
I am more convinced than ever
that I know very little
and have so much to learn.'
Prof. Jonathan Jansen VC UFS

This issue of the *Journal* is not associated with any conference or prescribed topic. I had hoped it would provide a small window on the mining and metallurgical research efforts at our universities and other institutions. I was not disappointed.

There are two, much welcomed, papers from Iran and Egypt. From the University of the Witwatersrand Mining School, there were five excellent papers - those of Matthew Handley and Dick Stacey are monumental contributions which certainly provided me with a much better insight into the status and importance of rock mechanics, even though the extensive detail was at a speciality level beyond my comprehension. The Institute will hopefully make these contributions available as monographs for students and groups working on rock mechanics.

Economic modelling was a popular theme, and the paper by T. Tholana, based on work for an MSc thesis on developing an algorithm for calculating cost curves, will be referred to in more detail later in this Comment.

But particularly gratifying were two unexpected contributions.

One is from Botswana, which I consider to be part of the SAIMM home constituency, and which I shall discuss later. The other is from neither mining nor metallurgical graduates, but from a group of geologists at the University of the Free State.

I wish to make this paper the feature of this Comment, and have chosen my usual quotation from the profound wisdom of the Vice Chancellor, Jonathan Jansen, my idol on all education matters ranging from primary to tertiary, post–graduate, and the professional community. Education in the widest sense of the word is the 'nuclear DNA' of a nation.

The paper is: 'A progress report on ultra-high-pressure waterjet cutting underground: the future of narrow reef gold and PGE mining,' by C.D.K. Gauert *et al.*).

In their motivation for continued work on waterjet cutting, reference is made to mine call factors and selective blast mining, the topic of several of my publications with other co-authors. My work goes back to the late 1950s when, as one of the first members of the Anglo American Central Research Laboratories, I was commissioned to investigate gold (and uranium) losses at Daggafontein Mines. Amusingly, the missing gold was referred to as 'un-assayable gold'.

This work was taken to a new level in the 1990s, in association with the consulting mining engineers of Anglo American, Shaft Sinkers, Kopaneng Mine, and Impala Platinum, with the expertise in detonators provided by Dr I. Bock leading to the publications.

Prompted by the computing work of E.J. Sellers, African Explosives Ltd (AEL), it is my conviction that selective blast mining is eminently feasible and highly attractive, and the concepts were recently made available to AEL via Gys Landman (DETMET) for further development. The concept becomes even more attractive if waterjet cutting could be shown to be economically justified. It will make a highly significant contribution to selective blast mining. There is a great deal of cost calculations in the paper based on rock cutting as the basis for separating the gold-bearing reef from the waste rock. But there is a more direct way to achieve the desired separation and to avoid the gold losses – by avoiding the direct blasting within the reef so that no explosion gases come into contact with demineralized constituents of the reef. This is achievable by shock wave fracture of the reef using a single cutting operation. The critical features would be:

- Positioning the narrow reef close to the roof (hangingwall) and cutting one slot just above the reef along the stope face
- Cast blasting waste rock below the reef to the back of the stoping area, to ultimately provide a hard-packed total backfill
- Fracturing of the reef by shock wave energy from the cast blast with no fragmentation or gas evolution within the reef. This is done by selecting the correct blasting pattern and the correct explosive characteristics in the blast line below the reef.

This will provide complete protection of the roof from damage, but allow the shock-fractured reef to fall to the footwall, allowing easy and complete collection. This would result in a 100% MCF and more than 50% reduction in haulage costs.

However, it would be of immediate value to make use of the algorithm proposed by Tholana to identify those gold and platinum mines that would fall into the economically viable category if the additional precious metal recoveries and the decreased mining costs were included in the calculations.

Once these features are demonstrated and implemented, additional benefits can be considered as future improvements, such as:

- High-pressure roll crushing underground
- Pressure leaching, recovery, and sale of uranium, cobalt, and nickel
- Improved gold processing with zero-toxicity waste suitable for agriculture
- Hydraulic hole cutting with hydropowered drills.

Journal Comment (continued)

In the future, it is probable that several exciting new technologies will be developed, leading to remote automation of mechanized methods that are likely to employ only a fraction of the current workers, but it is vital to maintain an employment pattern in the intermediate term to allow education and skills development in the newly created community clusters that have been my suggestions in the most recent Journal Comments.

It is, I believe, one of the few options to avoid a calamitous rapid decrease in the employment capability in the mining industry.

The paper on 'Kinetic studies on the leaching reactions in the autoclave circuit of the Tati Hydrometallurgical Demonstration Plant' by B. D. Paphane *et al.*, who are welcome contributors from the College of Agriculture at the University of Botswana, establishes the kinetic models of the dissolution of nickel and copper from the low-grade Tati base metal deposit in Botswana. The kinetic equations, which have been meticulously and convincingly established, are believed to be the key to a better understanding of the reactions of the Activox® process. A feature of this process is the addition of sodium chloride with sulphuric acid to form hydrochloric acid as the main leaching reagent. The impact of this is to convert most of the sulphur in the minerals pentlandite and chalcopyrite to elemental sulphur. This is considered to be preferable to the usual bio-oxidation, pressure leach, or sulphuric acid leach processes. I sincerely hope that there will be a follow-up paper giving the conclusions from the kinetic equations in terms of the mechanism of the Activox approach and its applicability to other sulphidic minerals, such as pyrite for example. Pyrite is a main constituent in the waste coal residues and the culprit for environmental pollution from acid mine drainage. The production of elemental sulphur, a valuable and readily transportable by-product from the coal wastes, would be one potential option as an outcome in a portfolio of alternative process options to utilize the billions of tons of coal wastes in southern Africa. Coupled with this option would be the recovery of cell-grade alumina, which is another constituent of the coal waste.

With these two potential concepts, it would be appropriate to end with a wistful old song quotation:

'Why don't we do this more often' - to keep our strategic conference planners more active.

R.E. Robinson