

Optimum versus maximum recovery of gold*

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It is interesting to note that, when the Technical Programme Committee-Mining first decided on this particular topic for a colloquium, the proposed title was different in that it used the words 'rising price of gold'. The very fact that the title was reworded to use the words 'fluctuating gold price' highlights the problem that faces the South African gold-mining industry.

With virtually every mining and extraction operation there is a fundamental conflict between a company's objective to mine and extract the metal at maximum profitability, and its strong desire to achieve maximum recovery from a finite reserve. Although attempts are generally made to attain both objectives, namely maximum recovery at optimum profitability, I believe it correct to say that the South African gold-mining industry continues to pay admirable attention to the aspect of maximum recovery – presumably because the industry appreciates the very important role it plays, now and in the future, in contributing to foreign earnings and in providing employment opportunities.

However, optimum recovery (from an economic point of view) and maximum recovery (from a technical point of view), both during mining and during metallurgical processing, will always be different. The question therefore arises as to whether these two can be brought closer together.

Firstly, accurate information is required in terms of profitability versus recovery, but the provision of such information is an enormous task in the light of rapidly increasing operating and capital costs, changing technology, and fluctuating gold price. Presumably, the graph of profitability versus recovery has a maximum for any set of conditions that may apply at a given time, and the question arises as to whether it is possible to ensure that any deviation from the optimum is on the side of additional recovery. The difference between maximum recovery and optimum recovery is characterized by the fact that the incremental costs of the additional recovery in relation to the revenue from that recovery would provide a lower overall profitability. Clearly, the object should be to endeavour by scientific and technical development and by management techniques to devise a way of decreasing the incremental

costs for additional recovery, or of modifying the entire process so that higher recoveries than previously can be achieved at similar profitability. This rather obvious statement is surely the motivation for most of the research-and-development work being undertaken by the Chamber Mines, the individual mining houses, and the statutory research organizations and universities associated with the industry, and is presumably the only yardstick against which success in research and development in this context can be measured.

Secondly, an increase in the price of gold obviously has an effect in decreasing the gap between optimum and maximum recovery. This is shown by the fact that ore of considerably lower head grade has been mined in the past year because of the higher gold price. The reprocessing of relatively low-grade dumps is another manifestation of the effect that a higher gold price has on recovery. Because the price of gold fluctuates, and many believe that this will continue – not least because of international political instability – the gap between optimum and maximum recovery fluctuates in sympathy.

Thirdly, one can speculate that, in the context of gold, there should be an incentive to decrease the gap between optimum and maximum recovery without infringing on optimum profitability, where it can be shown with reasonable accuracy that the lost metal is unlikely to be recovered in the future. Presumably, the State could provide such an incentive. The form of this incentive could be a reducing tax formula for incremental recovery beyond the optimum recovery as identified by private enterprise. The real problem as I see it would be the definition of lost metal, the time span that is allowed in the assessment of whether the metal is unlikely to be recovered, and how close to maximum recovery the reducing tax formula should encourage extraction. The argument that the decreasing reserves will automatically increase the price of raw materials, so ensuring that close-to-maximum recoveries are obtained ultimately, is not being demonstrated in practice. Current predictions for several natural resources appear to indicate that, towards the end of a natural resource's availability, replacements are developed or arbitrarily adopted that decrease the demand for the rapidly depleting raw material.

Delegates should have an interesting day discussing the economic and technical strategies that are available, or that will have to be developed to ensure that the optimum company and national benefit is obtained over the long-term from the gold-mining industry.

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