

Journal Comment

The Platinum Group Metals

*'Do you know who made you'
'Nobody, as I knows on
said the child, with a short laugh
I 'spect I grow'd'*

Topsy, in Harriet Beecher Stowe Uncle Tom's Cabin (1852)

It was in 1924 that Hans Merensky first reported the presence of the platinum group metals (PGMs) on the rim of the largest and most complex igneous extrusion known. The successive quantities of molten magma that spread out in a huge elliptical mushroom created a resource of great riches and, following successive intrusive enriching geological alterations, a complexity in mineralogical structures was created that has made the exploitation of this resource one of the greatest challenges to mining and mineral processing engineers across the world.

For the first half a century there was much processing confidentiality associated with exploitation of the platinum and chromite resources, but in the latter part of the last century, when sophisticated novel mineralogical and extraction technology became available, many other mining organizations became involved. And in the new millennium the platinum mining industry took off internationally and 'grew like Topsy'. This expansion was spurred on by new and strategic uses for the PGM's and this in turn brought new challenges.

There have been many conferences and published features on the PGMs but the papers in this issue probably represent some of the most exciting innovations that have evolved in the last few decades. It could be that this young lady will be turning the world of ore dressing fashions 'topsy turvey'.

There are several incentives for a new look in the processing of PGMs. The ever increasing cost of electric power is now a critical element. The pattern of usage of the individual PGMs is changing and rhodium, which is a relatively rare metal in the Merensky Reef, but more prevalent in the UG2 Reef, has become economically important. The ready availability of the 'hard lumpy' chromite ore for ferrochrome production was diminishing, so that the recovery of by-product chromite was important. Water for the mining and processing had to be balanced against a growing need for general domestic use, including that in mining homestead clusters and associated small-lot agriculture.

In fact a good starting point for the reader is the paper, 'Does thickening save water' by A.J. Vietti et al. It gives some most interesting statistics on the existing and future size of the platinum industry and its water requirements. It also points the way to reducing the water that is lost along with the discarded slimes.

A second paper which is well worth looking at is that of R.G. Cawthorne on 'The geological interpretation from the PGE element distribution in the Bushveld Merensky and UG2 chromitite reefs'. Detailed reading is not for the faint-hearted but rather the specialist mining geologists (for whom it is a monumental contribution). But it does deserve some perusal to provide a concept of the immense complexity of the mineralogical and mining challenges in exploiting the Bushveld Igneous Complex (BIC). Indeed, I now understand

why so much attention has had to be given to evolving the sophisticated techniques in mining, comminution, and froth flotation to handle the variability of the mineralogy. I suggest that producing an acceptable flotation concentrate from the Merensky and UG2 reefs (so as to comply with the tight restrictions on the chromium content and to enable an acceptable recovery of the PGMs and the nickel, copper and cobalt values) is fully deserving of the concerted efforts of mineral researchers across the world. The advances in the modelling of this complex problem and the advances in automated control of flotation plants reported in the several excellent papers in this issue, are remarkable achievements and well worthwhile studying.

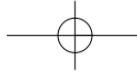
One conclusion, which is unanimously confirmed in Cawthorne's panel of references, and which relates to the UG2 Reef, is that the PGMs are all confined to the interstitial spaces between the chromite grains within the boundaries of the reef. This implies that if one could separate the UG2 chromites from the gangue material, virtually all the PGMs could be recovered by focusing attention on this chromite-bearing layer, which is a much smaller fraction of the total material mined.

In the Merensky Reef, where the PGMs are more finely distributed within the gangue minerals, to achieve a physical separation of the valuable constituents from the gangue and from the chromite requires extremely fine grinding of huge tonnages of mined material. The comminution cost factors have been a major consideration.

The paper, 'Stirred milling—a new comminution technology' by Chris Rule, is for me, and probably many others, the most fascinating contribution in this issue. The extent to which this equipment has already been introduced into the plants, underlines recognition of its cost effectiveness. In his paper I must draw attention to some remarkable photo micrographs of composite mineral particulate material, which are dramatic in their impact.

The recognition that steel ball milling has deleterious effects in coating the surfaces of minerals, is long overdue. Reference to the production of zirconium ceramic balls to provide an ultra-hard but economically viable grinding material, is an advance with much future potential. Moreover, the production of such inert materials could, one hopes, be the basis of a suite of sustainable cluster industries of what must soon be a conglomeration of mining interests surrounding the BIC.

The paper, 'Energy consumption in the Kell hydrometallurgical refining process versus conventional pyrometallurgical smelting and refining of PGM concentrates' by Keith Liddell et al., I regard as the highlight in that it points towards a major change in direction in PGM processing. This research was inspired by the need to reduce the increased electric power and processing costs. The technologies involved are well established and chlorination,



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which is the key step in this Kell process, has previously been shown to be able to increase recovery of the PGMs. This paper, although not providing detailed experimental results, provides convincing calculations to show that the reduction in energy requirements and costs more than justify further serious attention.

All the papers in this issue demonstrate the high level and quality of work on the challenges offered in the platinum industry. They should be read in conjunction with the December issue of this Journal, which reports on the ferroalloy industry where there are similar power increases. Where the supply of chromite is of concern, it is obvious that from the BIC a direction of maximum recovery of all valuable

minerals must be a target for the future. This will demand all the ingenuity and inventiveness of the mining, metallurgical, mineralogical and associated scientific collegiate that have been so active to date.

With its additional magnetite and vanadium resources, the elliptical BIC is undoubtedly the focus of employment opportunities and the establishment of a social and technical conglomerate to match that of the declining Witwatersrand goldfields.

There is little doubt that Topsy will have many attentive suitors in future years. ♦

R.E. Robinson