

Journal Comment

Physical beneficiation

*"Old Soldiers Never Die
They Only Fade Away"
Song of 1914–18 war*

I was particularly delighted to work through the papers in this issue, for two reasons.

Firstly, a high proportion of the papers are the work of two of the most prestigious research capabilities in South Africa, namely those of Anglo American and De Beers, with headquarters in what might be described as the Crown Mines research park. It is pleasing to recognize that they are alive and active and that they and their associated mining companies are prepared to publish well-researched transactions in our Journal. It is fascinating to recognize that some highly sophisticated mineralogical methods are being developed for productivity in what might be regarded as low-valued base mineral resources such as iron ore and the age-old jigging technology.

The second reason has nostalgic, as well as topical features, going back 58 years when I took my first steps from the academic space into the rough and fearsome world of big mining and metallurgical activities. This was when I obtained my first job ever in industry with the Central Metallurgical Laboratory, (CML), then newly established at the Crown Mines research park in 1954. I had been recruited by the metallurgical department of Anglo American, where Jumbo Pinkney, Iain Cairns, and Dick Adamson worked under the Chief Consulting Metallurgist, C.K. Stent.

They, like many others, had just completed the commissioning of the uranium plants that placed South Africa as the major uranium producer in the western world and which had earned the respect of the first-world nuclear nations and elevated South Africa to the status of an important member of the club. There was an excitement and new vision of the potential of the new world of nuclear and special metals waiting to be exploited.

I was thrown into the deep end, but thank goodness for my new colleagues, Eric Rudolph, Hans Nel, and Professor Howat who were the Divisional Heads of Ore-dressing and Mineralogy and the Director respectively. They had expertise of the best I have encountered.

My first assignment was to ensure that the new ion exchange process at the AAC mines would function satisfactorily without poisoning of the IX resins. My first and essential recommendation was to reverse the sequence of gold and uranium extraction steps in all the AAC gold and uranium plants. I recall making this first proposal to Stent, who informed me in no uncertain terms that the changeover would mean a week's delay of production, and if it was wrong and gold losses were incurred and had to be reversed, the loss of profits would be more than my salary for life.

This reaction took me to the depths of a Daggafontein stope face, and through every step to the final precipitation, including the assay. I was investigating the mystery of the missing gold as indicated by the low 'Mine Call Factor'. Nothing could have been a better exercise, even though it took 50 years before I had the answer!

Fortunately I was well supported by my colleagues. Less frightening was my first and only publication from my PhD thesis on the IX process. This was in the form of a paper in the name of the Metallurgical Department of AAC to the United Nations Conference on Peaceful Uses of Atomic Energy held in Geneva in 1958.

The activities of the CML produced many other new advances, and I mention a few of them that are particularly topical today, and relevant to papers in this issue:

- ▶ The first physical separation of the beach sand minerals ilmenite, rutile, zircon, and monazite was piloted at CML. A plant went into operation at Umgababa on the south coast of Kwa-Zulu Natal. Sadly, soon after proving to be successful, the plant was closed down because of environmental pressure
- ▶ The first attempt to treat ilmenite to produce high-purity titanium dioxide and agglomerated pellets of iron oxide as blast furnace feed, was operated by a team from the Chemical Engineering division at the Appleby Frodingham Steel Works. This 'TOIL' (Treatment of Ilmenite) process was confined to the archives when the Umgababa plant was closed down. It is most topical today in the light of recent concepts for producing titanium alloys for aerospace applications
- ▶ Monazite was produced at Van Rhynsdorp and a pilot plant was built to produce thorium oxide and rare earth sulphates at the CML. The pilot plant was discontinued owing to the premature closure of the Van Rhynsdorp Mine. Again this is topical today. In South Africa, highly valuable rare earth materials have been and still are being deposited on waste dumps
- ▶ My first ever provisional patent was taken out by AAC for the pressure leaching of uranium, which was designed to significantly reduce the costs of uranium production on the lower grade gold mines. The first leaching tests on the Rössing uranium deposit in South West Africa (now Namibia) were undertaken. However, the AAC directors declined to pursue these options
- ▶ My final assignment at the CML was to become the manager of a team of AAC operators at a newly established vanadium plant in Witbank with a view to establishing profitability, which was achieved. Vanadium-based storage systems for off-peak power are hot news, another South African first that seems to have been ignored.

Sadly, this was my last assignment for the CML. I was 'delegated' to take over from Dr M.G. Atmore, previously Technical Manager of the Nuclear Fuels Corporation and a past President of the Institute. Anglo American's commitment to assist the Atomic Energy Board's creation of an Extraction Metallurgy Division aimed at the production of the much greater, much higher valued nuclear components for reactor fuel element manufacture. Little was published on this work by virtue of the draconian secrecy provisions of the Atomic Energy Act. In time, full success was achieved, from nuclear grade zirconium metal to high-purity uranium hexafluoride and UO₂ fuel element pellets.

From the 1960s, R&D in the mining industry boomed. All the mining groups established research facilities and the next 20 years saw great advances in ferroalloys, beach sand processing, and not the least, in the Crown Mines precinct of AAC, synthetic diamonds, X-ray sorting of diamonds, carbon-in-pulp for gold, and many other innovations by the CML, Diamond Research, Boart, the Hard Metals laboratories, and the Debex facilities.

Journal Comment (continued)

But inevitably, the uranium research bubble burst, owing to and initiated by the Chernobyl and three Mile Island nuclear incidents. Research facilities were downgraded. Uranium plants were closed and the economic whizz-kids convinced directors that it was cheaper to buy guaranteed technology than to develop it yourself.

The pendulum has swung again. Beneficiation of mineral resources is once again the battle cry, now coupled to job creation and global warming. Innovation and entrepreneurs are the order of the day, and more university graduates are demanded for research.

This is only part of the solution.

Attendance and innovative buzzwords in PowerPoint presentations at summit conferences are not the answer.

Well-researched results scientifically analysed, such as the papers in this issue, are what is needed locally, to move down the technology transfer chain and to mobilize an army of operators of mines and plants and mentors of technically trained marketers of international status. Technical colleges and teachers are what are going to generate the bulk of the personnel to produce the goods and services to justify the salaries of those creating added value and profits.

Long may the 'Crown Mines' Research quality papers appear in our Journal. May they never fade away. ♦

R.E. Robinson



This is the month of the year when we say that 'time is marching on' and 'we can't believe how quickly it is going'. Just a personal observation regarding the passage of time, with perhaps a lesson in relativity, is that I notice that the older you get, the longer the weeks become but the shorter the years.

The month of February was the traditional month of the Mining Indaba in Cape Town. As an Institute, we do not regularly participate officially although a fair number of our members do, some in their private capacity and others representing their employers. This year, we were there as an organization, albeit not part of the official proceedings.

The event was the meeting of the Mineral Economics Committee (MEC) on the issue of mine nationalization, which includes nationalization as part of the broader topic of state intervention in mining which also includes royalties, taxes, etc. The meeting, hosted and kindly sponsored by Investec, was exceptionally well attended by a number of senior persons in the mining industry. The Chairperson of the MEC, Mike Solomon, presented an excellent overview of the impact of nationalism on mining activity. This was followed by a lively panel discussion with panel members representing the individual authors of Mike's presentation.

This ran over into a workshop on the second day where the way forward was discussed. Even though the topic of nationalization has been de-dramatized by recent declarations by senior government officials (including a welcome statement by the President), it is clear that the issue of mine nationalization on the broad front is not dead and the dialogue needs to continue. The extent to which the SAIMM will be directly involved is still to be determined.

Our position is clear. The SAIMM cannot and will not take a position that is politically motivated or could be construed as being political in nature. Our members belong to a number of political parties and have diverse political views, and we respect that. Our participation in this very important debate will continue to be limited to inform the debate in a scientific manner and to provide a platform for exchange of scientific views in the economic sphere.

The MEC meeting was preceded by a meeting of the World Economic Forum. Thus far, Mike Solomon has been our 'representative' on that in his personal capacity, and we discussed the possibility of the SAIMM being involved as an organization. This discussion will continue and we will keep our members informed of progress.

The second matter I want to raise very briefly is our contribution to the National Development Plan. As individuals, we all have a role to play and I urge members to study the report, which is available at the National Planning Commission's website, npconline.co.za. The planning document is apolitical and sets a number of targets in all spheres of society including education, crime prevention, job creation, etc. If we as a nation are to contribute to a future for our children, it is clear that the status quo cannot be tolerated and that we have work to do.

The planning document refers specifically to South Africa, but the problems we are facing are fairly common to the southern African region.

As an Institute, the question is what can we do to contribute? From discussion at the February Council Meeting, it emerged that we are already contributing to the continued wellbeing of the mining industry by providing for the exchange of scientific knowledge in mining in the southern African region. Perhaps we can do more. It was decided that whenever possible, we will include sessions related to the energy efficiency of mining and metallurgical processes at all our conferences. We will also encourage discussion and exchange of ideas on improving the water efficiency of operations. How many tons of water do we use to produce a gram of gold or a ton of coal? What can we do to improve this?

There has to be more. Members are invited to participate in this drive. Please think, let us have your ideas, and let us see how far we can collectively contribute to the future of our region. Mail your ideas to julied@saimm.co.za. Nothing is trivial, nothing is unimportant.

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