



President: 2013-2014

Base metals production in Southern Africa provides the common thread between all the country branches in the SAIMM

Marek Dworzanowski

Because of the diversity and complexity of the South African mining industry, innovation has become a prerequisite to survival.

During my term as SAIMM President, 2013 to 2014, the South African mining industry witnessed the longest strike in its history, namely the 5-months strike in the platinum industry. It was thought that the strike would result in a substantial increase in the platinum price and cause a serious supply deficit. However, neither happened. The platinum price is now below US\$800 per ounce and more than half of the platinum operations are operating at a loss, threatening the survival of the industry.

At the same time the global mining industry was also experiencing uncertainty, with decreases in most commodity prices. However, despite all these negative factors, the SAIMM continued to grow in membership numbers and in many other areas. The relationship that the SAIMM had with its sister mining industry institutions continued, one of the best examples of this is the now well established MINESAFE conference on industry health and safety. The Global Minerals Professionals Alliance (GMPA) came into being during my term and I hosted the first GMPA meeting in Cape Town in February 2014. The GMPA consists of the SAIMM, the AusIMM (Australasian Institute of Mining and Metallurgy), the CIM (Canadian Institute of Mining, Metallurgy and Petroleum, and the SME (Society for Mining, Metallurgy and Exploration). This alliance has given the SAIMM a firm global footprint, thus allowing members of the SAIMM to have national and international benefits. The country branches of the SAIMM during my term were Zimbabwe, Zambia, DRC, and Namibia. These branches have grown in stature and now Botswana has been added. In terms of South African branches, the Northern Cape Branch was added during my term and all these branches continue to thrive.

Because of the diversity and complexity of the South African mining industry, innovation has become a prerequisite to survival. Certainly, over the last 25 years this has become more important than ever. The South African gold mining industry started with mines at relatively shallow depths and with high feed grades, making them highly profitable. Initially the mines were located in the Witwatersrand area but innovative geological exploration led to the discovery of the Carletonville, Klerksdorp, Free State, and Evander goldfields. It is hard to imagine now that back in 1970

South Africa's gold production was a staggering one thousand ton, about 35 million ounces.

As mining had to be deeper, again the development of new mining methods was instituted. We are now heading for depths in excess of 4 km, well beyond any other deep-level mining globally. With the decrease in gold feed grades, metallurgists also had to look at more cost-effective gold processing routes. This is where the carbon-in-pulp /carbon-in-leach (CIP / CIL) technology took over from the traditional leaching / filtration / clarification / cementation technology. Although the CIP / CIL technology was not pioneered in South Africa, the development of carbon elution, carbon regeneration, and gold electrowinning was mainly as a result of South African innovation. With the escalating costs that the gold mining industry faces, mining methods will need to be re-examined. The importance of tailings re-treatment has increased substantially over the last 25 years, given that the costs involved are significantly lower than deep-level mining.

The South African platinum mining industry started with the mining and processing of the Merensky Reef. Initially the UG2 Reef was not considered because of metallurgical challenges. However, as the Merensky Reef reserves started to dwindle, the mining and processing of UG2 Reef became a necessity. Again, South African metallurgists came to the party and developed innovative approaches to the concentration and smelting of UG2 Reef. More UG2 Reef is now processed than Merensky Reef but over the last 25 years the mining and processing of Platreef has become significant. The Anglo Platinum Mogalakwena Platreef operation is the only large-scale open pit mining operation in the platinum industry and is by far and away the lowest cost producer. The platinum industry is being forced to reduce costs substantially in order to survive. Innovation around mining and processing will be at the forefront.

When the global consumption of stainless steel and speciality steel increased significantly after the Second World War, the opportunity of producing ferroalloys in South Africa was identified. The design of submerged arc electric furnaces for the production of ferromanganese

and ferrochromium was developed in South Africa. During the last 25 years the application of DC arc electric furnaces for the treatment of fine chromite for the production of ferrochromium and then for the smelting of ilmenite to pig iron and titanium slag was pioneered in South Africa.

When it comes to hydrometallurgy there are also significant achievements to highlight. The Rand Refinery is the world's largest gold refinery and the technologies employed are efficient and innovative. In the platinum industry there are three precious metals refineries with capacities in excess of anything else globally. There have been significant technology changes over the years within these refineries, again mainly locally conceived.

The South African mining industry has mainly been associated with gold, which is understandable given that it was the gold mines of the late nineteenth century that were really the beginning of the South African mining industry as we know it. But base metals have never received any prominence even though they have been contributing for many decades. Copper, nickel, lead, and zinc are produced in South Africa. Palabora Mining Company produces copper, Nkomati Nickel produces nickel, and Black Mountain produces copper, zinc, and lead. In addition, copper, nickel, and cobalt are produced as by-products from the base metals refineries associated with the four main platinum producers.

If we broaden our view of base metals to Southern Africa then we have a global-scale industry when it comes to copper and cobalt. The Copperbelt that spans Zambia and the Democratic Republic of Congo (DRC) is world class. Although mined tonnage does not compare with the copper porphyries of North and South America, the higher copper grades mean that actual copper production is not that far behind. Zambia and the DRC are 5th in global copper production when their output is combined. Beneficiation of copper ores, sulphide and oxide, in Zambia and the DRC is well developed with most of the copper being produced as cathode metal via electrorefining or electrowinning. There is a significant diversity of copper concentrators, smelters, and refineries within Zambia and the DRC. When the Nchanga tailings leach complex in Zambia was originally built close to 40 years ago, it boasted the world's largest copper solvent extraction and electrowinning plant. At Ndola in Zambia is one of the world's few refineries processing copper refinery anode slimes, producing selenium, tellurium, silver, and gold by-products.

Within the Copperbelt we also have the world's largest deposit of cobalt. The cobalt is associated with the copper. There are a number of cobalt plants which beneficiate oxide and sulphide cobalt concentrates, produced from the copper / cobalt ores, into cathode metal via electrowinning. Zambia and the DRC produce about half the world's cobalt. This has become more significant now given the potential consumption of cobalt in new battery technologies. There are nickel mines in Botswana and Zimbabwe and there are zinc, lead, and copper mines in Namibia. This all highlights the extent of base metals production in Southern Africa and this provides the common thread between all the country branches in the SAIMM. This has been used to promote increased SAIMM membership in the country branches and the SAIMM biannual Base Metals Conference has grown in stature as a result of the contributions of the country branches. Along similar lines the Namibia country branch has established a focus for uranium mining and the Botswana country branch has established a focus for diamond mining.

The South African coal mining industry is very often

portrayed as a poor cousin to the gold and platinum sectors within the South African mining industry. And more often than not when coal is highlighted then it is around the supply of coal to Eskom. What is not appreciated is the true contribution of coal to the South African economy and the significant size of the industry. This has changed significantly over the last 25 years, with coal assuming a far greater importance.

The majority of coal mines are still based in Mpumalanga. These mines supply numerous Eskom power stations, Sasol's facilities in Secunda, and they produce a significant amount of export thermal coal. Limpopo has the very large Grootegeluk coal mine supplying the Matimba power station and also now the new Medupi power station. In the near future the centre of gravity of the South African coal industry will shift from Mpumalanga to Limpopo as the coal reserves are depleted in Mpumalanga. However, this shift will not be a simple case of more of the same, just a different location. The Limpopo coalfields are very different to those in Mpumalanga in terms of mining and in terms of coal washing. Whilst Grootegeluk is leading the way, new mining projects in Limpopo will require different approaches and future developments will need innovation and extended project execution. Coking coal required by the South African iron and steel industry is largely imported. Some coking coal is produced from the Limpopo coalfields but only on a limited scale. Development of coking coal resources in Limpopo is an important objective for reducing coking coal imports and adds further incentive to the more rapid development of the Limpopo coalfields.

Thermal coal produced in South Africa is of two types. The lower grade thermal coal is supplied to the Eskom power stations. The higher grade thermal coal is exported through Richards Bay to numerous global markets. The difference between these two types has sparked debate over the 'strategic' value of coal in South Africa over the last 25 years. There should be a secure supply of coal to the Eskom power stations but at the same time coal mining companies will obtain greater profits from export coal. Therefore, as the shift from Mpumalanga to Limpopo progresses, this aspect of Eskom supply versus export will become even more important to balance correctly in terms of the future sustainability of the South African coal mining industry.

The South African mining industry has changed significantly over the last 25 years. The size of the industry has reduced in terms of production and the size of the labour force. The industry operating costs have soared, particularly electricity and labour. Highveld Steel and Vanadium, the ferroalloy producers, and the aluminium smelters were all based on cheap electricity. With Eskom having had to increase the cost of electricity substantially, this has resulted in either complete closure and or a reduction in capacity. The gold and platinum mining sectors have relied heavily on cheap labour. With the increases in labour costs the size of the South African mining industry labour force has reduced by hundreds of thousands over the last 25 years. There is also the question of regulatory certainty, which has stalled meaningful capital investment into the South African Mining industry. To survive, the mining industry will have to adapt and be innovative. The advances in technology, IT, and communications have not been fully embraced and this will definitely be key to reducing operating costs. *