

and the meeting today. Today's meeting, I think, has been outstanding by the way in which we have been brought up to date with the latest thoughts on mining and metallurgy by our two main speakers. All that is left for me now is to wish you a very happy birthday."

## THE MINERAL INDUSTRY IN SOUTH AFRICA

*A radio talk given on 16th March, 1969, as an introduction to the Institute's 75th Anniversary celebrations.*

**R. C. J. Goode** (President): South Africa is known for its sunshine and mineral deposits—especially its gold and its diamonds—and as this year marks the 75th Anniversary of the establishment of the South African Institute of Mining and Metallurgy, it is appropriate that I say a few words about mining and metallurgy and the part this industry and our Institute has played in the life of this country.

Africa, as the Dark Continent, with its fascinating tales of Prester John, Ophir, Queen of Sheba and its myths and legends has throughout the ages fired the public imagination. Pharaoh Necho, 600 years before the birth of Christ, sent an expedition from Egypt around the Cape to probe this strange land. The gold for King Solomon's throne was said to come from Monomotapa—the country now known as Rhodesia. Centuries later the Arabs and Portuguese searched for this mineral wealth. The Arabs found little gold but unfortunately established a lucrative trade in black slaves.

Now let us take a brief look into the closing stages of the Stone Age when the indigenous population of the lower portion of this continent consisted of the Bushmen, a nomadic hunting people who knew no metals and kept no stock, and the Hottentots who were a pastoral folk with cattle and sheep. Then somewhere about the 11th century the Bantu started their long migration southwards and brought with them the knowledge of smelting of iron ore. One of their settlements was here in Johannesburg on the Melville Kopje at Emmarentia. These people were the first miners and metallurgists on the Witwatersrand and the beautifully preserved iron smelting furnace constructed nearly 1,000 years ago is a tribute to their technical ability. This ability to use iron to make better spears for hunting or to fashion hoes for cultivating the soil led to their establishment as a superior tribe. The earlier Bushmen were pushed back to the inhospitable swamps and deserts and the Hottentots fled to the south.

The Bantu also knew the art of copper smelting. In the days of the Dutch East India Company, at the end of the seventeenth century, Bantu workers brought copper from the north-west Cape to Simon van der Stel, but it was another two hundred years before the white man turned this to advantage.

Stories of the Bantu mining gold spurred the early European hunters to travel deeper into the heart of Africa in search of wealth, and we are told that Karel Kruger, in 1834 whilst leading an ivory hunting expedition, discovered gold on the Witwatersrand, and took samples to Cape Town; but when he returned with a larger expedition a few years later his party was attacked by Moselekatze's Matabele near Potchefstroom. Kruger was killed and only the legend survived.

The real spur to mining in this country was the discovery of diamonds in Griqualand West in 1867. The field seemed fabulously rich and diggers flocked to the scene from the four corners of the earth. With them came Cecil Rhodes, Barnato, Beit and some of the finest mining and financial brains the country had yet seen. These giant entrepreneurs were not tempted by the small deposits of gold in the Barberton and Pilgrim's Rest areas when these were made a few years later but

when the big Witwatersrand deposits were discovered in 1886 there was a major exodus to what was to become Johannesburg.

Now how many of you are aware of the early difficulties of gold mining at Johannesburg. Initially, fortunes were quickly made by mining the rich outcrop near the surface; nearly half a million ounces of gold were recovered in 1890, such riches had not been seen before—not even in California; but as the workings got deeper the early pioneers found it increasingly difficult to recover the gold. It was mixed with pyrites in a hard grey speckled conglomerate rock.

The problem was to extract the gold metal from the pyrites and the rock, a science we call extractive metallurgy. So metallurgists and chemists were brought to the Rand from far and wide. Within a couple of years the McArthur Forrest cyanide process had largely solved the problem and this is when our society, the South African Institute of Mining and Metallurgy was born.

These chemists and metallurgists, in order to unravel the various problems of gold extraction, got together and decided on 24th March, 1894, to form a technical society called the Chemical and Metallurgical Society to bring together at regular meetings as many people as possible who were interested in this great problem. The first President was William Bettel, a graduate of the College of Science, London. In his first address in 1894 he pointed out the necessity to recognise that science must take over from the rule of thumb practices, and that in this Society the first essential was to spread scientific knowledge and apply it to technical processes. He went on to say 'The Transvaal is rich in minerals which, as the country develops, will require the aid of science to extract and render marketable their valuable contents.'

In the 75 years since our first president made his optimistic prediction, the Transvaal province has developed its iron ore to the extent that we produce some of the best and cheapest steel in the world. We produce nearly half the world's platinum and allied metals in the Rustenburg Platinum Mines, the largest underground mine in the Republic. Copper is produced at Phalaborwa in an equally large enterprise. Chrome ore, chrome silicon and stainless steel alloys are coming forward from what are the world's largest chrome reserves. We are producing enough phosphate to supply the whole of the country with fertilizers from a chemically complex orebody in the Eastern Transvaal. Good steel and vanadium are being produced from a titaniferous iron ore in Sekukuniland, which at one time was considered metallurgically unworkable. Our coal is mined at an average pit head price of R1.50 per ton, and is used to produce electricity in quantities and at prices which are the envy of the world. All this is in the Transvaal and I have not yet mentioned our gold and uranium.

Due credit for these gigantic enterprises must first be given to the entrepreneur, the mining finance houses and the shareholders who were prepared to invest their money. Secondly, and equally important, credit must go to the State, which in so many ways has encouraged and supported private development of this nature. But whatever we do, we cannot overlook the backroom boys, the metallurgists and the mining engineers, who convinced the financiers and the State that such developments were worthwhile and thus made the realisation of these great dreams possible.

Now many of you, I imagine, have only a vague idea of what some of these people are, and what they do. To you a metallurgist may as well be a blacksmith, an engineer, a mechanic, and a geologist a prospector dabbling in gemstones, so let us see what are these professions. And perhaps then you will realise why the 75th Anniversary of the South African Institute of Mining and Metallurgy is such a noteworthy event.

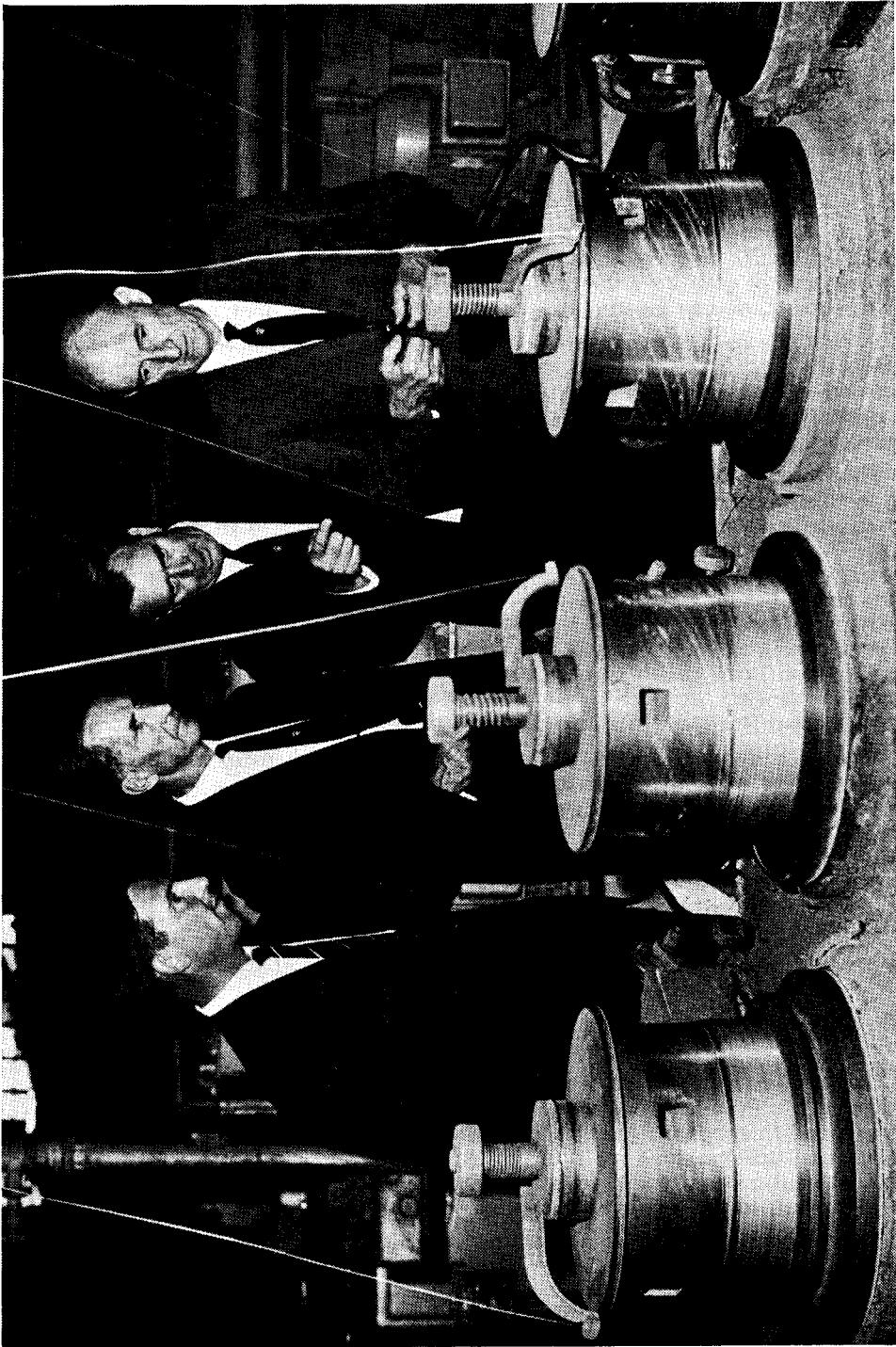
When a new mineral deposit is discovered, the mining engineer and metallurgist are called in to assess its economic possibilities. The mining engineer has to measure the size and the limits of the orebody—he does this with the help of the geologist, and all the scientific techniques he can muster. Diamond drill holes, to extract small cores of the mineral contents, may be drilled to depths of two miles or more—incidentally South Africa leads the world in this type of drilling. The mineral contents of these and other samples are examined by the metallurgist who works out a means of extraction. Then working together these highly trained specialists formulate a plan of operation. If it is a gold mine, the chances are that the main problems will be connected with mining—massive shafts may have to be sunk over a mile deep and a network of tunnels like the streets of a modern city, complete with electric power, water, telephone and drainage facilities installed. Ventilation, air conditioning, rail and other forms of transport are all vital factors to be considered. Specialists of the highest calibre with the best university training and a fund of practical experience are needed to plan these activities. It is truly a wide and challenging task, and as a mining engineer myself, I assure you a most interesting field, and a satisfying subject—particularly in this country where the standards are so high.

Alternatively, the project may well be one in which the mining is simple and the metallurgy more complicated. Here the metallurgist will take the lead. Like the mining engineer, the metallurgical engineer is a highly trained university man whose field of expertise ranges from a knowledge of the physical properties of the minerals making up the deposit to an awareness of the uses and economic values of the metals of the world. He is a chemist of metals, he uses the physical properties of the minerals to separate them from each other by gravity, by flotation, by chemical processes, and then he must purify, alloy and even be prepared to sell the final product. He must design the extraction plant, the refineries, and often the final fabrication mills. Truly a fascinating profession and one of rising importance in this country.

The mining engineer and metallurgist thus work very closely together—our field is all over the Republic and growing numbers of us are spreading further around the world. Just as in the 1890's when chemists and metallurgists were called to Johannesburg to help us solve our early gold extraction problems, so now our members disappear temporarily to Australia, to England, to Europe, to the frozen north of Canada, to the snow clad heights of Peru and to the deserts of North Africa, helping others to sink their shafts, drive their tunnels, extract their metals and improve their methods. We have a worldwide reputation, and justifiably, we mining and metallurgical engineers are proud of our achievements.

Just as those early pioneers in Johannesburg, the Bantu who smelted iron on the Melville Kopje, procured by their special knowledge a higher standard of living and a greater security; so too have we South Africans, by developing our minerals succeeded in establishing the highest standard of living and civilisation on the African continent. Though the Republic covers only some 6 per cent of the area of this continent, we produce about 45 per cent of its mineral wealth and 75 per cent of its iron and steel.

Did you know that over the last 25 years our mineral production has been doubled every 10 years? This then is our task—to keep this up. We believe in the South African Institute of Mining and Metallurgy that we can do it by applying still more scientific knowledge to our problems. We, like the craft guilds of the middle ages, but on a higher plane, are here to improve our expertise, to share our skills and to further our research so that South Africa can keep ahead. From this we believe will follow greater security, a greater sharing of wealth, and more happiness for all our people, and we will hand over a still worthier heritage to those who come after us.



A number of excursions to research laboratories and industrial establishments were arranged for members after the 75th Anniversary Meeting. In this photograph the President, Mr R. C. J. Goode and the Vice-President, Mr V. C. Robinson are being shown a wire drawing machine at African Wire Ropes Ltd.