

*Address by the Chairman of The Industrial Development Corporation and
of the South African Iron and Steel Industrial Corporation Limited*

Dr H. J. van Eck (Honorary Life Member): "Mr President, I regard it as a signal honour that I was invited to address the South African Institute of Mining and Metallurgy on its 75th Anniversary. I also wish to add my congratulations and good wishes to the many you have already received on this memorable occasion.

Seventy-five years is indeed a good age and the achievements of your Institute certainly justify this special celebration.

South Africa owes her present prosperity largely to the technological ability and determination of her own people. Members of the Institute contributed in large measure to this great development of our country and through the years have upheld their high reputation for scientific integrity, dynamic enterprise and dedicated service. It was their knowledge which provided the key to unlocking the mineral wealth which lay dormant for countless ages.

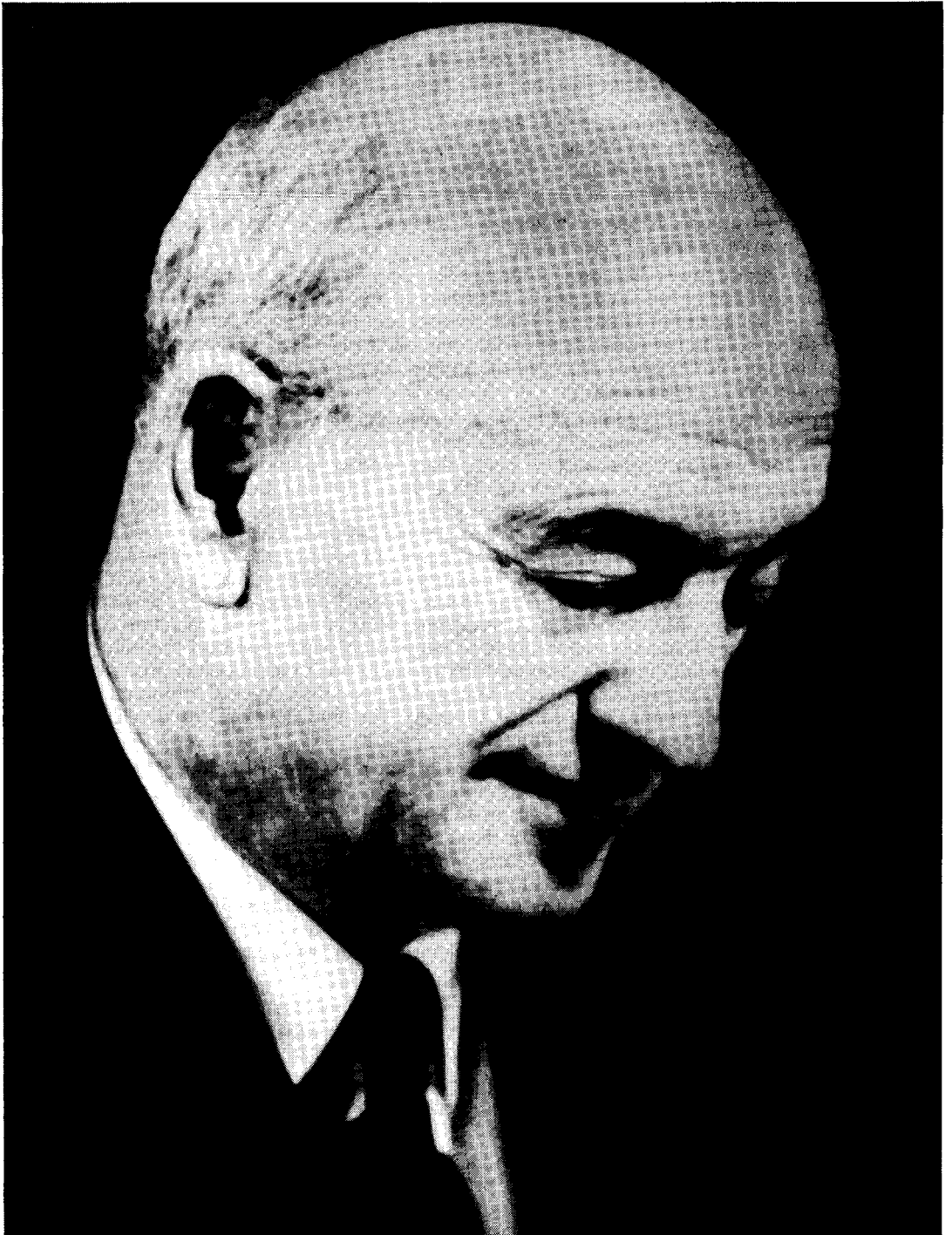
The history of world mining dates back many centuries. We know of the mercury mines of Spain, the tin mines of Cornwall and the zinc mines of Poland, but it was not until colonization of the western hemisphere started in about 1500 that mining of any consequence began in North America. It is true that the peoples of South America and Mexico had accumulated wealth out of gold and silver, but industrialized mining was not a feature of these agrarian cultures. The mining wealth that eventually developed in North America was based on advances in the technology of processing minerals and served as an incentive to people in other new countries. Big mines were opened elsewhere in the world. From Canada, Mexico, Venezuela, Brazil, Peru, Chile, Bolivia, Rhodesia, Australia, Burma and India, to name but a few, there has been a steadily increasing production of an expanding range of minerals and metals. By the middle of the 20th century the trend was to increase the production and use of such comparatively uncommon metals as cobalt, nickel, titanium, and others, and a great mining rush started to search for, and develop, the deposits of uranium, and related radio-active minerals.

It is worth pausing a few minutes to reflect that most of early mining was based on the recovery of virgin metals like gold and silver or easily treated high grade ores of copper, tin and zinc. Today, much of this type of mining would be regarded as picking the eyes out of the mine. With the development of improved ore separating, ore concentration and recovery processes, we developed into bulk mining and bulk treatment and in South Africa we have some very big mines, also outside the gold mining industry at Phalaborwa, for instance. Mining techniques are applied which compare with the best in the world. These large mines could only develop because of the perfection of new concentrating techniques and, of course, because of the development of markets.

We have mentioned nickel and cobalt. These names were given to those mischievous mining sprites called nickels and kobolds to whom the suspicious miners ascribed their inability to smelt copper from copper nickel or arsenious copper ores.

In South Africa, the presence of minerals was known to the modern Western world as far back as 1497 when Vasco da Gama found the native 'strandlopers' at the St. Helena Bay wearing copper rings.

In 1669, after the British East India Company had formed their settlement, they employed miners and assayers in prospecting for minerals and in 1685 found traces of copper in the copper mountain of Namaqualand where some 170 years later a rich deposit of copper was to be opened up. This deposit also had a chequered



DR H. J. VAN ECK

career because it was restarted at O'Okiep and Nababeep after a shut down following almost a 100 years of profitable exploitation. It is still flourishing.

From the earliest times, the country north of the Vaal River was reported by explorers to be rich in minerals. Sir John Barrow, in the map of his travels (1806) makes the first reference to gold in the Transvaal, when he noted high mountains supposed to contain gold in the approximate position of the Witwatersrand, or of the Magaliesberg Mountains, where gold in small quantities had also since been found.

In the course of prospecting for gold it became obvious that there was considerable mining activity in South Africa long before Vasco da Gama rounded the Cape to India. The very extensive workings in Rhodesia have not yet been satisfactorily integrated into the known cultural history of Europe or Africa. The same can be said of the mining at Phalaborwa. The recent interest in the copper nickel deposit at Sedibe and Phikwe 35 miles south east of Francistown in Botswana has led to the conclusion from radio active carbon dating determinations that this deposit was worked about eight centuries ago. This conclusion is indeed intriguing in the light of my previous remarks on the early difficulties in treating copper nickel ores. The most dramatic carbon dating discovery in Southern Africa is that of Dart and Beaumont who studied tools, weapons and artefacts in the iron ore mine at Ngwenya. Dart comes to the conclusion this deposit was worked in the 29th millennium B.P. for ritualistic purposes and he gives a fascinating account of the symbology of blood associated with the blood red and glittering black ores of iron. Dart confirms that the smelting of iron had been carried out by iron age people at the end of the fourth and the beginning of the fifth century A.D. in Swaziland.

The great discoveries of gold in California in 1849 and in Australia in 1851 had stimulated the search for gold throughout the world, and there was a considerable influx of miners and prospectors in South Africa.

With the discovery of diamonds in 1866 and gold on the Witwatersrand in 1886, a new era opened up in the history of South Africa. Mining became the second pillar of our economy, after agriculture.

With this development came a large influx of population and the development of the railway system into the interior.

Our early pioneers in mining played a very important role in this new development in our country and we think of colourful personalities such as J. B. Robinson, Cecil Rhodes, C. D. Rudd, George Farrar, Abe Bailey, Barney Barnato, Solly Joel, the Albus, Lionel Phillips and Percy Fitzpatrick, to name but a few. On a more modest level we refer to George Walker who discovered the Main Reef with George Harrison. Walker became an itinerant teacher and taught my mother on their farm in the Kimberley district. She said he was a fine man and a wonderful teacher. He also taught the Thompson children at Willowmore.

Mention must also be made of the later discovery in 1924 of the famous 'platinum reef' in the Transvaal Bushveld by Dr Hans Merensky, followed by the discovery of the rich Alexander Bay diamond field on the Namaqualand coast in 1926.

Diamond mining suffered at times due to unfavourable market conditions and in 1931 some of our most famous diamond mines actually closed down. Later these mines were reopened, equipped with modern plant and developed by improved mining methods. During this recession we built Iscor. The well trained engineers and artisans from Kimberley assisted greatly in building Iscor and putting the complex plant into operation.

Gold mining remained the country's most important economic activity for many years, and it also provided the early markets for secondary industry in South Africa. Since 1936 new gold mines were developed to the west of the Witwatersrand. Further discoveries held out the prospect of several profitable new mines further west near Klerksdorp. In 1939 the most important economic gold reef horizons were first intersected in the Orange Free State and this great discovery led to the opening up of other large mines. In October, 1951, the first gold ingots from the Free State Mines were poured at the St. Helena Gold Mines Limited, to be followed a few weeks later by the start of smelting operations at the Welkom Gold Mining Company. These events mark the first fruits of the most intensive bore hole drilling and shaft sinking programme undertaken up to that time.

Today the mining industry represents about 12 per cent of our Gross National Product. In 1967 mining employed 616,000 persons with a salaries and wages bill of R329.6 million. Of the 616,000 persons employed in 1967, 404,189 were employed by the Transvaal & Orange Free State gold mines with a total salaries and wages bill of R218 million.

The value of our production of precious metals and minerals almost doubled during the last ten years to reach a figure of approximately R1,300 million in 1967. Of this figure gold production amounted to R768 million, copper R99 million, coal R87 million, diamonds R59 million, iron R27 million, asbestos R27 million, and manganese R24 million. In the past 40 years the value of our mineral production has approximately doubled every ten years.

The mining industry is also an important earner of foreign exchange. In 1967 minerals worth R1,100 million were exported out of the total production of R1,300 million.

All this was achieved after overcoming the most serious challenges which at times threatened the survival of economic exploitation of the relatively low grade diamond, gold and other mineral deposits. In our extensive goldfields the low grade ore is treated under conditions which challenge the greatest ingenuity of man and the highest technological skills. The average gold content in the treated ore is only about one part in 85,000 or 0.001176 per cent. The diamonds are found in a concentration of one part in a hundred million or one carat in 20 tons of diamondiferous material.

At Phalaborwa six million tons of low grade phosphate ore are mined to produce a million tons per annum of high grade concentrate for fertilizers. The capacity of the phosphate plant has been increased to such an extent that it can meet South Africa's total requirements in regard to phosphatic raw materials for chemical fertilizer production. Also at Phalaborwa is the Palabora Mining Company which is the most modern copper mine in the world, but here they have to mine about ten million tons of waste and ten million tons of ore per annum containing .7 per cent of copper in order to produce 70,000 tons of copper which they are able to do at a profit.

The upward trend of uranium production in South Africa was maintained during 1967 and reached 3,214 tons of uranium oxide. The industry is undertaking active and extensive research into more efficient methods of extracting uranium from newly mined ores and particularly from old tailings dumps and slimes dams. The extraction of uranium from such surface reserves may prove economic within the next few years.

A solvent extraction plant at one of the Republic's newer gold mines is at present one of the largest of its kind in the world, and the active ingredient used is a tertiary amine dissolved in ordinary lighting paraffin, which has a high affinity for uranium. This new process can produce uranium more cheaply than the conventional process

and the final product approaches nuclear purity. This is, however, by no means the last word in the improvement of uranium extraction. Dr Robinson and his collaborators are improving this and other processes of ore beneficiation all the time.

The process of cementation by which cement could be injected under pressure into cavities in a shaft under water, has been one of the great inventions in mining in this century. Without this process, it is unlikely that it would have been possible to sink shafts through the dolomite on the Far West Rand.

One of the outstanding events in our mining history is certainly the magnificent victory against the struggle of unprecedented and completely unexpected inflow of water at the West Driefontein mine, one of our richest gold mines, during the latter part of 1968. It is the story of 4,000 men who battled against the inflow of water that must have totalled 2,000 million gallons during a period of 23 days. One of the outstanding achievements was the fact that not one of the 1,500 Bantu mineworkers and 20 odd white miners in the No. 4 Shaft (where the unexpected flood took place) was drowned.

The decision to install the enormous plugs in the No. 4 Shaft in a matter of 11 days, was one of the important steps which made the ultimate recovery of the mine possible. The whole West Driefontein episode was certainly a magnificent record of courage, endurance and engineering skill, and we as South Africans are all proud of this wonderful achievement.

While we have large coal reserves, only a small portion has coking properties, the ash content is high and the mining extraction is very low; our engineers and scientists in our steel works and power stations are stretched to the limit all the time in solving the problems posed by some of our intractable raw materials. At Sasol the coal could formerly hardly be brought to burn, yet Sasol has succeeded in producing petrol and oil and waxes and numerous other important chemical products from that poor raw material. South African engineers made enormous contributions to the ultimate success which Sasol has achieved and its technical staff is now recognised as world leaders in the highly specialized science of petro-chemical industry. Sasol's turnover today is well above R50 million per annum.

From the above remarks it is clear that we need no further proof that we live in a technological society where most of our minerals can be recovered economically and profitably only by the most highly developed organisations working under the strictest industrial discipline.

Technological developments in mining are taking place in all parts of the world today. Increased mechanization, accompanied by improvements in automation techniques, continue to dominate engineering advances in mining and mineral dressing. Slowly but surely the underground push-button coal miner is becoming a reality and the goal of increasing productivity to about 200 tons of coal per man, per underground shift, cannot be too far off. A gigantic 200 cubic shovel is at present being used in a coal mine in Illinois for stripping overburden, while a 3,500 horse-power wheel excavator has started uncovering lignite in North Dakota. A tremendous expansion in truck haulage capacity was made possible by the development of a 240-ton coal hauling truck, powered by two 1,000 horse-power diesel engines. This particular unit is 96 ft long, 15 ft wide and almost 16 ft high, with 16 wheels.

We in South Africa have started open cast coal mining in the Eastern Transvaal while at Dannhauser and Sasol we have started important experiments on long-wall mining whereby the extraction of coal from the mine can be improved,

The days of the highly independent miner, armed with pick axe and divining rod, seems to belong to the past. Instead, skilled teams of scientists and engineers

from many countries and companies cover the globe. These men take along with them new equipment and techniques that were virtually unheard of a few years ago; electronic equipment that represents the latest advances in technical devices and computer capabilities, new vehicles, and new uses of existing ones, and new applications of scientific theories.

The search embraces many minerals, from petroleum, sulphur and potash to gold, silver, diamonds, iron ore and bauxite, to name but a few. Because of heavy demand, tight supplies and rising prices, the modern prospectors—mainly large companies—concentrate on base metals such as copper, nickel, lead, zinc and uranium.

In addition to being an important raw material in the chemical industry, our coal plays a major role in the generation of electric power in the Republic. Escom alone consumed over 20 million tons of coal in 1967. Total sales by Escom in 1967 amounted to 26,657 million units. Mining was by far the biggest consumer, accounting for 11,441 million units or 43 per cent of the total. 9,946 million units were sold to Gold Mining (including uranium).

Electricity still remains the great driving force in the development of our country, and our strength lies in the degree to which our power has been developed.

In 1967 the Republic generated just under 38,000 million units of electricity or 2,022 units per head of total population. This is more than 20 times the average generation per head of the rest of Africa or more than one and a half times the average for the whole world. It is a remarkable achievement by any standard and provides the soundest foundation for the future rapid development of the welfare of all our people. Power generation will increase tenfold in the next 30 years and most of this will have to be nuclear. It is obvious that we shall have to pay attention to optimum coal utilization as well as optimum uranium utilization.

While we have coal reserves on which to base our additional coal-fired thermal power stations, water for cooling purposes in a relatively dry country with few perennial rivers, must become a factor of critical relevance. Consumption of raw water at a 2,000 megawatt generating plant, is estimated at 30 million gallons a day and Escom is therefore to be congratulated on the experimental work which they are carrying out on air-cooling, and the Atomic Energy Board and the Commission on their progressive approach to the possibilities of the development of low-cost nuclear generators at the coast, using sea water for cooling purposes.

Power can today be transmitted economically over distances of nearly 1,000 miles. One of the major contributions which will be made by the giant Orange River Project is that the relatively modest 300 megawatt hydro-electric generating capacity on the two main dams will make it feasible to supply Cape Town's increasing power needs from the vast and reliable Rand and Orange Free State power grid.

The Republic's extensive power grid not only offers the possibility of bringing power economically to all parts of the country, but also offers the possibility of exploiting the vast potential of the major river systems in Southern Africa. The construction of hydro-electric power stations on the Kunene River, the common boundary of South West Africa and Angola and on the Zambesi at Cabora Bassa in Mocambique could be operated to the mutual benefit of South Africa and her northern neighbours—Zambia, Malawi, Rhodesia, Mocambique and Angola. South Africa could assist in this development by accepting into her vast power grid electricity generated at these remote sites, giving and paying for the base load which would permit low cost operation at maximum capacity and efficiency, and could assist further by participating in the construction of the schemes.

Our expanding power network will also widen the choice in siting industrial growth points.

No known bauxite deposits occur in South Africa and like the world's major aluminium producers, the proposed smelter at Richard's Bay will import its raw material, alumina. The value of the imported alumina will increase through beneficiation by 260 per cent and the smelter will therefore effect important savings in foreign exchange. Conservative estimates indicate that about R150 million in foreign exchange will be conserved during the first ten years of production. The planned initial capacity of the smelter is 50,000 metric tons and adequate provision has been made for future expansion. Marketing surveys indicate that the local market in 1971, when the plant is to commence production, will amount to 57,000 tons, which is expected to increase to 77,000 tons by 1974. Production planning provides for growth in order to satisfy market requirements.

Site preparation for the project has already been commenced. Approximately 2 million cubic yards of sand and clay have to be shifted and consolidated in order to prepare the area for the necessary buildings and equipment. Construction should be completed during the first half of 1971.

The South African Railways Administration, responsible for the harbour development, has already commenced building the railway line from Empangeni to Richard's Bay, while Escom will increase power supplies in the Natal network to Richard's Bay. On completion of the Escom powerline during the first half of 1971, production will commence and it is expected that full capacity will be reached in June, 1971.

The development of the smelter and harbour should serve as a particular stimulus for the further development of a new growth point. The requirements of the smelter should provide an important contribution to the economic justification at an early date of the infra-structure to be created at Richard's Bay.

South Africa is on the eve of further great developments, and in the industrial field many metal and metallurgical plants have been erected or expanded. Iscor is being expanded as part of a plan costing about R600 million to produce over 5 million ingot tons by 1971/72, with a further target of approximately 8,700,000 ingot tons per annum by 1980. Highveld Steel has been established near Witbank to manufacture pig iron, vanadium pentoxide and steel.

Our steel and engineering industries have faced many challenges in the past which we have met successfully but we face greater challenges in the future.

I believe that we are poised for revolutionary changes in steelmaking during the next 20 years. Capital costs and operating costs must be reduced substantially if steel is to maintain its competitive position in the world and this applies even more forcibly to South Africa. One visualises a continuous process from ore to steel to rolling mill under complete computer control and in our case using pulverized non-coking coal as a reducing agent of the ore and as a fuel.

Future progress will involve not only the saving of capital costs for the vast equipment required in steel-making but the optimum combination of capital charges, raw material costs, fuel costs and labour availability. The blast furnace is still the most efficient and most economical metallurgical instrument known but for South Africa there are two important limitations at present, namely the handicap of distance and high transport costs as well as poor coke. Iscor is experimenting with formed coke and is much impressed by Japan's success with the enormous importation of high grade iron ores and of high grade coking coal. This latter might be economically

feasible in the iron ore ships which will be returning empty to our shores or in the railway trucks returning empty from the harbour to the iron ore mines in the interior. But these possibilities require careful study and much planning on a comprehensive basis.

Blast furnace operation can be much improved by higher blast temperatures, oxygen enrichment of blast, higher top pressures, liquid fuel injection preparation of raw materials, etc.

South African steelmakers are wide awake as proved by the development of the Rotor and the famous Tandem furnace. Scrap and sponge iron are bound to play a greater part in future steelmaking. Electric smelting is now coming into its own in South Africa.

Great progress has also been made in other major fields of manufacturing industry, particularly in the engineering industry. At least 150 winders manufactured in South Africa are operating safely and reliably on our mines in South Africa and with every winder there is a South African steel rope of the highest quality.

Successful steps have been taken in increasing the South African content of locally assembled motor cars, while aircraft assembly at Kempton Park is in full swing and actual manufacture has been started.

The new submarine telecommunication cable between South Africa and Europe was inaugurated by the Prime Minister at Cape Town on the 18th February this year. This is one of the most modern and efficient external telecommunications systems in the world. It will integrate South Africa still more closely into the great international system of communications through the possibility of further direct links with various cables to the Americas, Australia, New Zealand, Japan and other countries in the Far East. It will also be an essential link in satellite tracking programmes.

Soekor is continuing its search for oil, and has already built up a dynamic organisation capable of carrying out its objects effectively. Perhaps its most important function is the mobilization of internal and external resources in search for oil in South Africa; it has already sub-let the entire Continental Shelf (off-shore) area to a number of prominent oil exploration organisations. It has paved the way for mining in the sea. The borehole in the sea about 30 miles south of Plettenberg Bay is now being evaluated and more and more we shall explore the earth under the sea and the sea water itself as a source of the raw materials needed for an ever-growing world population. I believe the time to be ripe for a study to be made of the economics of nuclear explosions to blast out a few deep water harbours on the sparsely populated West Coast stretching from Saldanha Bay to the mouth of the Kunene River. Soon it will no longer be possible because of human settlement. The same considerations may apply to the bulk mining of certain large low grade deposits.

A keen appreciation has developed with the South African investor to invest in his own country. Even the overseas investor realises today that South African development offers safe conditions. Our gross domestic investment is now financed to about 90 per cent out of local savings and this proportion will increase not because there is any sign of economic nationalism which seeks to keep out foreign capital, but simply because of inherent strength. Foreign capital has always been welcome, particularly if backed with skills and know-how. At the end of 1965 total foreign liabilities in the Republic as a result of investments, amounted to R3,471 million. During the subsequent year this was increased by a further R354 million to R3,825 million, of which the sterling area accounted for R2,439 million, the dollar area R741 million and Western Europe including Belgium, Luxembourg, Western Germany, France and Switzerland, R623 million.

South Africa will have to continue exporting in fields where she enjoys a comparative advantage. A promising field seems to be the export of iron ore in addition to increasing exports of uranium, diamonds, anthracite, coal, manganese, chrome ores, platinum, phosphates, asbestos and fluorspar. We are naturally cautious about depleting our valuable raw materials, but in iron ore we fortunately have many thousands of million tons of ore so that increased exports will hardly affect our enormous reserves.

The export of large quantities of iron ore and other minerals may bring about a revolution in methods of transport in the Republic such as the improvement of our railway system and perhaps even the construction of long distance pipelines for carrying fine ore, limestone slurry, phosphate concentrates and even wood chips for paper and pulp. We also cannot avoid the building of new harbours to accommodate giant tankers and ore carriers of between 100,000 and 150,000 tons.

Mr President, I think you will agree with me that a great future lies ahead for our country, but there is one weak link in our chain of progress. That is the chronic shortage of skilled labour, which is dictated by the rate at which we can train human beings or the rate at which we can train ourselves or drive ourselves.

In considering the future development of mining in South Africa, we believe that important new discoveries will still be made and the sites of these future mineral discoveries will influence population movement. The processing of mineral raw materials and of metals like steel, however, offers a wider choice of siting and this must obviously be largely influenced by economic factors. Sociological and political factors are already recognised in most countries of the world in the location of industry and so also in South Africa. We should therefore bear in mind that vital economic factors in the short term may not be valid in the longer term and this is one of the most challenging problems facing your young dynamic industrial leaders who have to operate in the milieu of a large developing population. The rate of their development, their acceptance of education and training, their ability to accept responsibility and take decisions, their future wants and aspirations cannot be worked out on a computer and we can see the future only dimly. What is uneconomic today may be economic tomorrow because of technological progress. Our economists working with our sociologists may be able to give our planners and decision-makers more guidance in these problems. The responsibility for the welfare of our developing population is the challenge which in South Africa will energise our young people and keep them from the frustrations which seem to be common in other parts of the world even among the most advanced countries or shall we say particularly in the most advanced countries.

This is the challenge to your younger generation. I know we can depend on the South African Institute of Mining and Metallurgy to make its contribution to meeting the challenge of the future which is so vital to our country and the welfare of our people."