

Meeting the Increasing Demand

TWENTY-FIVE YEARS OF EXPANSION AT RUSTENBURG PLATINUM MINES

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To meet the growing requirements for platinum and its allied metals a continuing programme of capital investment, exploration and production has been undertaken by the world's largest platinum producer, Rustenburg Platinum Mines. These developments provide the majority of many of the platinum group metals required by industrial users throughout the world.

The first issue of *Platinum Metals Review* in January 1957 included an article describing the operation of Rustenburg Platinum Mines at that time. Output was then some 200,000 ounces of platinum a year and involved the employment of 10,000 workers.

Now, twenty-five years later, and as a result of a continuing programme of expansion and mechanisation, the annual output has risen by a factor of six to approximately one-and-a-quarter million ounces of platinum with more than 40,000 people employed in the mining and refining operations.

This achievement, brought about by the increasing demand for platinum that has occurred from time to time over the period, has been the product of a series of capital expenditure programmes aimed at matching supply with demand by the bringing into operation of new mining areas, by the mechanisation of mining methods and by the development of improved methods of extraction and refining.

Rustenburg Platinum Mines was established fifty years ago and now comprises three distinct mines on the Bushveld Igneous Complex in the Transvaal. Taken together these form the largest underground mining operation in the world—the strike extending over thirty-three miles in length. Some ten tons of rock have to be mined, brought to the surface and treated in order to produce one ounce of the metal.

The platinum, together with its allied metals palladium, rhodium, iridium, ruthenium and osmium as well as nickel, copper and cobalt, is found in the Merensky Reef which is named after Dr Hans Merensky who made the initial



The use of twin-boom pneumatic rigs, for drilling the holes to contain blasting explosives during the development of underground haulage routes allows a considerable saving in labour and improved breaking efficiencies, and has also improved working conditions



The Waterval smelter complex shown here is one of four such plants within the company where the mineral brought to the surface is crushed, treated and smelted to a matte

discovery in 1924. This reef averages only three feet in thickness and involves difficult stoping operations.

The shallow parts of the reef are worked from a series of inclined haulages that start from surface and which are sited about 650 feet

apart. The deeper areas are opened up from a number of vertical shafts ranging in depth from 500 to 3000 feet.

The mineral brought to the surface is first crushed and milled, the ground product being treated by flotation and gravity separation

Electric smelting is highly efficient and more economical than traditional blast furnace smelting. Molten matte, containing the platinum metals and much larger quantities of iron, copper and nickel sulphides, is periodically tapped from this submerged arc electric smelting furnace into the two ladles for transfer to the casting area



to yield the free mineral particles of platinum generally known as "metallics". The concentrates from which these have been separated, and which still contain some two-thirds of the platinum metals as well as most of the base metals, are further treated by flotation, then filtered, dried, pelletised and smelted to a matte containing mainly nickel and copper sulphides and some 25 to 30 ounces of platinum per tonne.

The nature of this complex series of extraction operations has remained essentially unchanged during the past twenty-five years although many improvements in technique have been introduced so as to increase efficiency and reduce the amount of time required to yield the final products. Since 1957 a series of expansion programmes have been implemented in order to match the increase in demand. On several occasions these expansion programmes have had to be postponed or curtailed as a downward swing in the demand cycle occurred.

With the introduction during the 1970s of the demand for platinum converters in automobiles in the U.S.A. and Japan, a new mining area was opened up by Rustenburg Platinum Mines which has the potential for significant expansion in the future. In recent years a great deal of attention has been given to the productivity of the mines, involving new mining methods as well as mechanisation of both underground and surface operations. These have resulted in higher outputs from the workers and a greater degree of control of operations.

Extraction and Refining

The production of the metallics and matte forms the final operation at Rustenburg. The further treatment of these products is performed by Matthey Rustenburg Refiners, a company jointly owned by Rustenburg and Johnson Matthey, with three plants in operation. One of the plants is at Rustenburg, another at Wadeville near Johannesburg and a third in England at Royston in Hertfordshire. The first of these treats the matte so as to separate out the base metals from the noble

metals. The nickel and copper are refined electrolytically, while the cobalt is produced as a sulphate.

The final refining of the noble metal concentrate together with the metallics into the individual platinum metals in a state of high purity is then undertaken at Wadeville and Royston where a complex series of precipitation methods has been employed since the beginning of operations in 1931. In the last few years, however, an improved process making use of solvent extraction has been developed to the pilot plant stage and a new refinery is at present being built at Royston to put this into operation on a large scale. The new process reduces both the number of refining stages and the time required to yield the insoluble metals. It also lends itself to an increased use of automation.

Matching Supply with Demand

The joint activities of Rustenburg and Johnson Matthey constitute the world's largest source of platinum metals and together these companies ensure adequate and continuing supplies of these metals to the many industrial and jewellery customers. Expansion and substantial investments of capital over the years (the total assets of Rustenburg and Matthey Rustenburg Refiners now amount to some £900-million in today's terms) have been based upon carefully researched estimates of future requirements, but inevitably the vagaries of the economic cycles and the eighteen to twenty-four months' lead time required to establish new capacity have made it difficult to achieve a close balance between supply and demand. A long-term view has to be taken to justify the investment of expansion capital as well as the employment of thousands of extra workers that are needed.

There is no doubt that platinum has the potential for a wide variety of new uses and that it will be required in ever greater quantities during the years ahead. Happily the known reserves of this metal in the Merensky Reef run to over 300 million ounces and below the Merensky is another reef that contains as much platinum again.