

Platinum Mining in the Transvaal

OPERATIONS AT RUSTENBURG PLATINUM MINES

The mining of platinum in the Transvaal is being carried out by the Rustenburg Platinum Mines Limited, at the two sections of its property, one of which, the Rustenburg section, lies a few miles to the east of the town of Rustenburg while the other, the Union section, is situated some sixty miles to the north of that town.

Rustenburg Platinum Mines Limited has in recent years become the world's largest producer of platinum and is in fact the only major producer whose prime business is the production of platinum group metals.

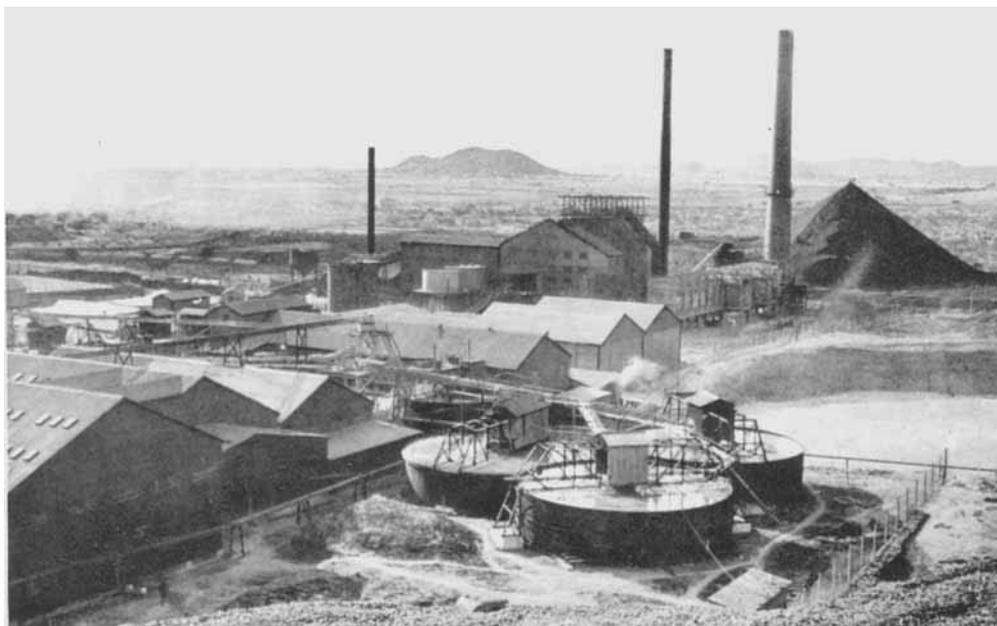
The deposit worked on both sections of the mine forms part of the so-called Merensky Reef Horizon of that extraordinarily interest-

ing geological formation — the Bushveld igneous complex.

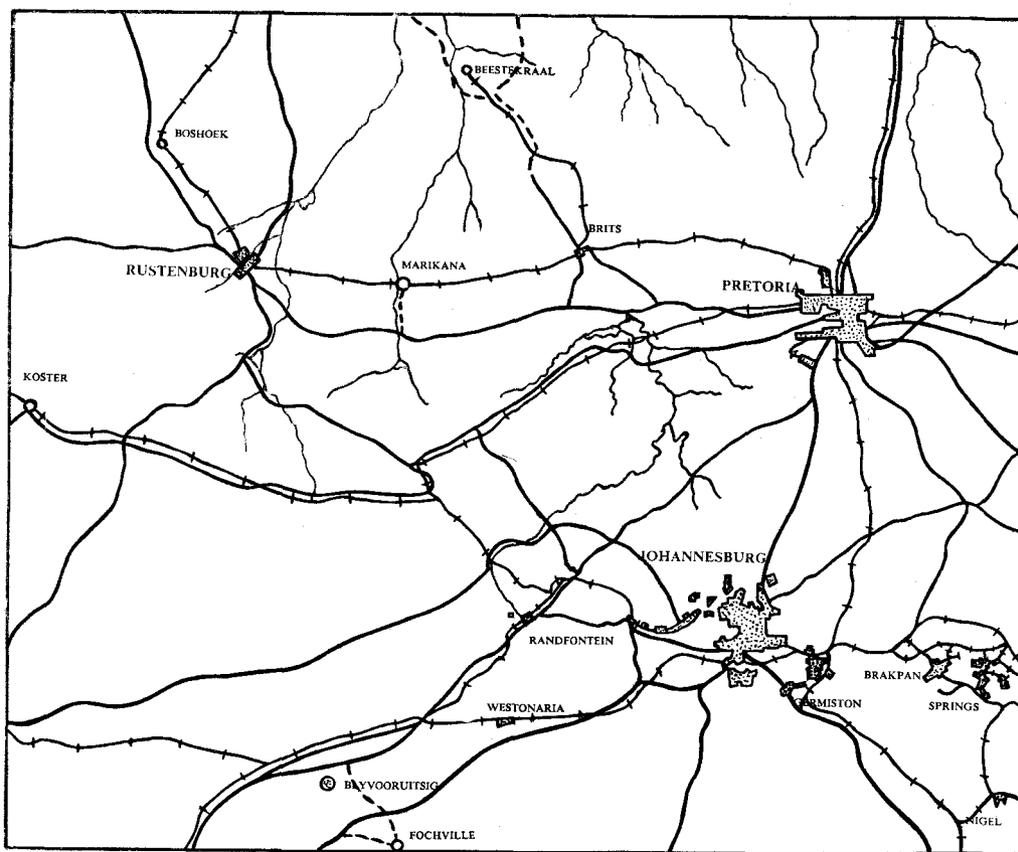
Platinum was first discovered in South Africa in 1923 in lode deposits in the Waterberg district of the Northern Transvaal and the discovery of these occurrences started off a search for further deposits.

The Merensky Reef

Dr. Hans Merensky found platinum in both the Dunitite deposits and the Merensky Reef Horizon in the Lydenburg district, and also in this latter horizon in the Potgietersrust area. Both of these discoveries were on the eastern fringe of the Bushveld igneous complex. Dr. Merensky finally located the



The reduction plant at the Rustenburg section, showing the smelter plant and slag dump in the background



Rustenburg lies some 70 miles to the north-west of Johannesburg in the Western Transvaal. The Rustenburg section of the property lies a few miles to the east of the town, the Union section being some 60 miles to the north

platinum bearing reef beneath the black turf soil of the Rustenburg district, and this reef has now been traced for over 140 miles in that area.

These discoveries were followed by a minor boom in which several platinum mining ventures were started. The boom was, however, shortlived and following upon reductions in the price of platinum a slump occurred in the late 1920's. Only two mining companies survived. These companies were Potgietersrust Platinums Limited and Waterval (Rustenburg) Platinum Mining Company, which in the interests of economy were merged in 1932 to form the Rustenburg Platinum Mines Limited.

In 1947, the Union Platinum Mining Company Limited was formed to work the

Merensky Horizon on the Farm Swartklip, some 60 miles to the north of Rustenburg. This company was amalgamated with the Rustenburg company in 1949 and it now constitutes the Union section of Rustenburg Platinum Mines Limited.

Other South African mining houses have prospected, and continue to prospect, areas in the Rustenburg district but no further active mining operations have started.

Geology

The Bushveld igneous complex is a vast composite body of plutonic and volcanic rocks in the central part of the Transvaal. It is irregularly oval in shape, measuring some 280 miles along its major axis with a maximum width of roughly 150 miles, and

covers an area of about 15,000 square miles. The outer or lower portion of the complex consists of norite and allied basic and ultra-basic rocks, and in the inner or upper portion of red granite, granophyre, basalts and pyroclastic volcanic rocks.

The norite forms a great basin-shaped sheet from two to three and a half miles in thickness and the width of the outcrop ranges from five to over twelve miles. The Merensky platinum-bearing horizon is located in the lower portion of this norite sheet.

At both the Rustenburg and Union sections the platinum group metals are mainly concentrated in a layer of coarse felspathic pyroxenitic norite against which lies a three-quarter-inch chromite-rich platiniferous band known locally as the "Chrome Band".

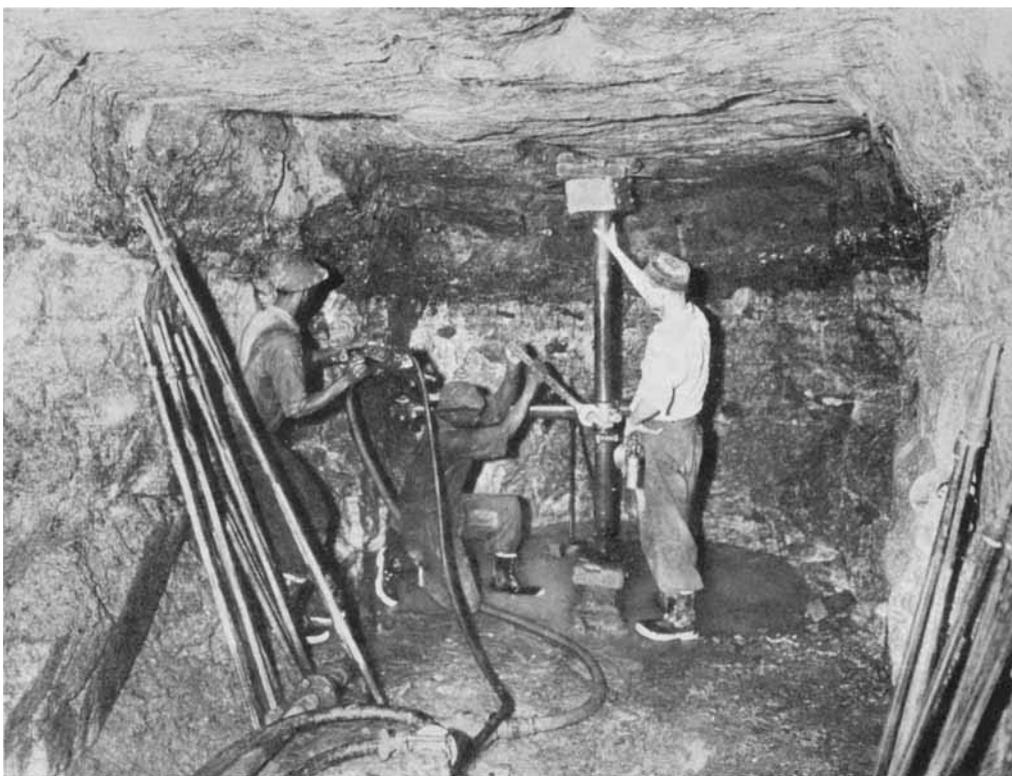
At the Rustenburg section a strike length of approximately 40,000 feet of the reef is being mined with a 9 to 10 degree dip to the north, whereas at the Union section that portion of the reef being worked has a strike length of about 13,000 feet and an easterly dip of 21°.

On both sections the following minerals are found in the sulphide ore mined:

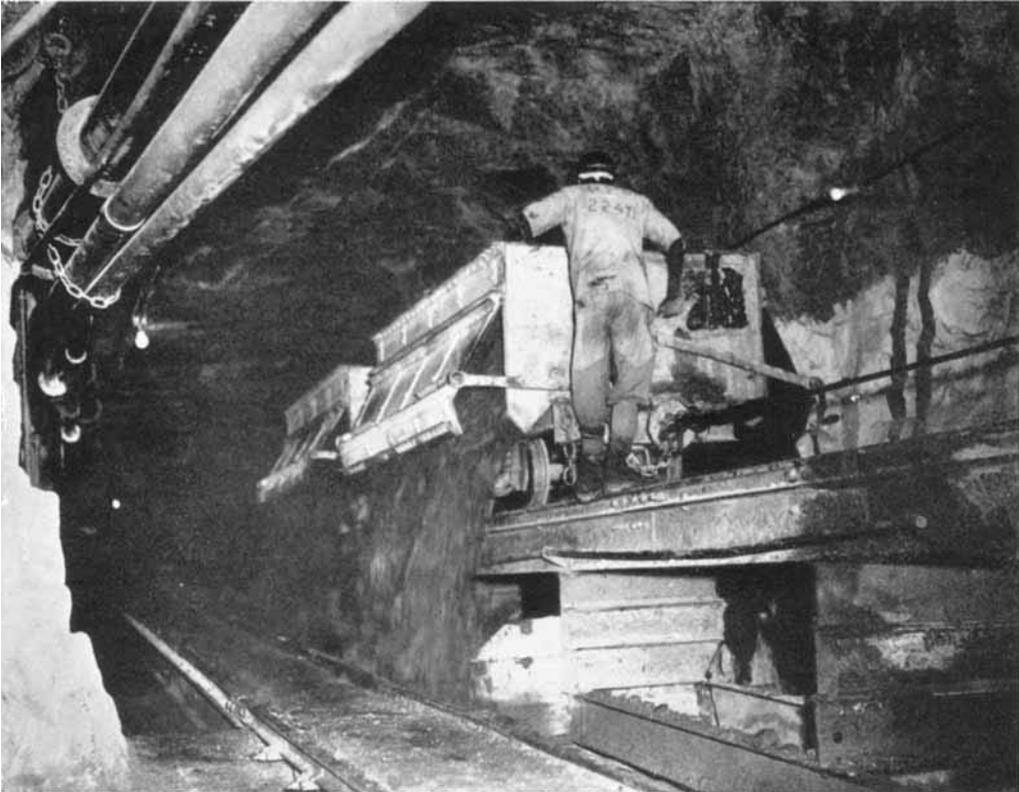
Chalcopyrite	Cubanite
Nickeliferous pyrite	Graphite
Phyrrhotite	Millerite
Pentlandite	Violarite

The primary silicates include olivine, diallage, bronzite and labradorite, while hornblende and biotite occur as secondary reaction minerals.

The metals of economic value recovered



Drilling in progress in a typical development end, showing the ore body as a dark-coloured formation against the roof



Four-ton trucks discharging platiniferous ore into the underground shaft ore bins

after the reduction and treatment of the ore comprise platinum, palladium, iridium, rhodium, ruthenium, osmium, gold, copper and nickel.

Mining Methods

The dip and strike of the ore bodies on each property are consistent, and although an occasional dyke is met with there is an almost complete absence of faulting. Certain geological disturbances which interfere with mining operations and which exist mainly on the Rustenburg section are circular depressions of the ore body locally known as "potholes". These vary in diameter from 20 feet to 300 feet and represent a depression of the ore body, usually of about six feet in extent.

The consistency of values found throughout

the breadth and length of the ore bodies in each of the two mining areas is remarkable.

In both sections, incline haulages from the surface on or under the reef are used to work the shallower portions of the deposit. These haulages are sited about 2,500 feet apart on strike and are connected by drives on reef. The deeper areas are being opened up by means of vertical shafts and footwall haulages.

Underground traction is by diesel or electric haulage of four-ton hoppers which deliver the broken ore to the shaft ore bins. Very little water is made in the mine and there are therefore no pumping problems. Likewise, ventilation methods are straightforward.

At the Rustenburg section mining has now reached a vertical depth of 1,000 feet from surface, which is equivalent to about 6,000

feet on dip. Three vertical shafts have been sunk to depths varying from 300 feet to 1,500 feet, and a further 1,500 foot shaft is about to be started. The vertical depths of workings at the Union section are of the same order.

Reduction Practice

As the platinum group metals are associated with the sulphides found disseminated throughout the chromite and pyroxenite bands, the collection of these metals follows the collection of the sulphides.

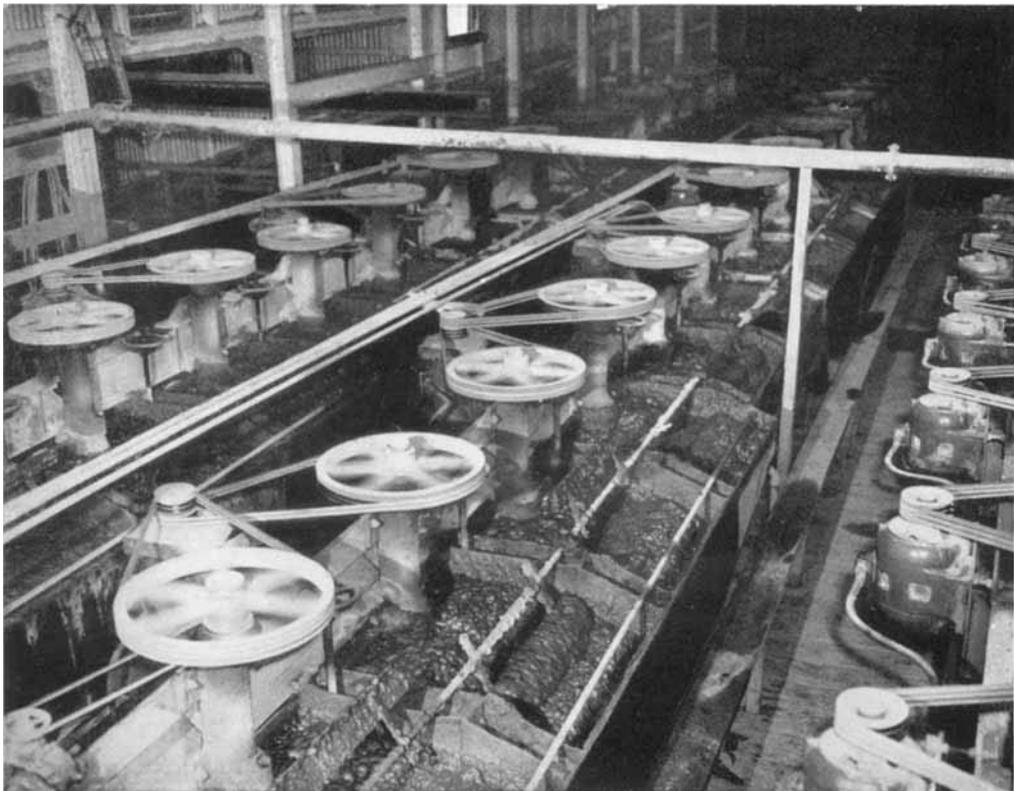
The reduction process may be divided into four sections:

- (a) Crushing
- (b) Milling and gravity concentration
- (c) Concentration by flotation and
- (d) Smelting

The smelting process is carried out only at the Rustenburg section and flotation concentrates produced at the Union section are delivered by road to the Rustenburg section.

Two-stage grinding is carried out in ball mills and is followed by gravity concentration on corduroy cloths, the concentrate being cleaned and redressed on James shaking tables ready for transportation as a high grade metallic concentrate to Johnson, Matthey & Co., Limited, of London.

The pulp from this section is thickened and fed to the flotation circuit, the concentrate being itself thickened and filtered on drum filters ready for the smelter section. The moist concentrate is mixed with slaked lime and flue dust and is then briquetted. After drying the briquettes are fed to the blast



A portion of the flotation plant, where the platiniferous concentrates are separated from the pulp

furnaces with coke fuel and fluxes and smelted.

The flow from the blast furnaces is by trap spout to a forehearth where the slag and matte separate. The slag is granulated and dumped, while the matte is tapped at intervals, conveyed to a "Great Falls" type converter and blown to a high grade copper-nickel matte. This matte is cast and either prepared for shipment to the Johnson Matthey refinery in London or sent to Matte Smelters (Proprietary) Limited, which is situated adjacent to the mine at Rustenburg. Matte Smelters (Proprietary) Limited is a joint subsidiary of the Rustenburg Platinum Mines Limited and Johnson, Matthey & Co., Limited.

In the refinery of Matte Smelters the copper-nickel matte is reduced to electrolytic copper and nickel and an enriched concentrate of platinum group metals and gold. The copper and nickel are available for sale either locally or overseas, and the concentrate is sent to London for further treatment by Johnson Matthey.

A pelletising plant, capable of converting moist flotation concentrates into one-inch pellets, is shortly to be installed at the Rustenburg smelter to improve both the handling operations prior to smelting and the smelting process itself.

Labour Force

During the last financial year the two sections together employed about 1,100 Europeans and nearly 9,000 African natives. With the expansion programme in progress these figures will be increased towards the end of 1957 to 1,800 Europeans and 15,000 African natives.

The European labour supply is drawn partly from the farming area around Rustenburg, where the young men are recruited as learner miners, plant operators, etc., while

trained miners and artisans are drawn from other mining areas.

The native workers are largely the migratory type who come from areas far afield seeking employment to their liking and in the knowledge that good housing, feeding and medical attention are supplied. Many of these natives complete a number of tours of duty interspaced with long holidays and rest periods at their homes.

Scale of Operations

It has always been the policy of Rustenburg Platinum Mines to operate at a scale commensurate with the demand for platinum, and since the amalgamation of the two sections the company, operating in close conjunction with Johnson Matthey who refine and dispose of the metals produced, has been engaged in a process of almost continual expansion. The annual tonnage milled at the commencement of operations in 1932 was 91,000 tons. By 1955 this figure had risen to 1,600,000 tons and, in view of the present increasing world demand for platinum, a programme is in hand which will result in a milling rate of approximately 2,600,000 tons per annum before the end of 1957.

The present scale of operations involves the consumption of 85,000,000 kilowatts of power and 570,000,000 gallons of water a year, in addition to the purchase of £1,500,000 worth of stores, while £1,100,000 is paid out in European wages and £400,000 to native employees. During the course of the coming year there will be an increase in all these amounts by more than 60 per cent.

The directors of the company are constantly alert to the changing demand for platinum brought about by modern technological development and are ready to enlarge the rate of production when it is required by the developing needs of industry.

(This article has been contributed by the technical advisers to Rustenburg Platinum Mines Ltd., the Johannesburg Consolidated Investment Company Limited.)