



Supplies

The expansion of platinum mining in South Africa

A period of unprecedented growth

The South African platinum industry is currently expanding at an unprecedented rate in order to meet projected increases in demand. With the exception of Northam, all existing producers have ambitious expansion plans. They will be joined by several new entrants as the South African government's policy of black economic empowerment leads to the greater involvement of black-led companies in the platinum mining sector, mainly in the form of joint ventures with existing producers. Additional investment is also expected from non-South African companies, such as the UK's Cluff Mining and Canada's SouthernEra.

As a result of this expansion activity, platinum output is set to rise substantially over the next four years. If all new projects reach their targets, refined production from South African platinum mines could be as high as 6.3 million oz in 2006, with Anglo Platinum alone reaching an annual production rate of 3.5 million oz.

The changing focus of platinum mining

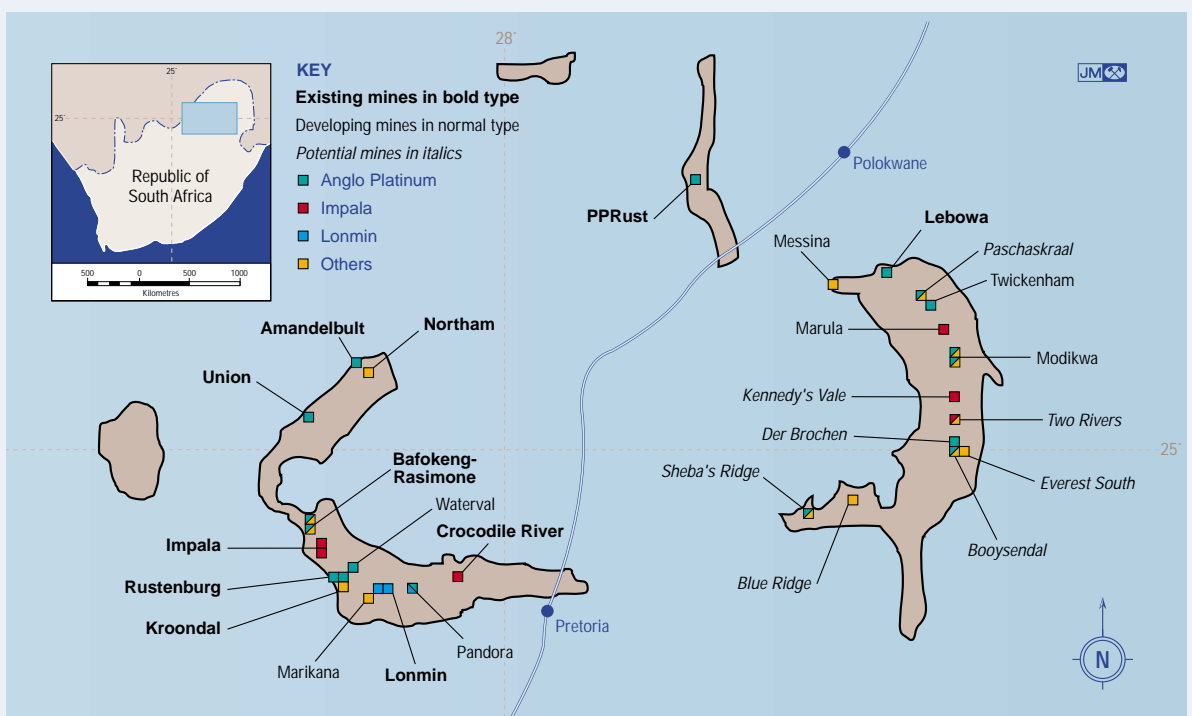
Traditionally, platinum mining in South Africa has been concentrated on Merensky Reef reserves hosted by the western limb of the Bushveld Igneous Complex. The Merensky Reef has been the main source of ore because it generally has a higher pgm content than the UG2 and, because of its lower chromite content, is also easier to process. However, as much of the shallow Merensky ore on the western Bushveld has now been extracted, most of the proposed new projects will mine UG2 reserves.

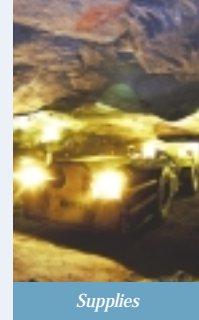
In 1998 – before the most recent phase of expansions – the UG2 reef accounted for around 38 per cent of the ore processed by South African platinum mines. By 2002, that proportion had risen above 50 per cent and in 2006 we expect UG2 to account for over 60 per cent of the total ore processed.

The Merensky Reef reserves on the western Bushveld were exploited in preference to those on the more remote eastern limb because grades in the west tend to be higher and access and infrastructure was easier to develop. However, higher platinum prices, the prospect of rising demand, and above all the depletion of the most attractive ore reserves on the western Bushveld have begun to offset these disadvantages. The eastern limb accounted for a mere 6 per cent of platinum production in 2002; by 2006, that proportion will be around 18 per cent and by the end of this decade, could be as high as 30 per cent.

These developments have important implications for the production of other pgm, especially palladium and rhodium. Assuming all the proposed expansions are successful, platinum output will rise by over 40 per cent between 2002 and 2006, but palladium and rhodium output will each increase by over 60 per cent. Ruthenium and iridium output will also increase significantly. Compared with the Merensky Reef, the UG2 contains a higher proportion of minor pgm, particularly rhodium and ruthenium, while the UG2 in some parts of the eastern Bushveld contains unusually high concentrations of palladium (in some places, exceeding the platinum grade) – see charts opposite.

Schematic map indicating the Bushveld Complex and showing the approximate locations of actual and potential platinum mines





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The western Bushveld: near-term additions to production

Despite increased investment on the eastern limb, development is also continuing on the western Bushveld; in fact, in the short term, most additions to platinum production will come from projects in this area. The existing infrastructure means that expansions can often be brought on stream very quickly. For example, Phase 1 of Anglo Platinum's Rustenburg UG2 project was able to source ore through the redevelopment of existing Merensky Reef shafts. This enabled the project to reach production just 17 months after the decision to develop the mine had been announced. On the eastern limb, the construction of new mines and the build-up of production will generally be much slower.

Anglo Platinum is engaged in a number of other expansion projects on the western Bushveld, including a doubling of capacity at its Bafokeng Rasimone Platinum Mine. This project, which involves the Royal Bafokeng Nation as a 50 per cent joint venture partner, should add 230,000 oz of platinum to the mine's annual capacity.

In November 2002, Anglo Platinum announced a tailings retreatment project at Rustenburg, which will produce an average of 120,000 oz of platinum annually over its 15 year life, and a month later the group confirmed that it would proceed with Phase 2 of its Rustenburg UG2 project. This will involve a doubling of concentrator capacity to 800,000 tonnes of ore per month, and will generate an additional 306,000 oz of platinum annually (although this will be offset by declining output from the Merensky Reef at the Rustenburg Section).

Lonmin is also expanding its existing mines on the western limb, with the aim of lifting platinum production to over 1 million oz per annum (this will include the company's share of output from the Pandora joint venture with Anglo Platinum). In October 2002 Lonmin commissioned two new 120,000 tonne per month concentrators; these will initially be used to process ore from newly developed open pits, and later to concentrate material from underground operations at the Karee mine and the Pandora joint venture. The latter is planned to mine some 320,000 tonnes of UG2 ore per month, yielding 230,000 oz of platinum per annum, when it reaches full production in 2007.

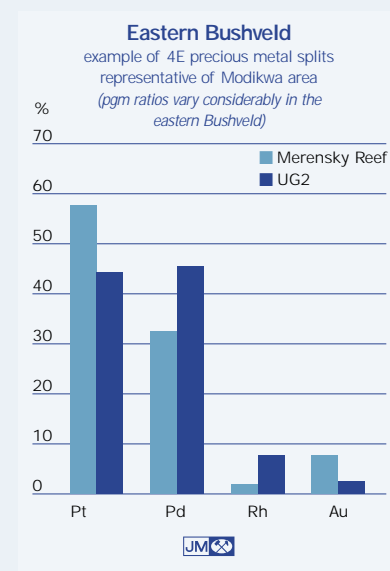
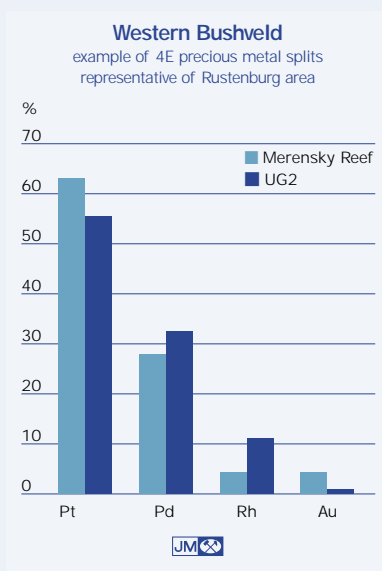
Impala's ability to grow output from its existing lease area is relatively limited. However, the company is considering investing in a new concentrator circuit to increase UG2 milling capacity and is also evaluating a tailings reprocessing project. These projects could help to lift annual platinum output from the Impala lease area to over 1.1 million oz per annum.

Towards the end of 2002, Aquarius Platinum brought the Marikana platinum mine into production following a very rapid construction and commissioning schedule. This is the company's second operation on the western limb, joining the Kroondal mine



The Marikana mine is one of several projects contributing to rising pgm production on the western Bushveld.

An aerial view of the Modikwa mine in the middle of the eastern Bushveld.





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Decline development at Impala's Marula mine, which is scheduled to produce 103,000 oz of platinum per year.



10 km to the west. The Marikana UG2 concentrator has a milling capacity of 128,000 tonnes per month, which will yield 95,000 oz of platinum in concentrate annually. The project will make its first significant contribution to platinum supplies this year.

New horizons: projects on the eastern Bushveld

Until 2001, Anglo Platinum's small Lebowa operation was the only active platinum mine on the eastern limb of the Bushveld (not counting PPRust on the northern extension). It was joined in 2001 by SouthernEra's redevelopment of the mothballed Messina mine, and in 2002 by the start of Anglo Platinum's Modikwa project, a joint venture with a black empowerment consortium led by African Rainbow Minerals.

The Messina project was partly developed in the early 1990s, but low pgm prices led to the operation being placed on care and maintenance in 1992. The Canadian company SouthernEra acquired the mine in March 2000 and limited pgm production began in 2001 from the Voorspoed section. Last year the company announced a decision to expand Phase 1 of the project by 50 per cent to 120,000 tonnes of ore per month; this is expected to yield around 95,000 oz of platinum per annum when full production is reached in 2005.

A second phase of development is currently in the advanced stages of planning; this will involve a further increase in production

via the exploitation of resources on the farm Doornvlei, about 12 km east of the Voorspoed shaft. A third stage of expansion is also proposed that could encompass reserves on the Dwaalkop properties, which lie between Voorspoed and Doornvlei. Prospecting rights for this section were granted to a joint venture between SouthernEra and Mvelaphanda Resources in August 2002.

Modikwa is the most advanced of Anglo Platinum's suite of projects on the eastern Bushveld. The mine made its first contribution to platinum supplies last year, and output should increase rapidly in 2003. The concentrator reached its design throughput rate of 200,000 tonnes per month in September 2002, initially milling relatively low-grade ore from underground development and early stoping operations. The head grade should improve substantially this year and full production of 162,000 oz of platinum per annum is expected during 2004.

Anglo Platinum also began construction of the first decline at the new Twickenham mine in mid-2002. Sinking of a second shaft commenced in February 2003, and a 250,000 tonne per month concentrator plant is scheduled for commissioning in 2005. Full production of 160,000 oz of platinum and 176,000 oz of palladium should be achieved two years later.

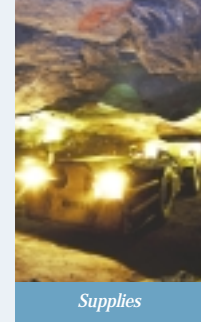
The Der Brochen project is likely to be the next of the group's eastern limb projects to proceed. A feasibility study is due to be completed in 2003 and the mine is scheduled for commissioning in 2006. Anglo Platinum also has two proposed joint ventures adjacent to the Twickenham and Der Brochen project areas. These will be stand-alone operations, with ownership split 50:50 between Anglo Platinum and black empowerment groupings. The latter will contribute some mineral rights to the joint ventures, which were granted by the government in August 2002. The Booyensdal project is located immediately south of Der Brochen, while Paschaskraal fills the gap between Lebowa and Twickenham (*see map*). No formal announcement of the scope of these projects has been made, but they are all likely to be substantial operations, similar in size to the Modikwa mine.

Impala is also undertaking a major project on the eastern Bushveld – the Marula platinum mine – in which it holds an 80 per cent interest. The remainder is split evenly between Mmakau Mining and a community-based empowerment consortium. Mine development began in September 2002 and stockpiles of development ore are being accumulated in anticipation of the start of concentrator commissioning in October 2003. Full mill throughput is planned for March 2004, with steady state production of 103,000 oz of platinum per annum from August of that year.

A second possible phase of development at Marula would involve an increase in the volume of UG2 ore mined and would lift platinum production to about 190,000 oz per annum. This could be undertaken about two years after Phase 1 is completed. A third phase would see Impala develop the Merensky Reef, which is

Sinking of the second shaft at Anglo Platinum's Twickenham project began with this blast in February 2003.





Legislation leads the changes

Two pieces of South African legislation enacted over the past year have been instrumental in opening up opportunities for new companies to enter the South African pgm industry.

The Mineral and Petroleum Resources Development Bill ('the Minerals Bill') was enacted in October 2002 and resulted in the control of mineral rights being transferred from the private sector to the state. A key aim of the bill was to broaden ownership of mineral rights and to expand opportunities for 'historically disadvantaged South Africans' (HDSAs) to participate in the mining industry. To this end, the legislation introduced the principle of 'use it or lose it' to prospecting and mining rights that had previously been granted. This resulted in significant packages of prospecting rights that had no record of recent or current

exploration being relinquished by their previous owners to the government, many of them in advance of the legislation. Some of these were subsequently then put up for tender.

October 2002 also saw the publication of the Broad Based Socio-Economic Empowerment Charter for the Mining and Minerals Industry (the 'Mining Charter'). One of the key elements of this legislation is that mining companies have to provide for HDSA participation in the industry. Targets of 15 per cent HDSA ownership of equity or attributable production within 5 years and 26 per cent within 10 years have been set. This has encouraged the formation of joint ventures between established platinum producers and black economic empowerment groups to develop new pgm mines on the Bushveld Igneous Complex.

vertically separated from the UG2 by about 400 metres. This has the potential to more than double platinum output at Marula to around 400,000 oz per annum but is unlikely to go ahead before the end of this decade.

Another project that is likely to contribute to platinum production within the next two years is Aquarius Platinum's Everest South. This is immediately east of the Booyssendal project area, in a location where a "bulge" in the UG2 has produced a small stand-alone deposit east of the normal path of the reef. During 2002, Aquarius undertook a feasibility study, including trial mining operations. The project is expected to be given the formal go-ahead during 2003 and to enter production about 12 months from the start of development. It will have a milling rate of 250,000 tonnes per month, generating around 135,000 oz of platinum annually.

Other projects on the eastern Bushveld are less advanced and are unlikely to add to platinum supplies before the second half of this decade. The Two Rivers project, immediately north of Anglo Platinum's Der Brochen project, is a joint venture between Anglovaal Mining, Impala, and a black empowerment consortium. It is currently at the feasibility study stage, and a formal decision to proceed is expected this year. At a milling rate of 175,000 tonnes of UG2 ore per month, annual output of platinum would be around 113,000 oz.

Other potential future producers include the mothballed Kennedy's Vale mine, in which Impala owns an 83 per cent stake via its holding in Barplats. The operation has an existing partly developed vertical shaft to a depth of 900 metres. Impala is currently evaluating the feasibility of redeveloping the mine to extract the UG2 reef using mechanised methods.

The UK company Cluff Mining has two active projects on the southern section of the eastern limb (in addition to other projects at a less advanced stage of exploration elsewhere on the Bushveld).

Drilling at Blue Ridge West has enabled the company to outline a resource of 39 million tonnes of UG2 ore at a grade of 3.1 grams per tonne. A feasibility study is due to be completed in the second quarter of 2003, and this envisages a mine producing around 105,000 oz of platinum per annum.

Cluff is also currently undertaking a second phase of exploration at the Sheba's Ridge project, to the west of Blue Ridge, in a joint venture with Anglo Platinum. The area has a complex geology: previous drilling discovered five pgm-bearing reefs, including layers similar to the Merensky Reef, UG2 and Platreef.

A number of other companies are also exploring the pgm potential of properties on the Bushveld Complex, some through joint venture agreements with Anglo Platinum and Impala. Most of these projects, however, are at a very early stage of exploration.

The Changing Profile of PGM Production Across the Bushveld Complex

