

# SOUTH AFRICAN PGM PRODUCTION

The South African mining sector has changed shape radically over recent years. Issues such as mineral rights, black economic empowerment and personnel recruitment have driven significant change across the industry. Although the effects of these challenges have been seen in coal and gold mining, they have perhaps been most obvious in the platinum industry, which has at the same time been working to increase output.

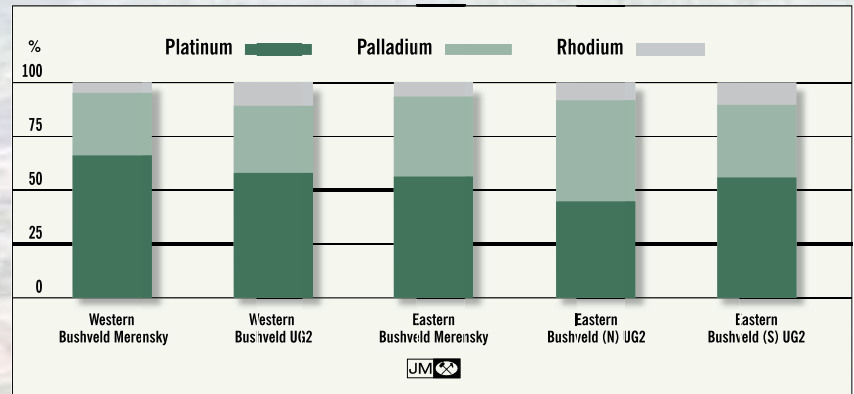
## BEE/HDSA

Perhaps the most important change in the mining environment has been the introduction of regulations governing black economic empowerment (BEE) or ownership by historically-disadvantaged South Africans (HDSA). These rules were set out in the 2002 Mineral and Petroleum Resources Development Act and the Mining Charter. They target 26 per cent HDSA ownership of the mining industry's assets by 2014.

## MINERAL RIGHTS

The same rules set out a process for the conversion of mineral rights. Before 2004, these were owned by individual companies. The new law passed ownership and regulation of mining and exploration rights to the South African state and required mining companies to reapply for so-called "New Order Rights". The process of converting to these new rights is dependent on compliance with HDSA rules and is in progress.

Other new legislation covering mining royalties and beneficiation (added-value processing such as smelting or the manufacture of final



products such as jewellery) also either exists or is being developed.

## JUNIOR MINING HOUSES AND EXPLORATION

Increased metal prices, BEE rules and the redistribution of some mineral rights have encouraged a proliferation in the number of mining houses exploring and producing metal across South Africa. Most platinum production in 2002 was from the big three producers (Anglo Platinum, Impala and Lonmin). This is still true but substantial contributions are now being made by a second generation of producers in the form of Aquarius, ARM and Eastplats.

Announcements last year of various BEE deals also look set to create a further wave of producers in the medium-term such as Mvelaphanda Resources and Anooraq, two BEE mining companies which look set to control significant platinum resources.

## FUTURE DEVELOPMENTS

In line with the well-publicised expansion plans of the platinum industry, a number of mines are set to come into operation soon (2008 should see the first production from Platinum Australia, Platmin

and Ridge Mining). There are many other projects which could begin operating within the next five to ten years, as shown overleaf. Much of this expansion will be on the Eastern limb of the Bushveld Igneous Complex. These operations typically mine UG2 ore rather than Merensky Reef and are richer in palladium and the minor pgms than most Western Bushveld mines.

However, despite the expansion plans, the mining industry still faces significant challenges. Recently, a reduction in the amount of power supplied has caused problems, and will depress production in 2008. It is likely that implementation of some projects will be delayed by a lack of generating capacity in South Africa.

Obtaining sufficient water for cooling and processing has also been problematic and will be challenging for the next few years at least. Shortages of skilled staff have been severe due to a boom in mining worldwide and to construction of infrastructure for the 2010 Football World Cup, and are likely to continue. Despite this challenging operating environment, there is potential for expansion and the South African mining industry is still planning to increase pgm output over time.

*The typical ratio of platinum to the other platinum group metals in the ore mined differs from the Western limb of the Bushveld Complex to the Eastern limb.*

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This map provides details of all pgm mines operating or due to operate within 2008 on South Africa's Bushveld Complex. Locations and some information are also provided on some of the many potential projects in this area.



**RUSTENBURG**

Rustenburg is the largest of Anglo Platinum's mines. Underground operations produced 665,000 oz of refined equivalent platinum from 69% UG2 and 31% Merensky at a 4E average grade of 3.98g/t.

Various replacement projects and a UG2 expansion project could help output grow to an annual 900,000 oz of platinum over a number of years.

**IMPALA**

The Impala lease area is Impala's largest operation and produced a record 1,086,000 oz of platinum in the second half of 2007 from a mix of Merensky and UG2 ore.

There are currently 14 active shafts and plans are in place to maintain production between 1.1 and 1.2 million oz.

**BAFOKENG RASIMONE**

BRPM, or Bafokeng Rasimone Platinum Mine, is 50% owned by Anglo Platinum and 50% by Royal Bafokeng Resources. It is managed by Anglo Platinum.

Mining in 2007 was from 100% Merensky Reef with a 4E content of 4.34g/t. Platinum equivalent refined production was 194,000 oz. A feasibility study on mining UG2 could lead to greater output in the medium-term.

**WESIZWE**

Wesizwe will start construction of the Frishgewaagd Ledig mine in 2008. Merensky Reef and UG2 will be mined from underground via two shafts. Steady state output could reach 350,000 oz of 4E per year by 2016 with first production scheduled for 2011.

**UNION**

Union is managed and 85% owned by Anglo Platinum with 15% BEE ownership. Underground mining produced 309,000 oz of platinum in 2007 from 64% UG2 and 36% Merensky. Replacement projects mean that output should remain stable at this level.

**KROONDAL**

Kroondal is a joint venture between Anglo Platinum and Aquarius. From early-2008, all production will be processed by Anglo. The mine is managed by Aquarius.

FY 2007 output was 440,000 oz of pgm and this should grow to 500,000 oz, with over 90% of the UG2 ore coming from underground mining.

**SEDIBELO**

**SUN CITY**

**WESTERN BUSHVELD**

**STYLDRIFFT**

**AMANDELBULT**

Amandelbult (100% Anglo Platinum) produced 577,000 oz of equivalent refined platinum in 2007 from a roughly equal mix of Merensky and UG2 at an average grade of 5.13g/t.

Output will be lower in 2008 because of a temporary closure due to flooding. The East Upper UG2 expansion could deliver more than 100,000 oz more platinum from 2012.

**MARIKANA**

Marikana is the subject of a pool and share agreement between Anglo Platinum and Aquarius. Aquarius's output is sold to Impala Refining Services. Anglo's share is attributed to and refined by itself.

Open pit tonnage is scheduled to fall over time but underground volumes will rise. Total 4E output was 155,000 oz in 2007.

**PILANESBERG**

Platmin holds 72% of the Pīlanesberg project through Boynton Platinum. Construction of the mine is underway. Ore mining may commence in 2008 and first concentrate should be produced in 2009.

Mining will be open pit and 4E (pgms and gold) output could reach 250,000 oz within the first year.

**NORTHAM**

Northam (100% owned by Northam Platinum) is the deepest of the Bushveld mines with mining stretching 2.2km underground.

2007 saw production of 300,000 oz of pgm from a mixture of UG2 and Merensky Reef. Steady state production should be roughly 360,000 oz annually.

**LONMIN**

Lonmin's Marikana operations produce the majority of its pgm (752,000 oz of platinum in concentrate in 2007) from underground UG2 and Merensky ore.

Development of three new shafts should allow enough extra production over the next five years to more than offset the decline in output from current operations.

**LEEUKWOP**

Impala obtained 74% of the Leeuwkopp project when it bought Afplats in 2007. The mining permit was still awaited in early-2008. Production could start in 2010. Conventional underground mining of UG2 only should yield a steady state output of 250,000 oz in the ratio 6:3:1 platinum, palladium and rhodium.

**PANDORA**

Pandora is a joint venture between Lonmin, Anglo Platinum (42.5% each) and Mvela Resources and the Bapo-Ba-Mogale tribe (7.5% each).

Development is being phased and current mining is from the Marikana lease area. 2007 output was 52,000 oz of platinum or 98,000 oz of pgm (bought by Lonmin). Output could eventually expand to an annual 440,000 oz of pgm.

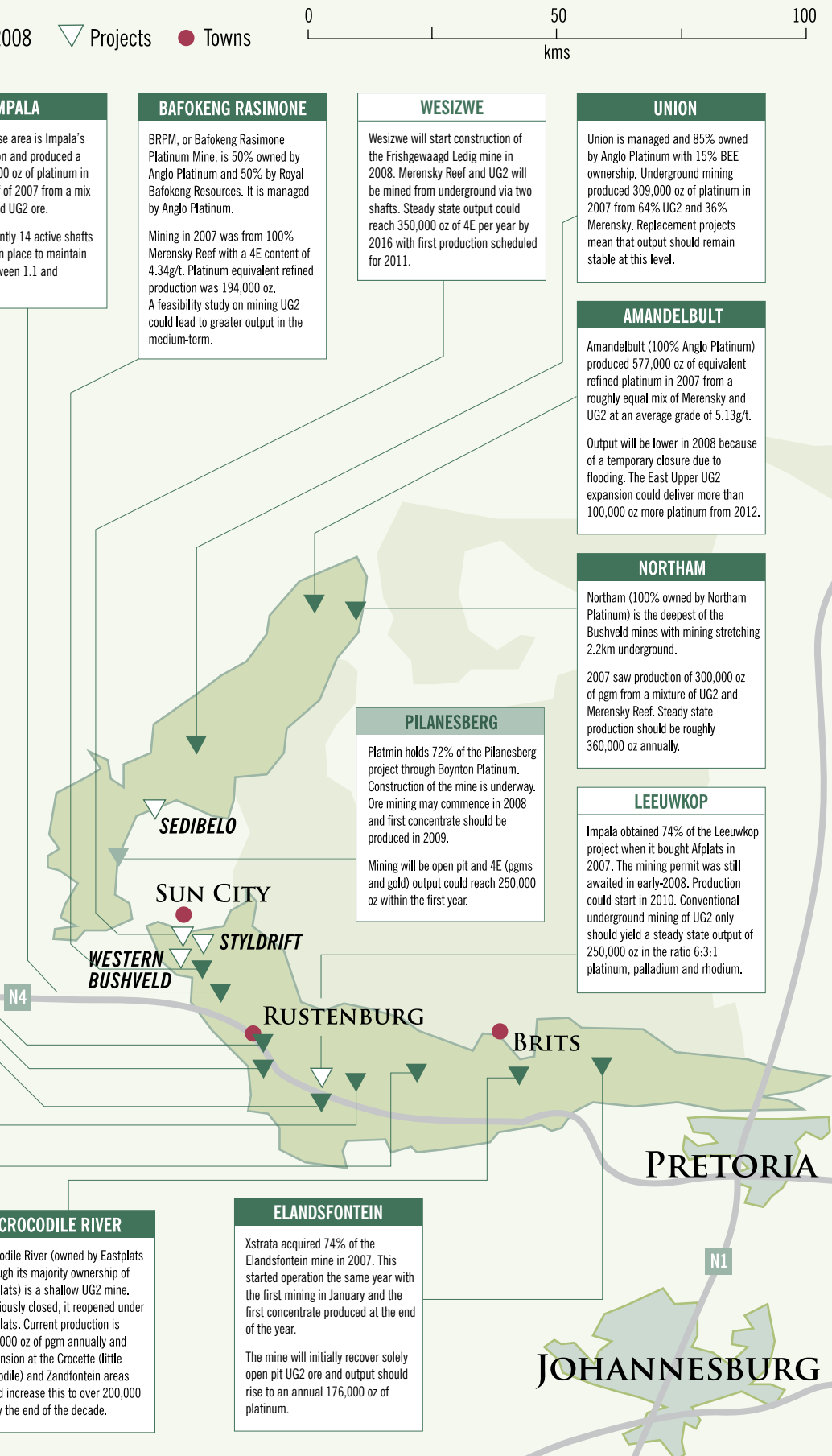
**CROCODILE RIVER**

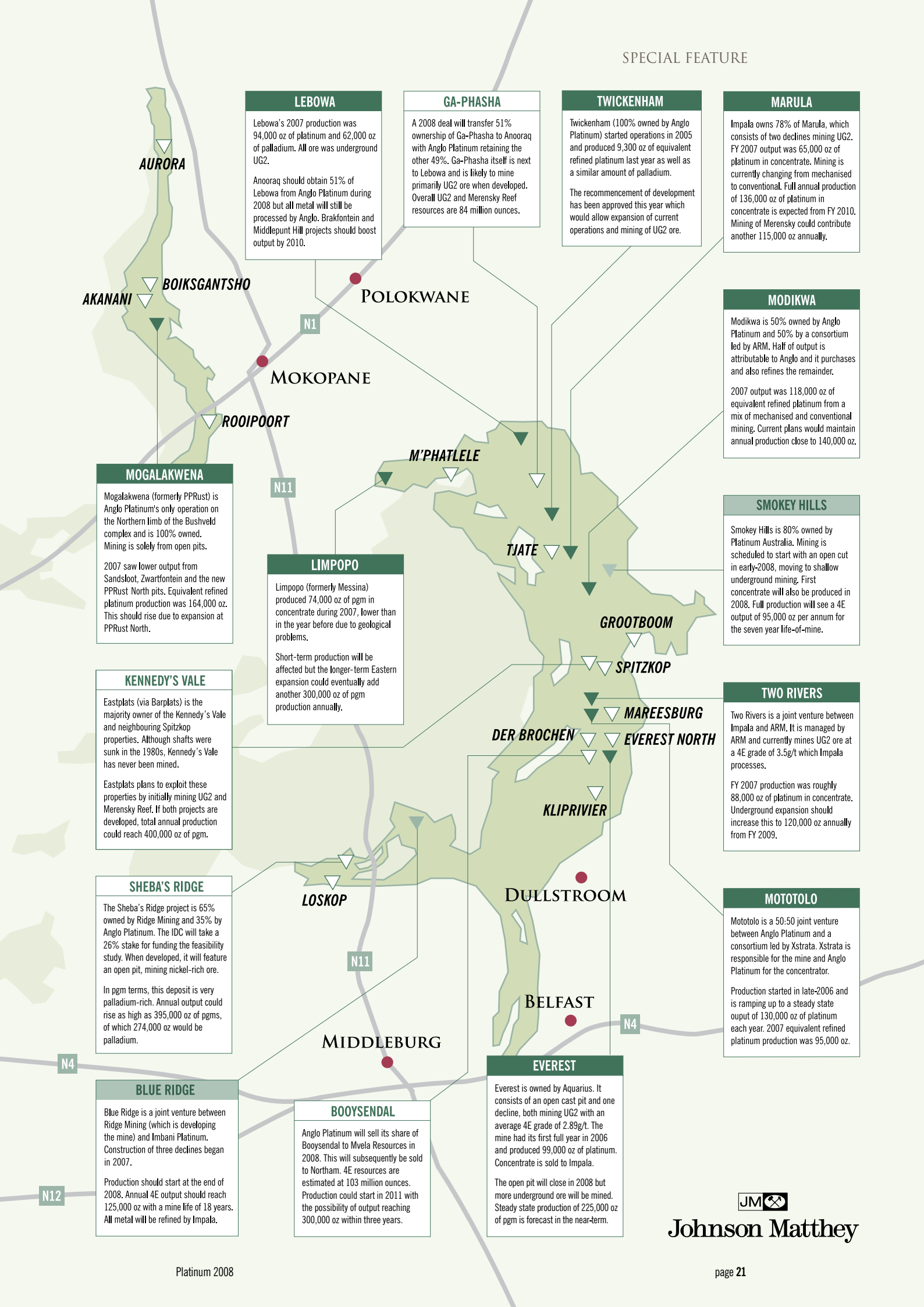
Crocodile River (owned by Eastplats through its majority ownership of Barplats) is a shallow UG2 mine. Previously closed, it reopened under Barplats. Current production is 125,000 oz of pgm annually and expansion at the Crocette (little crocodile) and Zandfontein areas could increase this to over 200,000 oz by the end of the decade.

**ELANDSFONTEIN**

Xstrata acquired 74% of the Elandsfontein mine in 2007. This started operation the same year with the first mining in January and the first concentrate produced at the end of the year.

The mine will initially recover solely open pit UG2 ore and output should rise to an annual 176,000 oz of platinum.





**LEBOWA**

Lebowa's 2007 production was 94,000 oz of platinum and 62,000 oz of palladium. All ore was underground UG2.

Anooraq should obtain 51% of Lebowa from Anglo Platinum during 2008 but all metal will still be processed by Anglo. Brakfontein and Middlepunt Hill projects should boost output by 2010.

**GA-PHASHA**

A 2008 deal will transfer 51% ownership of Ga-Phasha to Anooraq with Anglo Platinum retaining the other 49%. Ga-Phasha itself is next to Lebowa and is likely to mine primarily UG2 ore when developed. Overall UG2 and Merensky Reef resources are 84 million ounces.

**TWICKENHAM**

Twickenham (100% owned by Anglo Platinum) started operations in 2005 and produced 9,300 oz of equivalent refined platinum last year as well as a similar amount of palladium.

The recommencement of development has been approved this year which would allow expansion of current operations and mining of UG2 ore.

**MARULA**

Impala owns 78% of Marula, which consists of two declines mining UG2. FY 2007 output was 65,000 oz of platinum in concentrate. Mining is currently changing from mechanised to conventional. Full annual production of 136,000 oz of platinum in concentrate is expected from FY 2010. Mining of Merensky could contribute another 115,000 oz annually.

**MODIKWA**

Modikwa is 50% owned by Anglo Platinum and 50% by a consortium led by ARM. Half of output is attributable to Anglo and it purchases and also refines the remainder.

2007 output was 118,000 oz of equivalent refined platinum from a mix of mechanised and conventional mining. Current plans would maintain annual production close to 140,000 oz.

**SMOKEY HILLS**

Smokey Hills is 80% owned by Platinum Australia. Mining is scheduled to start with an open cut in early-2008, moving to shallow underground mining. First concentrate will also be produced in 2008. Full production will see a 4E output of 95,000 oz per annum for the seven year life-of-mine.

**TWO RIVERS**

Two Rivers is a joint venture between Impala and ARM. It is managed by ARM and currently mines UG2 ore at a 4E grade of 3.5g/t which Impala processes.

FY 2007 production was roughly 88,000 oz of platinum in concentrate. Underground expansion should increase this to 120,000 oz annually from FY 2009.

**MOTOTOLO**

Mototolo is a 50:50 joint venture between Anglo Platinum and a consortium led by Xstrata. Xstrata is responsible for the mine and Anglo Platinum for the concentrator.

Production started in late-2006 and is ramping up to a steady state output of 130,000 oz of platinum each year. 2007 equivalent refined platinum production was 95,000 oz.

**MOGALAKWENA**

Mogalakwena (formerly PPRust) is Anglo Platinum's only operation on the Northern limb of the Bushveld complex and is 100% owned. Mining is solely from open pits.

2007 saw lower output from Sandsloot, Zwartfontein and the new PPRust North pits. Equivalent refined platinum production was 164,000 oz. This should rise due to expansion at PPRust North.

**LIMPOPO**

Limpopo (formerly Messina) produced 74,000 oz of pgm in concentrate during 2007, lower than in the year before due to geological problems.

Short-term production will be affected but the longer-term Eastern expansion could eventually add another 300,000 oz of pgm production annually.

**KENNEDY'S VALE**

Eastplats (via Barplats) is the majority owner of the Kennedy's Vale and neighbouring Spitzkop properties. Although shafts were sunk in the 1980s, Kennedy's Vale has never been mined.

Eastplats plans to exploit these properties by initially mining UG2 and Merensky Reef. If both projects are developed, total annual production could reach 400,000 oz of pgm.

**SHEBA'S RIDGE**

The Sheba's Ridge project is 65% owned by Ridge Mining and 35% by Anglo Platinum. The IDC will take a 26% stake for funding the feasibility study. When developed, it will feature an open pit, mining nickel-rich ore.

In pgm terms, this deposit is very palladium-rich. Annual output could rise as high as 395,000 oz of pgms, of which 274,000 oz would be palladium.

**BLUE RIDGE**

Blue Ridge is a joint venture between Ridge Mining (which is developing the mine) and Imbani Platinum. Construction of three declines began in 2007.

Production should start at the end of 2008. Annual 4E output should reach 125,000 oz with a mine life of 18 years. All metal will be refined by Impala.

**BOOYSENDAL**

Anglo Platinum will sell its share of BooySENDAL to Mvela Resources in 2008. This will subsequently be sold to Northam. 4E resources are estimated at 103 million ounces. Production could start in 2011 with the possibility of output reaching 300,000 oz within three years.

**EVEREST**

Everest is owned by Aquarius. It consists of an open cast pit and one decline, both mining UG2 with an average 4E grade of 2.89g/t. The mine had its first full year in 2006 and produced 99,000 oz of platinum. Concentrate is sold to Impala.

The open pit will close in 2008 but more underground ore will be mined. Steady state production of 225,000 oz of pgm is forecast in the near-term.

