

SUPPLIES, MINING & EXPLORATION

SOUTH AFRICA

In 2006, sales of platinum into the market grew by a modest 3 per cent, to a total of 5.29 million ounces. In contrast, supplies of palladium and rhodium were above the level of refined production, increasing by more than 10 per cent to 2.91 million ounces and 690,000 oz respectively. Production in South Africa was boosted by new mines at Everest and Two Rivers, combined with a strong performance from Anglo Platinum. However, supplies of platinum rose more slowly than output, with producers adding nearly 200,000 oz to their year-end unsold stocks of refined metal.

Anglo Platinum

Anglo Platinum reported substantial growth in refined pgm output in 2006. Large releases of metal from the processing pipeline added nearly 180,000 oz to platinum production, which totalled 2.82 million ounces - an increase of 15 per cent on the previous year. Palladium output also rose strongly, reaching 1.54 million ounces, but rhodium production was stable at 326,000 oz, following the large pipeline release which occurred in 2005.

Equivalent refined platinum production (the amount of metal produced in concentrate, adjusted for standard smelting and refining recoveries) was up 5 per cent,

at 2.65 million ounces. Most of the group's mines contributed to this improvement, with only PPRust reporting a small decline in output. There was a recovery in pgm production from the flagship Rustenburg and Amandelbult operations, where

a lack of available reserves and geological difficulties had hampered production in 2005; while Modikwa, BRPM and Kroondal all moved closer to achieving planned production rates.

In addition, Anglo Platinum processed around 13,000 oz of platinum from each of two new operations: Marikana (the subject of a Pool & Share Agreement with Aquarius Platinum) and Mototolo (a joint venture with Xstrata plc). The latter came on-stream in late 2006 and is expected to produce

over 100,000 oz of platinum in 2007, despite difficult near-surface ground conditions which hindered the initial ramp-up in underground production. At Marikana, concentrator capacity has been expanded via the addition of a dense media separation plant, and over the next 2-3 years, platinum output should nearly double from the 2006 level of 65,000 oz. The processing of concentrate from Marikana will be split between Anglo Platinum and Impala.

Two expansion projects were approved in 2006. In December, the group confirmed its decision to proceed with the R1.6 billion Amandelbult East Upper UG2 project, which will involve the redevelopment of existing Merensky infrastructure to exploit the UG2 reef. Capacity at the UG2 concentrator will be raised by 135,000 tonnes per month, lifting annual platinum output by 106,000 oz from 2012.

A R3.8 billion expansion at PPRust also received the go-ahead, and will add 230,000 oz of platinum annually from 2009. The development of the new PPRust North pit began last year, and a new concentrator, capable of treating 600,000 tonnes of ore per month, is on schedule for commissioning in 2008.

Small-scale mining is underway at two other projects, Pandora and Twickenham. Anglo Platinum's joint venture partner Lonmin is currently exploiting open pits and a small underground section on the Pandora lease area; ore is being sold to Lonmin, and is reported as part of that company's production (see page 14). At Twickenham, the early mining project at the Hackney shaft yielded 6,400 oz of platinum in 2006. Feasibility work on the larger-scale development of these mines is in progress, while the group also continues to evaluate projects at Styldrift, Ga-Phasha, Booyendal and Der Brochen.

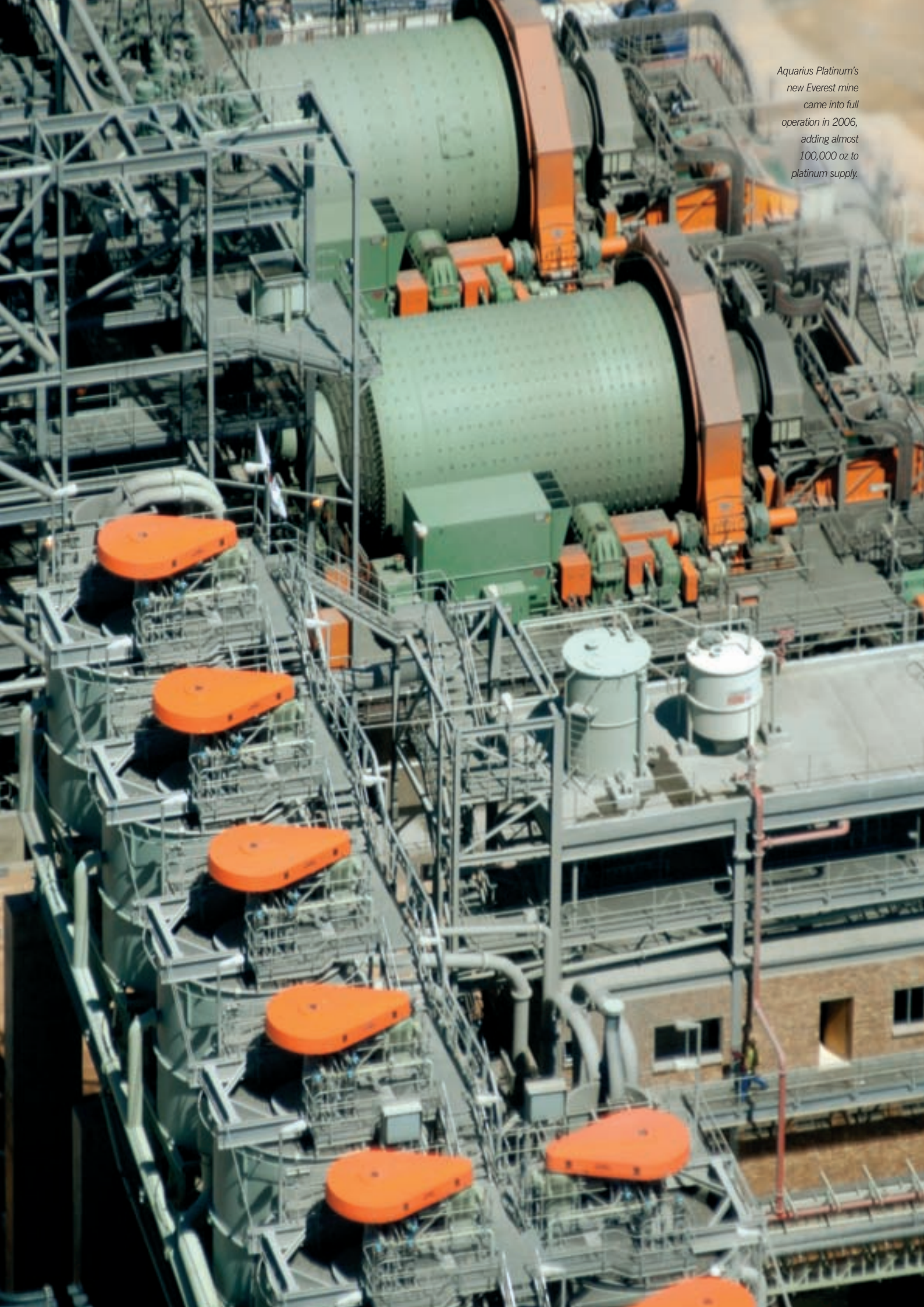
Impala Platinum

At the Impala Platinum lease area, platinum production slipped by 7 per cent in 2006 to 1.08 million ounces - the lowest level in three years. Output of palladium and rhodium fell by over 10 per cent, to 469,000 oz and 116,000 oz respectively.

Although mill throughput was only marginally lower, at 16.4 million tonnes, grades and recoveries were depressed by inefficient mining practices and changes in the ore mix. A reduction in tonnage from the

PGM Supplies: South Africa '000 oz		
	2005	2006
Platinum	5,115	5,290
Palladium	2,605	2,905
Rhodium	627	690

*Aquarius Platinum's
new Everest mine
came into full
operation in 2006,
adding almost
100,000 oz to
platinum supply.*



Merensky Reef was partly compensated by an increase in the mining of lower-grade open-cast UG2 ore, from which recoveries are typically lower. There was also a decline in the overall pgm grade of ore extracted from underground, which Impala attributed to excessive stoping widths and off-reef mining. The company has initiated a “back-to-basics” mining plan, focusing on improving grade control and mining efficiencies, with the aim of increasing platinum production to 1.15-1.20 million ounces per annum within 2-3 years.

In contrast, at Impala’s Marula operation on the Eastern Bushveld the implementation of a new mining plan began to have a positive impact on operational performance. Over 1.24 million tonnes of UG2 ore were processed by the plant in 2006, up 60 per cent on the previous year, while production of platinum in concentrate climbed by 73 per cent to 54,000 oz. The mine is on schedule to achieve full production of 136,000 oz of platinum annually by 2009.

Impala also has interests in two platinum producers in Zimbabwe, Zimplats and Mimosa, discussed in more detail on page 19. In South Africa, the company is involved in the Two Rivers joint venture (with African Rainbow Minerals (ARM)), which produced its first pgm in 2006. Matte and concentrate arising from these operations is processed by Impala Refining Services (IRS).

IRS has concentrate purchase agreements with a number of other producers, including Aquarius and

Barplats, as well as toll-refining significant quantities of pgm contained in secondary materials (principally autocatalyst scrap). In 2006, the company also treated reasonable volumes of pgm concentrate from Lonmin’s operations, which were once again affected by smelter outages. Offtake agreements are already in place with other potential future producers, and Impala announced in February 2007 that it would construct a third smelter at Rustenburg, lifting total capacity to 2.8 million ounces of platinum annually.

Although Impala has significant expansion potential in Zimbabwe, it has only limited scope to raise production from its mines in South Africa. Historically the company’s expansion strategy has been focused on concentrate purchase agreements with joint venture partners and third parties, but in February 2007 it moved to acquire a new project, with the announcement of a cash offer to buy out the London-listed company African Platinum (Afplats). The latter is the owner of the Leeuwkop project, down-dip of Eastern Platinum and Pandora, on which a feasibility study was completed in 2006.

Lonmin

For the financial year ending September 2006, Lonmin reported a 3 per cent increase in platinum production to 948,000 oz (including metal toll-refined or sold as concentrate). Palladium output was up 8 per cent at 439,000 oz, while that of rhodium rose by 12 per cent to 133,000 oz.

At the Marikana division (formerly known as Western Platinum, Eastern Platinum and Karee), mill throughput grew by 5 per cent to 14.3 million tonnes. This includes ore mined from the Pandora lease area, where the UG2 reef is being extracted via existing shaft infrastructure and from a new open pit. Overall, the balance of production shifted away from open-casting and towards underground mining, with additional ore being mined from the Rowland and K3 shafts.

Starting in early 2007, two new deep vertical shafts - Hossy and Saffy - will come into production, while the K4 shaft will come on-stream the following year. All three are being developed as fully-mechanised operations using ultra low profile equipment. Output from these shafts will support a planned increase in Marikana division’s platinum production to

Expansion at Lonmin’s Marikana division is being planned to boost long-term platinum output above one million ounces per year.



1.18 million ounces by 2012.

During its first full financial year as part of the Lonmin group, the Limpopo division (formerly Messina) milled 901,000 tonnes of ore and produced 50,000 oz of platinum in concentrate. The ramp-up to 75,000 oz of platinum per annum fell about six months behind plan, due to poor ground conditions and the discovery of a large pothole which affected the build-up in developed reserves. Full production is now scheduled for the second half of 2007.

A planned rebuild of the No. 1 smelter, involving the replacement of the copper cooling waffles, was completed in February 2006 and was expected to allow the furnace to operate continuously for two years. However, in April a leak adjacent to one of the matte tap holes was discovered, resulting in a further 11 day shutdown. Eight months later, in mid-December, a more serious leak occurred, and the smelter was shut down for over four months while extensive reconstruction was undertaken.

During this period, substantial stockpiles of untreated pgm are thought to have accumulated, despite the operation of the company's three Pyromet furnaces and the sale or toll-refining of some concentrate. The old Merensky furnace has been rebuilt, with the intention of running it in parallel with the No. 1 smelter in order to process the backlog of concentrate during the second half of 2007. Lonmin has stated that it expects platinum sales for its 2007 financial year of between 980,000 and 1 million ounces (including metal toll-refined externally or sold in concentrate).

In mid-December 2006, Lonmin announced a cash offer for AfriOre, owner of a 74 per cent stake in the Akanani pgm deposit west of PPRust. The acquisition was completed in February 2007. Initial estimates are based on a 5 million tonne per annum underground mine producing 250,000 oz of platinum annually, with first production targeted for 2013; this would represent the first attempt to mine the Platreef underground.

Northam

Northam reported platinum production of 223,000 oz in 2006, scarcely changed compared with the previous year; in contrast, palladium output slumped 12 per cent to 96,000 oz, while that of rhodium surged 38 per



cent to 30,000 oz. Mine output was supplemented by the purchase of Merensky concentrate, containing some 7,400 oz pgm, from an external source.

Mill throughput was unchanged at 2.36 million tonnes of ore, but grades declined, partly due to a shift in the ore mix towards the lower-grade UG2, and partly due to increasing geological complexity on the Merensky Reef. Northam mines a number of different Merensky facies (reef types), of which the richest in pgm - the P2 facies - accounted for only 42 per cent of production at the year end, compared with a historical average of over 50 per cent. Mining conditions on the Merensky reef are expected to remain challenging in the near future, with the company forecasting that overall production in the first half of this year will decline by 15 per cent.

Aquarius Platinum

Production of platinum in concentrate from Aquarius Platinum's South African operations increased by 36 per cent to 435,000 oz in 2006, largely as a result of the successful start-up of the Everest project on the Eastern Bushveld. This new mine - the plant was commissioned in December 2005 - produced 99,000 oz of platinum in concentrate during its first full year of production. Initial feed to the concentrator came mainly from open-casting but as the year progressed, the mix shifted steadily towards underground ore,

2006 development at Barplats' Crocodile River operations included the relocation of headgear from its Kennedy's Vale site.

which accounted for nearly 80 per cent of tonnes milled in the final quarter. By the end of 2007, the ramp-up in underground production should be complete, giving an annual output of around 125,000 oz of platinum.

Aquarius' two other South African mines are operated under Pool & Share Agreements with Anglo Platinum (see page 12). In 2006, Kroondal raised its output of platinum in concentrate by 7 per cent to 267,000 oz; this year it should operate close to full capacity (around 300,000 oz of platinum per annum). Production at Marikana was unchanged at 65,000 oz last year, but should increase significantly in 2007 following the expansion of processing and mining capacity under the P&SA.

ARM Platinum

With the commissioning of the Two Rivers mine in July 2006, ARM Platinum now has three pgm-producing operations in South Africa, the others being the Modikwa joint venture with Anglo Platinum and the Nkomati Nickel mine with LionOre.

Two Rivers (ARM: 55 per cent) milled 746,000 tonnes last year, yielding 55,000 oz of pgm in concentrate. A stockpile of 1.2 million tonnes of ore, built-up during two years of trial mining, permitted a rapid ramp-up to full production: the design milling rate of 225,000 tonnes per month was achieved in early 2007. Platinum output is expected to exceed 100,000 oz this year, this metal being refined by joint venture partner Impala.

Modikwa (ARM: 41.5 per cent) saw a 5 per cent increase in equivalent refined platinum production, to 135,000 oz, with a fall in mill throughput more than offset by a sharp improvement in grade. However, the mine continued to face challenges, including poor ground conditions at the South shaft and difficult labour relations. Employee discontent came to a head in early 2007, with production being halted for over three weeks in a dispute over seven day operations. ARM subsequently estimated that around 10,000 oz of platinum production was lost during the strike.

The existing underground mine at Nkomati (ARM 50 per cent) exploits the high-grade massive sulphide body (MSB), which contains around 2 per cent nickel and 4-6 grams of pgm per tonne. In 2006, the operation treated 361,000 tonnes of ore, yielding over 52,000 oz of pgm. The MSB mine is nearing the end of its life,

with operations expected to cease in 2007; it will be replaced with an interim programme, which involves an expansion of concentrator capacity to 100,000 tonnes per month, and the construction of an open pit and underground mine exploiting the lower-grade Main Mineralised Zone (MMZ). This project, due to be commissioned in the second half of 2007, will maintain nickel and pgm production close to current levels.

Other

The redevelopment of Barplats' Crocodile River mine continued in 2006. A second primary mill was commissioned in September, doubling concentrating capacity to 160,000 tonnes per month; vertical shafts and declines at Zandfontein were dewatered, and additional conveyor capacity was installed. This contributed to an increase of over 80 per cent in sales of pgm in concentrate, to 86,000 oz. By 2010, the company plans to increase output from Crocodile River to around 250,000 oz of pgm annually. It is also undertaking feasibility work on its Kennedy's Vale project on the Eastern Bushveld, while Barplats' 69 per cent share holder, the Toronto-listed company Eastern Platinum, is investigating the nearby Spitzkop and Mareesburg prospects.

Two new platinum mines entered the construction phase in 2006: Eland Platinum's Elandsfontein project, East of Crocodile River, and Ridge Mining's Blue Ridge, at the Southern end of the Eastern Limb. At the R1.1 billion Blue Ridge project, the decline portals were completed in late 2006 and shaft sinking began in January this year. The plant is due on-stream in mid-2008, with full production of 125,000 oz of pgm annually scheduled for the following year; this metal will be refined by Impala.

Open pit mining got underway at Eland Platinum's Elandsfontein project in January 2007. A stockpile of ore will be built-up ahead of the commissioning of the concentrator, which is planned to take place in the final quarter of this year. Initial production will come entirely from open-cast mining, but the sinking of an underground mine will commence in late 2007, and this will account for 100 per cent of production by 2012. At full production, Eland forecasts that it will sell around 270,000 of pgm in concentrate annually to Anglo Platinum.

RUSSIA

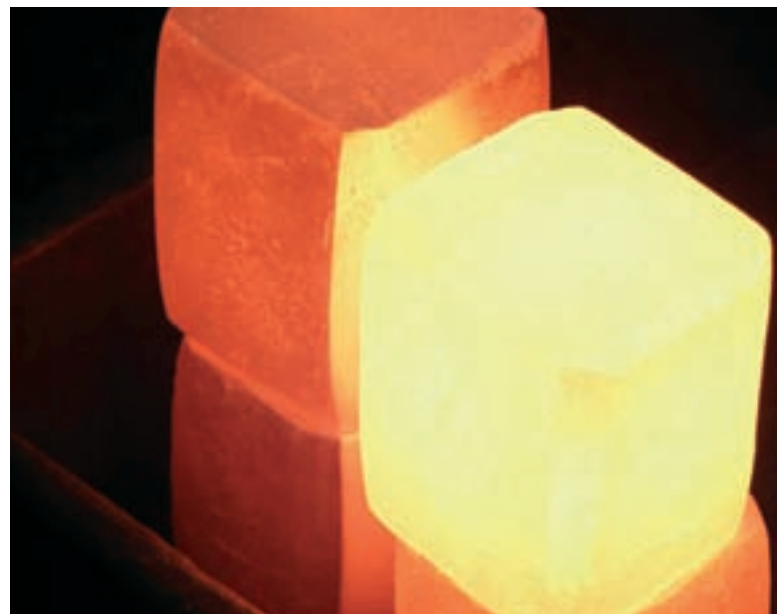
In 2006, supplies of palladium from Russia totalled 3.9 million ounces, a decline of 16 per cent compared with the previous year. This total includes 63,000 oz sold by Stillwater, representing the last of the stocks transferred during the acquisition of the company by Norilsk Nickel. Rhodium shipments were also up sharply, at 95,000 oz, as high prices encouraged the liquidation of rhodium stocks; supplies of platinum were stable at 880,000 oz.

Russian pgm supplies are composed of two elements: output from Norilsk Nickel and other pgm producers (principally alluvial miners in the Far East of the country), and sales from government-controlled stocks. In recent years it has been common for Gokhran, the state depository, to receive its palladium sales quota late in the year, often too late for all the metal to be shipped and sold before the year end. In January 2006, trade data shows substantial imports of Russian palladium into Switzerland; we believe this was part of Gokhran's 2005 quota.

It appears that Gokhran's 2006 quota was also granted very late in the year; December trade data shows the import of 40 tonnes (1.29 million ounces) of Russian palladium into Switzerland. In our view, it is unlikely that any of this metal was sold to consumers before the year end and we have therefore excluded it from our estimate of 2006 supplies.

Norilsk Nickel recorded a slight increase in pgm production in 2006, with palladium output rising by 1 per cent to 3.16 million ounces and that of platinum stable at 752,000 oz. This was some 7 per cent higher than the company's earlier forecasts for the year, a change which was attributed to improvements in recoveries and the release of metal from the processing pipeline. Nickel production was stable, while copper output fell marginally, with work to modernise hoisting capacity at the Komsomolsky mine on the Taimyr peninsula resulting in a decrease in output of copper-rich ore (which also has a high pgm content). The company's forecasts for 2007 allow for a slight reduction in pgm production, to around 3 million ounces of palladium and 700,000 oz of platinum.

In June 2006, Norilsk published its new long-term production strategy, the objective of which is to raise nickel production by 7 per cent in the period to 2015,



while maintaining copper and pgm production at around current levels. As part of the plan, processing efficiencies will be increased, resulting in lower costs and an improved environmental performance. Ore mining volumes from the Taimyr peninsula operations (the source of almost all the company's pgm) will be lifted by 28 per cent, from 14.4 million tonnes in 2005 to 18.5 million tonnes by 2015.

Production of rich (massive sulphide) ore will be maintained at current levels of around 7.5 million tonnes, via the deepening of the Taimyrsky mine and the completion of the 3 million tonne per annum Skalisty mine (which will ultimately be the source of up to a third of all nickel produced on the Taimyr peninsula). By 2015, production of lower-grade ore will rise by 70 per cent from 2005 levels, while output of copper ore will grow 50 per cent, largely due to increased mining of this ore type at the Oktyabrsky mine (where rich ore reserves are declining).

Norilsk also plans to invest heavily in upgrading its processing plant. Capacity at the Talnakh concentrator will be upgraded by 50 per cent, to allow the treatment of 10.5 million tonnes of ore annually, while an expansion will be undertaken at the Nadezhda smelter in order to allow the closure of the Nickel Plant. Together with the mining

Primary production of Russian platinum group metals was relatively flat in 2006 although palladium supplies were augmented by sales of state stocks.

PGM Supplies: Russia '000 oz		
	2005	2006
Platinum	890	880
Palladium	4,620	3,900
Rhodium	90	95

expansions outlined above, these developments will require capital spending of \$800 million to \$1 billion annually in the period 2007 to 2010, and around \$450-500 million per annum thereafter.

The alluvial producers at Amur and Koryak reported combined production of 180,000 oz of platinum in 2006, slightly up on the previous year. Looking forward, output is likely to decline as the deposits are depleted and grades fall. The Amur operation plans to compensate for lower grades by increasing throughput more than threefold in 2007, but platinum output is still expected to be below last year's level. Koryak also predicts a decline in output.

NORTH AMERICA

Supplies of platinum from North America fell by 5 per cent to 345,000 oz in 2006, due to lower production from the former Inco mines now owned by Companhia Vale do Rio Doce (CVRD). In contrast, palladium shipments rose by 8 per cent to 985,000 oz; the start-up of a higher-grade underground section boosted output at North American Palladium, while Stillwater also reported an increase in sales.

Canada

After a difficult 2005, last year saw a much improved performance from North American Palladium, largely due to the start-up of a new underground section exploiting a high-grade zone below the open pit.

During 2006 we estimate that 675,000 tonnes of ore were extracted from the underground workings at an average palladium grade of over 5.5 grams per tonne. This ore was blended with open-cast material, giving an average mill feed grade of 2.18 grams per tonne - 30 per cent up on 2005. Palladium output climbed 34 per cent to 237,000 oz, while platinum production rose by 10 per

cent to 22,000 oz; the company predicts further growth, to 290,000 oz of palladium in 2007.

The remainder of Canada's pgm production occurs as a by-product of nickel mining in the Sudbury area and to a lesser extent in Northern Quebec.



North American Palladium expanded output in 2006 by adding underground mining to its open-cast activities.

In 2006, there were changes in ownership of both Canada's major nickel producers, with Falconbridge being acquired by the Swiss company Xstrata in August, and a takeover of Inco by the Brazilian Companhia Vale do Rio Doce (CVRD) being completed in October.

Canadian production of nickel by the CVRD-Inco operations rose 13 per cent to 164,000 tonnes in 2006; however, this gain came entirely from the start-up of the Voisey's Bay nickel mine, which does not contain pgm. In contrast, nickel output from the pgm-producing mines in Ontario declined by 4 per cent. This contributed to a decline in pgm production, to 152,000 oz of platinum (down 13 per cent) and 208,000 oz of palladium (down 6 per cent).

At Xstrata Nickel's Sudbury operations, mill throughput declined by 13 per cent to 1.89 million tonnes of ore in 2006, while base metal grades also fell; as a result, nickel and copper production declined by 17 per cent. Grades of pgm in Sudbury ores are very variable, ranging from insignificant levels in nickel-rich ores to several grams per tonne in some copper-rich deposits. We believe that Xstrata Nickel's 2006 pgm output was supported by production from the Fraser Copper deposit, which is comparatively rich in platinum group metals.

The exploitation of Xstrata's Nickel Rim South deposit, also in Sudbury, will augment pgm production in future. The ore is rich in copper, and contains significant quantities of pgm, with the average grade expected to exceed 4 grams per tonne. First

PGM Supplies: North America		
	'000 oz	
	2005	2006
Platinum	365	345
Palladium	910	985
Rhodium	20	20

development ore from this project is expected in late 2008, with full production scheduled for 2010: by-products will include 89,000 oz of palladium and 73,000 oz of platinum annually.

At Raglan, Xstrata's nickel mine in Northern Quebec, plant throughput totalled 1.1 million tonnes of ore in 2006, up 14 per cent on the previous year. Milling capacity is being increased, which will lift production of nickel by 15 per cent from 2009. Production of pgm - principally palladium - should increase accordingly.

USA

At Stillwater Mining Company's pgm operations in Montana, a mine transformation programme - involving an increase in underground development as well as a change in mining methods - began to bear fruit in 2006. Sales of palladium increased 8 per cent to 466,000 oz, while shipments of platinum grew by 2 per cent to 138,000 oz.

Both the company's mines reported an improved operational performance, despite halting production on a number of occasions during the third quarter due to wildfires in the surrounding area. At Stillwater, there were gains in mill throughput and head grade, reflecting a shift towards more selective mining methods. The East Boulder mine saw an 11 per cent increase in tonnage sent to the mill, although this was partly offset by a slight drop in grade. Together, the mines produced 600,000 oz of platinum and palladium, a rise of 8 per cent on the previous year. Stillwater also reported data for rhodium for the first time; production of this metal totalled 4,000 oz in 2006.

In 2007, the company expects further gains in pgm output, which should total between 615,000 oz and 645,000 oz for the whole year. It also plans to begin an expansion of its metallurgical processing facilities in Columbus, Montana, with the addition of a second furnace; this will provide increased capacity for the company's secondary refining business, as well as processing output from the mines.

ZIMBABWE

The completion of the Wedza Phase IV expansion at Mimosa lifted platinum supplies from Zimbabwe by 6 per cent to 165,000 oz in 2006. Palladium and

rhodium shipments rose to 142,000 oz and 14,000 oz respectively. Mimosa has now embarked on a further upgrade to its plant, while Impala has approved a 75 per cent expansion of pgm production at Ngezi.

At the Mimosa mine, a 50:50 joint venture between Aquarius Platinum and Impala, an upgrade of milling capacity to 150,000 tonnes per month was completed in the second quarter of 2006. As a result, plant throughput for the year rose by 18 per cent to 1.8 million tonnes, yielding 74,000 oz of platinum in concentrate.

In January 2007, the joint venture partners announced a further incremental expansion, known as Wedza Phase V, at a capital cost of \$23.2 million. This will involve the installation of an additional mill to lift concentrator capacity to 175,000 tonnes per month or 100,000 oz of platinum annually. This expanded production rate will be achieved from July 2007.

Mill throughput at the Ngezi mine operated by Zimplats (Impala: 86.9 per cent) was very little changed at 2.06 million tonnes in 2006, but the successful completion of the Portal 2 project led to a significant shift in the ore mix, with just under half of all material processed coming from underground. A resulting increase in grade led to a 6 per cent rise in production of pgm in concentrate, although shipments of pgm in matte were unchanged compared with deliveries made in the previous year.

In May 2006, Impala reached an agreement with the government of Zimbabwe: Zimplats will release a portion of its mining claims (comprising 36 per cent of the company's resource on the Great Dyke) in return for empowerment credits and either cash or a share in a future joint venture. In return, in September 2006, the government approved an extension to the company's Special Mining Lease to cover all of Zimplats' remaining mining claims. This provides the security of tenure required by Impala in order to proceed with its long-term expansion programme.

A Phase I expansion programme costing \$258 million has now been approved. This will involve the development of two new underground shafts, and the construction of a concentrator at the mine site, resulting in an expansion of platinum production to 160,000 oz per annum from 2010.

PGM Supplies: Zimbabwe and Others		
	'000 oz	
	2005	2006
Platinum	270	270
Palladium	270	270
Rhodium	17	19