

PLATINUM 2008



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*Strong growth in demand for fertilisers
and for mining explosives has supported
the widespread use of platinum gauzes
like this in nitric acid manufacture.*

PLATINUM 2008

by David Jollie

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Johnson Matthey

EXECUTIVE SUMMARY

The platinum market moved from a surplus of 355,000 oz in 2006 into a deficit of 480,000 oz in 2007. Disruption to production in South Africa drove global platinum supplies down to 6.55 million ounces. Demand for platinum rose to 7.03 million ounces with increased purchases of metal for autocatalysts and for industrial uses. The platinum price hit a series of record highs in response.



Platinum supplies in 2007 fell by 4.1 per cent to 6.55 million ounces. A mixture of issues occurred in South Africa including unscheduled smelter closures, geological and safety problems and a difficult industrial relations climate: South African supplies fell by 4.9 per cent to 5.04 million ounces. The power supply crisis and flooding in early 2008 will affect production this year.

Platinum **purchases by the autocatalyst sector** rose by 8.2 per cent in 2007 to 4.23 million ounces. The market share of the diesel car continued to grow in Europe: these are fitted with platinum-based catalysts and, often, particulate filters.



The number of medium and heavy duty diesel vehicles produced in Europe, Japan and North America which were fitted with platinum-based exhaust aftertreatment to meet emissions rules also continued to increase.

Despite a rising price, **purchases of platinum by the jewellery industry, excluding scrap, fell only marginally** to 1.59 million ounces. Retail sales and manufacturing volumes were resilient in most geographical markets but the quantity of second-hand jewellery and unsold retail stock returned for recycling in Asia increased.



Platinum investment demand climbed sharply to 170,000 oz in 2007 from net disinvestment of 40,000 oz the previous year. Investors in Japan sold more metal back to the market than they bought. However, the launch of two new platinum-based exchange traded funds in Europe in the first half of 2007 created significant new investment demand.

Platinum **industrial demand rose strongly** to reach 1.94 million ounces, six per cent up from the 2006 total. Some price sensitivity was seen – for example, in the chemicals sector.



However, booming retail sales in the electronics sector drove platinum requirements for hard disks and for the manufacture of flat panel display glass higher.

Rhodium remained in deficit in 2007, by 34,000 oz. Despite lower production, supplies rose – to 822,000 oz – due to increased sales from stocks of refined metal. Demand climbed to 856,000 oz. Autocatalyst demand rose only slightly, pegged back by thrifting of catalyst rhodium content. The price firmed throughout 2007 and ended the year at \$6,850.





The palladium market was in a significant surplus of 1.75 million ounces in 2007. Demand rose to 6.84 million ounces, with increasing contributions from the autocatalyst, electronics and investment sectors. Palladium production in Russia and South Africa changed little but heavy sales of Russian State stock took total supplies to 8.59 million ounces in 2007.

Palladium supplies rose by eight per cent to 8.59 million ounces in 2007. In South Africa, increased sales from refined stocks augmented mine production to bring supplies to 2.77 million ounces, just 5,000 oz below 2006 levels. Russian primary production declined slightly, to around 3.05 million ounces. We believe the shipments of 1.29 million ounces of State stock in December 2006 were not sold until 2007 and therefore include these in our estimates for 2007 supplies.



Autocatalyst demand for palladium climbed by **10.8 per cent** in 2007 to a total of 4.45 million ounces. Rising vehicle production in China and the Rest of the World region added to palladium purchases.



Auto makers continued to use palladium to replace all of the platinum in a typical gasoline autocatalyst, and some of the platinum in a proportion of diesel catalysts, pushing demand higher.



Palladium jewellery demand fell from **995,000 oz in 2006 to 740,000 oz in 2007**. Jewellery manufacturing demand in China fell to 500,000 oz. The industry remains fully stocked and recycling of large amounts of old, unsold stock drove palladium demand lower last year although there are signs that this market has stabilised. In Europe and North America, palladium jewellery demand improved.

Net palladium **investment demand** climbed to an **unprecedented 260,000 oz**. Two palladium exchange traded funds were launched in Europe during the second quarter of 2007 and stimulated large new investment demand of 280,000 oz. There was net disinvestment of 20,000 oz of palladium coins and bars.



Industrial and other applications consumed 2.39 million ounces of palladium in 2007, a small increase from the previous year. Demand from the electronics industry continued to grow.



Strong growth in production outweighed the effects of miniaturisation and substitution of palladium in multi-layer ceramic capacitors. Dental demand rose marginally, reversing several years of decline.



Ruthenium demand fell by **almost a third** to 1.14 million ounces in 2007. New hard disk technology which employs ruthenium won an increasing market share but thriftier, higher amounts of recycling and careful control of working stocks reduced net electronics sector demand significantly.

SUMMARY

PLATINUM

Global platinum demand rose by 8.6 per cent to 7.03 million ounces in 2007. The autocatalyst sector grew strongly, with gross platinum purchases rising to 4.23 million ounces. The volume of metal purchased by jewellery manufacturers fell only slightly, outperforming market expectations considering the rising metal price. Industrial demand grew, with healthy contributions from the chemical, petroleum and electronics sectors. Investment demand rose substantially due to demand for metal from investors through the new exchange traded funds (ETFs).

Production of platinum fell, however, with lower South African output largely responsible. Safety shutdowns, geological and equipment problems and a difficult labour environment all affected platinum supplies from South Africa: these dropped by 260,000 oz to 5.04 million ounces in total. Combined platinum production from Russia, North America, Zimbabwe and the Rest of the World region fell slightly to a grand total of 1.52 million ounces. Overall, therefore, the platinum market moved from a surplus of 355,000 oz in 2006 to a deficit of 480,000 oz in 2007, driving the price higher throughout the year.

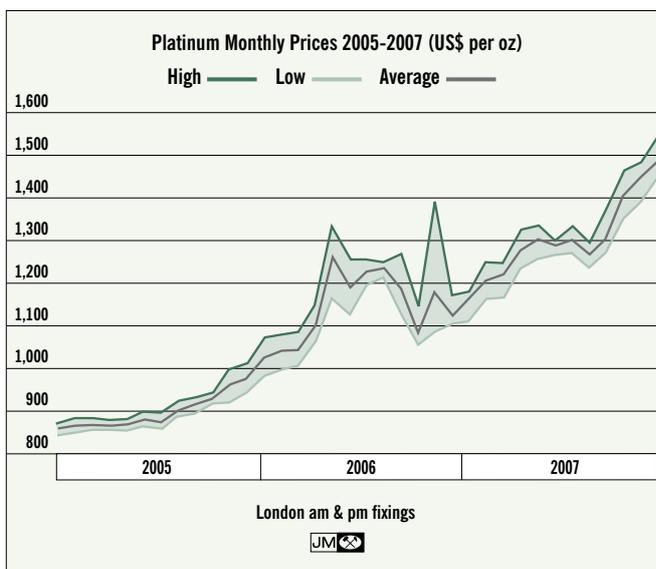
In the automotive sector, growing production of light duty diesel vehicles was beneficial for platinum use. 2006 saw the introduction of new Euro 4 light duty emissions legislation in the key European market. As a result, many of these vehicles now have a platinum-based oxidation catalyst and a platinum-coated particulate filter as standard, boosting average loadings. Ever-tighter emissions legislation applying to the heaviest diesel vehicles around the world required increased use of aftertreatment – much of it containing platinum – on trucks as well.

However, platinum demand was held back, to some extent, by the replacement of platinum by palladium in the autocatalyst sector. Although auto makers have removed much of the platinum from their three-way, or gasoline, catalysts already and replaced it with palladium, this trend continued. Palladium was also increasingly used in diesel catalysts during 2007, limiting growth in platinum autocatalyst demand.

Recovery of platinum from scrapped autocatalysts rose by 30,000 oz with high commodity prices, growing environmental consciousness and legislation all promoting increased levels of recycling. Overall, these trends increased net global platinum demand for autocatalysts by 9.5 per cent to 3.34 million ounces in 2007.

Excluding purchases of scrap, jewellery manufacturers bought 1.59 million ounces of platinum in 2007, marginally less than in the previous year. The high price did have some impact on the market although platinum jewellery retained its lustre as shown by the fact that demand in both China and in Europe grew modestly. While consumer purchasing was not greatly affected in most markets, manufacturers and retailers continued to minimise stock levels due to the rising metal price.

However, the amount of platinum recovered from scrap jewellery – whether from retailers rationalising their stock or from consumers trading-in or selling old pieces – rose substantially. High metal prices provided a strong incentive for companies to source and process this metal and have made consumers more aware of its residual value. We estimate that combined Chinese and Japanese recycling alone may have been in excess of



The platinum price reacted strongly to the South African supply disruptions in the final quarter of 2007.

Platinum Supply and Demand '000 oz			
		2006	2007
Supply			
South Africa		5,295	5,035
Russia		920	910
North America		345	325
Others		270	280
Total Supply		6,830	6,550
Demand			
Autocatalyst:	gross	3,905	4,225
	recovery	(860)	(890)
Jewellery		1,640	1,585
Industrial		1,830	1,940
Investment		(40)	170
Total Demand		6,475	7,030
Movements in Stocks		355	(480)

400,000 oz, with much of this metal being re-used by jewellery manufacturers.

Most other demand sectors were strong. In the electronics sector, the inexorable move towards greater data storage requirements helped increase the market share of perpendicular magnetic recording, or PMR, hard disks, adding to platinum uptake. The spectacular success of LCD televisions is forcing consumer electronics manufacturers to add flat panel glass production capacity, driving platinum demand up in the glass sector. High oil prices and growing demand for oil boosted platinum requirements for petroleum refining. Altogether, industrial purchases of platinum rose from 1.83 million ounces to 1.94 million ounces last year.

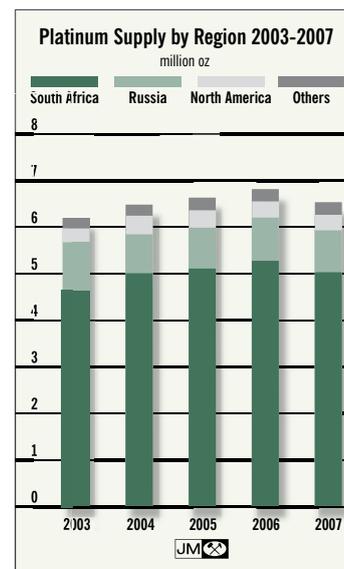
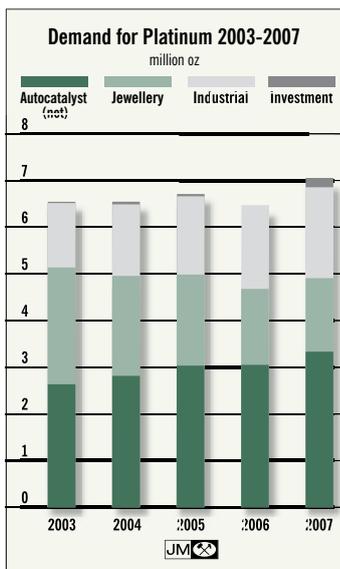
One of the most obvious changes in the platinum market was in the investment sector, where two exchange traded funds, or ETFs, backed by physical metal were launched in the second quarter of 2007. These have demonstrated that there is substantial retail and fund interest in investing in platinum under current market conditions and have made such investments simpler and more attractive for some investors. Largely due to ETF purchases, therefore, total net investment demand for platinum was 170,000 oz in 2007, a sharp increase from the previous year.

Global platinum supplies fell by 4.1 per cent to 6.55 million ounces in 2007 with sales from South Africa, Russia and North America all decreasing. This fall was most marked in South Africa where output dropped despite a ramp-up in production at a number of smaller operations.

The South African mining industry had a very turbulent twelve months in 2007. The year started with the temporary closure of one of Lonmin's smelters for a rebuild following a matte leak, cutting output. The two-yearly wage negotiations between the mining houses and the unions later in the year led to a difficult working environment, in which strike action was common if relatively short-lived. A new safety regime meant extended closures of individual shafts each time a fatal accident occurred, further cutting production. With the usual range of geological challenges present too, supplies fell from 5.30 million ounces in 2006 to 5.04 million ounces in 2007. There were, though, some bright spots, particularly in the form of growth from mines such as Crocodile River, Mototolo and Two Rivers.

Russian platinum supplies were interrupted for the first few months of 2007 due to confusion over the implementation of new export licensing rules, leading to some tightness in the market over this period. However, we believe that all of the Russian primary platinum production – both from Norilsk Nickel and from the alluvial producers – was sold during the year. With primary Russian production declining slightly and State stocks effectively exhausted, platinum sales were just below the 2006 total at 910,000 oz. Total platinum supplies from North America, Zimbabwe and elsewhere fell marginally to 605,000 oz.

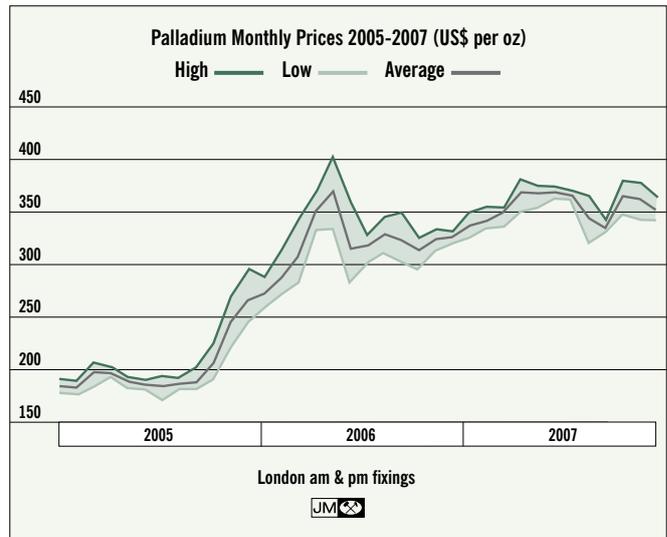
The platinum market therefore moved from a 355,000 oz surplus in 2006 back into a deficit of 480,000 oz in 2007. Unsurprisingly, the price reacted strongly to these tight supply-demand fundamentals, and was further supported by a weakening US Dollar and a strong financial performance from other commodities including gold. Platinum started the year by fixing at \$1,136 and rose almost relentlessly. The rise accelerated later in the year as the South African supply situation worsened. Buying of metal through exchange traded funds intensified at the same time, removing liquidity from the market and adding to volatility and reinforcing the price rises. Platinum reached a series of record highs before closing the year at \$1,529, almost 35 per cent higher than it had been at the start of 2007.



PALLADIUM

Demand for palladium increased by 3.5 per cent in 2007 to a total of 6.84 million ounces. A favourable price ratio between platinum and palladium encouraged automotive manufacturers to use palladium where possible in their catalytic converters – both diesel and gasoline. Production grew strongly in the Rest of the World region, also driving higher palladium purchases. Autocatalyst demand therefore rose by over 10 per cent to 4.45 million ounces. Industrial demand was dominated by a thriving electronics sector which took 1.29 million ounces. Demand for palladium from jewellery manufacturers, excluding the use of scrap, dropped significantly to 740,000 oz, compared to 995,000 oz in 2006, with a fall in purchases by Chinese manufacturers largely responsible. Purchases of palladium by the dental sector climbed by 2.4 per cent to 635,000 oz. Investment demand rose, with the introduction of two exchange traded funds boosting metal purchases to 260,000 oz.

Palladium supply also rose, to a 2007 total of 8.59 million ounces. Sales of primary metal from Russia – production from Norilsk Nickel as a by-product of its nickel output – declined slightly to 3.05 million ounces. Russian supplies from State stocks were substantial: roughly 1.49 million ounces were sold during the year although some of this metal had been recorded as shipped in the final days of 2006. South African palladium supplies edged lower to 2.77 million ounces. Output from North America, Zimbabwe and elsewhere was a little stronger than in the previous year at 1.28 million ounces.



The palladium price was heavily influenced by other precious metal prices and by movements in the currency markets.

Palladium Supply and Demand '000 oz			
		2006	2007
Supply			
South Africa		2,775	2,770
Russia:			
Primary Production		3,220	3,050
State Sales		700	1,490
North America		985	990
Others		270	285
Total Supply		7,950	8,585
Demand			
Autocatalyst: gross		4,015	4,450
recovery		(805)	(1,000)
Jewellery		995	740
Electronics		1,205	1,285
Other		1,195	1,360
Total Demand		6,605	6,835
Movements in Stocks		1,345	1,750

JMI

Palladium purchases for use in autocatalysts climbed by 10.8 per cent in 2007 to 4.45 million ounces, the highest total since 2001. Strong growth in the so-called emerging economies, including China, India and Russia, which produce mainly gasoline vehicles, raised palladium use. In North America and Japan, palladium gained some ground at the expense of platinum in gasoline catalysts. In Europe more palladium was used in diesel oxidation catalysts (DOCs). However, palladium remains the minor pgm component in any individual diesel catalyst and the total worldwide amount used in 2007 was below 300,000 oz.

The progress of the palladium jewellery market was mixed in 2007. In North America and Europe palladium is moving from being an experimental material to a more mainstream jewellery metal. As more manufacturers start to work with this metal and retailers become more comfortable with it, demand has risen, although still to modest levels compared to platinum. A fall in Japanese platinum jewellery demand caused lower palladium demand in that country where palladium is a component of some platinum jewellery alloys.

In China, however, the effects of the rapid early introduction of palladium jewellery were still evident in the market. The supply chain may have been overstocked in some places and large quantities of unsold Pd950 pieces were returned for refining and remanufacture into higher-purity Pd990 in 2007, depressing demand for new metal. Consumer purchasing does, however, appear to have been healthy in some regions of the country, particularly the West and far North-East. Overall palladium jewellery demand in China fell from 760,000 oz in 2006 to 500,000 oz in 2007.

Palladium purchases by the electronics industry grew strongly for the sixth successive year. Demand expanded by 6.6 per cent to 1.29 million ounces in 2007, mainly due

to palladium's use in multi-layer ceramic capacitors (MLCC). The use of a greater number of capacitors per electronic device and ever-increasing sales of electronic goods outweighed continuing miniaturisation and the slow erosion of palladium's share of this market by nickel. It is worth noting, however, that total demand in 2007 was still only sixty per cent of the peak metal consumption seen in 2000.

Dental sector usage climbed by 15,000 oz to a global total of 635,000 oz in 2007. While the palladium price rose, the costs of alternative materials, principally gold, climbed further, providing a boost to the palladium dental market after several years of decline. The Japanese Government subsidy for the Kinpala alloy was favourable for much of 2007, allowing demand to edge higher there. As previously noted in our 2007 Interim Report, we have restated our figures for this market to account for greater scrap recovery than we had previously observed.

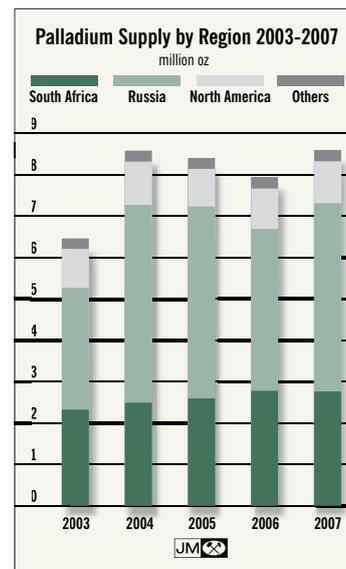
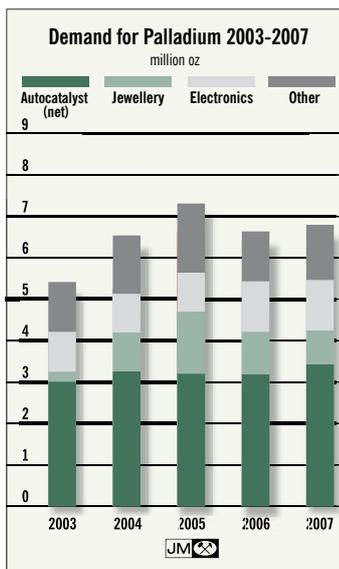
Investment demand rebounded to 260,000 oz in 2007 from only 50,000 oz in the previous year. The launch of two exchange traded funds (ETFs) which were backed by physical metal provided an opportunity for some new classes of investors to gain exposure to palladium. These ETFs were launched in Europe in the second quarter of 2007 and accounted for demand of 280,000 oz over the remainder of the year, with a large amount of this metal bought on behalf of institutional investors such as pension funds. However, demand for other investment products such as palladium coins and bars turned negative as investors in North America sold more of these items back to the market last year than they bought in the same period.

Palladium supplies rose in 2007, climbing eight per cent to a global total of 8.59 million ounces. South African sales of palladium were almost static at 2.77 million ounces. Total sales of metal from Russia rose while output from North America, Zimbabwe and elsewhere also increased marginally.

The amount of primary metal sold by Norilsk Nickel dropped by a few thousand ounces in 2007. Annual nickel production at Norilsk fell by over 4 per cent but palladium output was comparatively stable and fell only to 3.05 million ounces. Russian supplies were boosted significantly by extra shipments and sales of Russian State stocks. Trade data shows that 1.29 million ounces of palladium from this source was shipped to Switzerland in late-December 2006. We do not believe this was priced or sold until 2007 and we therefore include it in our supply figure for last year. Similarly, we do not believe that the 500,000 oz of Russian metal which reached Zurich late in 2007 was sold to the market during that year and we therefore exclude that from our 2007 estimate of Russian palladium supplies.

South African shipments of palladium fell to 2.77 million ounces, a drop of 5,000 oz. As was widely reported, a number of shafts were temporarily closed due to strikes and for safety reasons. Smelter closures also limited palladium output. Other labour issues, principally attracting and retaining skilled staff in an expanding South African economy, proved problematic. Overall, palladium supplies were supported by higher production from new mines and by sales of refined stocks from some established producers. Sales of palladium from North America, Zimbabwe and elsewhere edged 20,000 oz higher to 1.28 million ounces for the year.

Although the palladium market was once again in substantial surplus in 2007, it appears that much of this excess was absorbed by a small number of investors and institutions. The palladium price was therefore well supported, averaging \$355 during the year, 11 per cent higher than in 2006. Palladium started 2007 at \$332 and the price climbed to \$382 in April before falling to its yearly low of \$320 in August. It recovered sufficiently to close the year at \$365.



OTHER PGM

Rhodium

Rhodium demand climbed for the sixth successive year to 856,000 oz. Gross autocatalyst demand alone was 879,000 oz, an increase of 1.9 per cent from 2006. Autocatalyst recycling also grew to a total of 183,000 oz. However, sustained high prices did have an effect on consumers who moved to minimise their usage of this metal. In the autocatalyst sector, this was manifested by an acceleration of thrifting of the rhodium content in an average catalyst. The same trend towards lower rhodium technology was also seen in the glass industry where demand inched lower to 64,000 oz despite growth in manufacturing capacity in Asia.

Over the whole of 2007, rhodium supplies rose by only 20,000 oz to 822,000 oz. South African production of rhodium fell as the reduced tonnage of material mined and processed negated the extra rhodium content in the UG2 ore produced at many of the expansion projects on the Eastern Bushveld. However, the producers did sell more metal from refined rhodium stocks. Russian supplies fell too with lower shipments from State stocks. However, interruptions to shipments of Russian metal early in 2007 had a considerable impact on market sentiment, helping drive the price above \$6,000 early in the year.

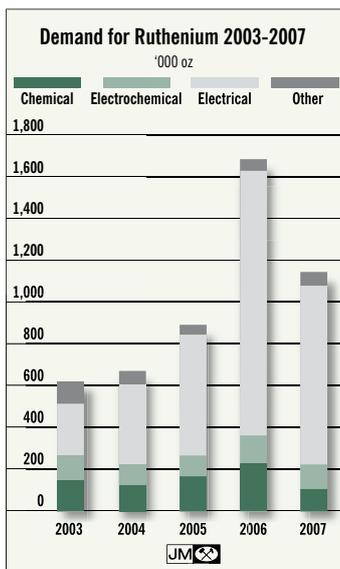
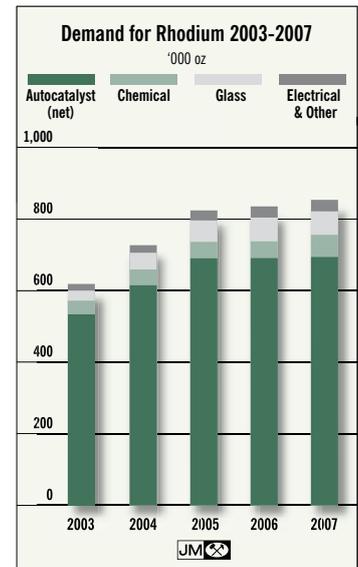
Gross autocatalyst demand grew from 863,000 oz in 2006 to 879,000 oz in 2007. Strong growth in manufacturing volumes in China and in many of the emerging economies in the Rest of the World region drove greater rhodium consumption there. In North America, rhodium purchases rose as a number of medium duty diesel trucks were fitted with NOx trap technology which typically employs high levels of rhodium in the catalyst formulations.

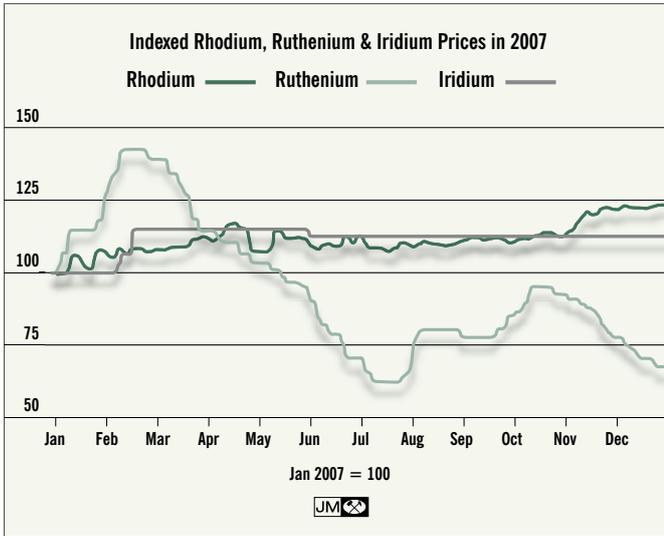
Japanese demand edged lower, though, as car makers there chose to use inventory that had previously been purchased. European rhodium consumption in autocatalysts fell: little if any rhodium is used on diesel vehicles which have taken market share from gasoline cars where rhodium is a constituent in almost every catalyst fitted. A high rhodium price also prompted many of the major auto manufacturers to intensify efforts to thrift rhodium in their autocatalyst formulations, driving average rhodium loadings lower, particularly in Europe. The overall impact of all of these trends on rhodium purchases in 2007 was a slight increase of 1.9 per cent.

Rhodium recovery from end-of-life autocatalysts rose too, reflecting increased loadings of rhodium both per catalyst and per vehicle. Most of the 183,000 oz of metal recycled globally is from the North American market but more metal was recovered in every region. This increase almost balanced the rise in gross rhodium consumption in the autocatalysts sector and net demand rose by only 4,000 oz to 696,000 oz for the year.

Glass sector demand edged only 1,000 oz lower to 64,000 oz in 2007. Some glass production facilities are being closed in North America and Europe but there was good growth in Asian production capacity for fibre glass and flat panel display glass. There was a degree of thrifting, or dealloying, as glass manufacturers sought to reduce rhodium inventories by partial substitution of this metal with platinum.

With supplies only rising marginally more than demand, the rhodium market remained in deficit in 2007 and the price was firm throughout the year. Rhodium started at \$5,550 and upward pressure was immediately applied by the hiatus in Russian exports due to unclear rules on export licences. When these resumed, the price did not soften significantly as industrial buying continued to snap up any market offers. Rhodium spent most of the year above \$6,000 and the concern over lost production in South Africa provided further support to the price in the second half of 2007. The rhodium price strengthened during this period and ended December at its peak for 2007 of \$6,850.





Ruthenium

Ruthenium demand fell to 1.14 million ounces, a 32.1 per cent decrease on the figure for 2006. Consumption of metal in the electronics industry – particularly in the manufacturing of perpendicular magnetic recording (or PMR) hard disks – was the primary driver in this change. Ruthenium remains a key material in the fabrication of this type of hard disk but net demand fell. Signs of price sensitivity were seen in some other applications.

The rise in the market share of PMR has driven gross demand for ruthenium higher. However, despite this, we now believe that the total figure for ruthenium demand for 2007 was significantly lower than previously forecast. High ruthenium prices created

A fourth successive year of deficit in the rhodium market drove the price of that metal higher in 2007. Ruthenium demand slipped and the price fell too. Little excitement was seen in the iridium price.

an intense pressure to reduce working costs amongst end users, encouraging the re-refining of this material. Additional ruthenium refining capacity came on-stream during 2007, allowing much more of this metal to be reprocessed. At the same time, the industry significantly reduced its working stocks to cut costs. The electronics industry was also able to improve the efficiency of the relevant manufacturing processes and to thrift the already low metal content of a hard disk. All of these factors drove net demand lower.

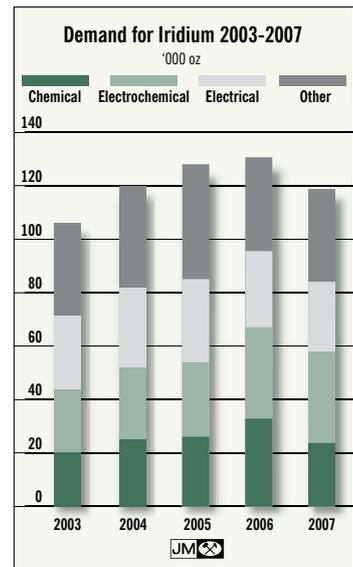
The dizzying rise in the ruthenium price through the second half of 2006 was reflected in thrifting elsewhere. Ruthenium-based pastes are used in the manufacture of plasma display panels. However, the makers of these have been able to cut the ruthenium content of the pastes dramatically, driving demand down by more than fifty per cent within a single year. Other applications such as the use of ruthenium in chip resistors were unaffected, however, with thrifting not technically feasible. Demand in the chemical sector did fall but this was more a return to trend after a spectacular year for demand in 2006 rather than a poor year for this sector.

Ruthenium supplies were hit by the frequent interruptions to mining in South Africa during much of 2007. A large percentage of production of this metal is from South Africa and primary output suffered despite growth in the amount of ruthenium-rich ore mined on the Eastern Bushveld. However, the South African producers were able to sell metal from above-ground stocks, just as in 2006, to meet demand.

Heavy purchasing of ruthenium by the electronics industry at the start of 2007 kept the upward pressure on the price and it climbed to a peak for the year of \$870 in February. However, with more metal being returned to the market from recycled sputtering targets and other electronic materials, buying interest diminished. The price softened and fell back to close 2007 at \$415.

Iridium

Global demand for iridium fell in 2007, dropping 12,000 oz to a total of 119,000 oz. The chemicals industry constructed fewer new factories requiring the use of iridium catalysts in 2007 than it had done in 2006 and demand fell in that sector. The use of iridium elsewhere, such as in automotive spark plugs and in the electronics industry remained steady. Iridium supplies to the market dropped in 2007, affected by a weaker performance by the South African mining industry. However, they remained large enough to meet industrial demand comfortably and the price moved very little during the year.



OUTLOOK

A number of trends are of key importance to the platinum group metals markets in 2008. In particular, the ability of the South African mining industry to stem the loss of production due to recent challenges in its operating environment will be vital to the market balance.

Platinum group metal production had previously been expected to grow in 2007 and in 2008. However, a new approach to safety – the temporary closure of shafts where fatal accidents occurred – and a very wide range of other operational challenges weighed heavily on production. Output and sales of pgms from South Africa fell in 2007 as a result.

This was followed, in early 2008, by the severe electricity shortages and ensuing power cuts experienced by industry in South Africa. This reached a peak in late-January when all deep level mining was temporarily stopped due to the safety hazards resulting from the short-notice loss of power to underground operations. Although mining restarted relatively quickly, a certain amount of pgm production was lost at that time. The short-term result of this temporary stoppage drove metal prices upwards and it is likely to mean that industry-wide pgm production in 2008 will be little higher than in 2007.

The power situation has stabilised with mines receiving a greater amount of their normal electricity requirements. Individual companies have prioritised particular mines or processing steps in order to maximise profitability and output. Assuming that the electricity supply can be maintained through the South African winter and power is available for new and expanding operations, the overall effect on South African pgm production in 2008 is estimated to be a shortfall of under 200,000 oz of platinum, less than initially feared. However, this figure does not include losses due to other causes such as the temporary closure of Amandelbult due to flooding, the slow ramp-up of production at Lonmin's new mechanised shafts and the challenges of finding and retaining skilled staff.

Over the longer-term, it is likely that the lack of sufficient generating capacity will continue until at least 2012. A number of the mining companies are installing some of their own electricity generation capacity to supplement the power that they are able to purchase. However, this will not fully resolve the issue and electricity supplies are likely to constrain South African

mining for several years. The effect of this "power gap" on the expansion plans of the mining industry cannot yet be fully quantified although some delays in the implementation of new projects will certainly occur.

A global economic slowdown now appears to be in progress, led by the USA. Any reduction in economic growth would soften demand for industrial metals such as the platinum group metals. Should the global economy suffer more than expected, there is the potential for lower demand for these metals than we currently forecast. However, it is still likely that demand for platinum and palladium will grow in 2008.

The price performance may also be affected by the same issues: falls in stock market indices around the world have had two opposing effects. Some investors have moved into gold and precious metals as "safe havens" while others have sold commodities to offset losses elsewhere. Any major stock market fall is likely to result in a greater sell-off and could knock pgm prices lower, even if physical demand is not affected.

PLATINUM

Platinum jewellery demand was fairly resilient in 2007, although the price averaged \$1,304, or 36 per cent more than in 2006. In fact, gross metal demand for jewellery (i.e. the total amount of platinum used by jewellery manufacturers including metal recovered from scrap) rose. However, the extraordinarily rapid price rise in January and February 2008 did have an effect on the jewellery trade with purchases in the key Chinese market falling in response. The full impact of prices above \$2,000 may not have been seen yet.

The outlook for jewellery demand over the entire year is more dependent on price than previously. While much of the high-end and the bridal sector is insulated from price changes, this is not true for the entirety of the market. However, a softening of the platinum price in March did encourage higher amounts of purchasing on the Shanghai Gold Exchange by the Chinese jewellery trade suggesting that the overall picture for 2008 may not be significantly worse than in 2007.

In the autocatalyst market, recent trends driving platinum demand are likely to persist into 2008 and beyond. The market share of production taken by light duty diesel vehicles in Europe should continue

rising from its already high level. The number of these vehicles with particulate filters will grow. The fitment of platinum-based aftertreatment on heavy duty diesel vehicles, in order to meet tightening legislation, will increase as well. All of these trends are expected to boost platinum demand from current levels.

However, a high platinum price, and a very large price differential between platinum and palladium are driving work on thrifting and replacement of platinum. In the gasoline sector worldwide, increased use of palladium catalyst formulations instead of platinum-based technology can be expected, although the scope for additional change is limited. In the diesel sector, an increase in the number of vehicles fitted with platinum-palladium catalysts rather than platinum-only catalysts is certain to happen. Considerable research effort is also being made by the industry to increase the palladium content of diesel catalysts. Together, these trends should restrict growth in platinum demand in the medium-term and beyond.

One significant change from previous years has been the 2007 launch of two exchange traded funds (ETFs) which are backed by physical platinum. Activity in these was limited for the first few months of their existence but the rate of investment accelerated dramatically in late-2007 and early-2008 as the price rose. It is currently hard to forecast the behaviour of ETF investors but activity over this period suggests that much of the money is invested over relatively short timescales. Demand and price also appear to be positively correlated – that is, when the price rises, more metal is bought by investors. Investment activity will also depend, though, on global economic conditions. Taken together, this complicates the forecasting of future demand. However, it seems reasonable, on the basis of current activity, to expect demand from this sector to be higher in 2008 than it was in 2007.

We expect that 2008 will again see large amounts of platinum reclaimed from jewellery scrap, particularly in Asia. There is now only limited scope for rationalisation of metal stocks at manufacturers, wholesalers and retailers. However, there is still an extremely large volume of metal in Japan in the form of jewellery bought over the last thirty years which is likely to continue returning for reprocessing under current market conditions, depressing jewellery demand. The amount of platinum recovered from



scrapped autocatalysts should rise too.

A further question for platinum will be the price sensitivity, or elasticity, of many of the industrial markets. Platinum is typically only used when its unique properties provide a benefit that outweighs its considerable cost. At current price levels, this balance could shift in some industrial sectors. However, there have been relatively few indications of this in industrial applications to date and we do not expect wholesale changes during 2008 or in the following years in most sectors. Instead, many users may be forced to rely on careful inventory control to contain costs.

Platinum supplies are expected to struggle in 2008, largely as a result of disruptions in South Africa. Problems in the mining sector have not solely been confined to power supply: flooding, reef geology and personnel issues have already played a part. However, Amandelbult is set to resume full production in the second quarter of 2008 and most producers are coping fairly well with their restricted power supplies. With construction of new mining capacity continuing, there is potential for South African platinum supplies to return to stronger growth in 2009. Nonetheless, worldwide production this year is likely to fall short of 2006 levels even if there is some recovery from 2007.

Nonetheless, the market is expected to be in a substantial deficit across 2008 as a whole. This suggests a strong price performance throughout the year, something which was certainly seen in the first quarter. The driving forces behind the price movements are not, though, solely pulling in one direction. A tight

While 2007 was a tough year for the South African pgm producers, there were a few bright spots with some mines reporting improved results.

supply-demand balance is supportive of the price but the deficit could be eroded by a USA-led global economic slowdown. However, the dollar looks likely to remain weak against most other major currencies, supporting the price, in dollar terms at least.

Stock market volatility has also infected the commodity markets and the US-subprime crisis is likely to continue to prompt extraordinary volatility in the platinum price. Poor performance by equities has encouraged investors into commodities, especially perceived safe havens such as gold. Conversely, wide daily movements on the stock markets have driven sales of the most liquid asset classes including metals. A sustained fall across the global exchanges would drive precious metals prices lower.

Upside risk remains, however: any further substantial interruptions to South African supply will push the price higher. Political uncertainty in Zimbabwe could damage output there too. We therefore expect platinum to trade in a wide range from \$1,775 to \$2,500 during the next six months.

PALLADIUM

Demand for palladium is expected to rise in 2008. The outlook for global palladium jewellery demand is somewhat uncertain but there should be increased requirements for this metal from the autocatalyst, industrial and investment sectors.

The production of platinum Olympic memorabilia to mark the Beijing Games will contribute to demand in 2008.



The autocatalyst sector is likely to show growth during 2008. Although the prospect of a USA-led global slowdown, or even recession, is still evident, automotive sales should remain relatively healthy. Although sales in the more established markets of Europe, Japan and North America will show little to no growth overall, the emerging markets of China, India, South America and, increasingly, Russia will manufacture and import more light duty vehicles. With the majority of these fitted with palladium-based aftertreatment technology, demand should increase.

There is also some scope remaining to replace platinum catalyst formulations with palladium ones. In the gasoline sector, this has been underway for several years already and there will be no step change in the trend. In the diesel market, however, we can expect both an increase in the number of vehicles with platinum-palladium oxidation catalysts fitted and, for the longer-term, considerable R&D effort into increasing the viable proportion of palladium in these catalysts from the current level of between a quarter and a third of the precious metal content.

Palladium investment demand has been reinvigorated by the launch of two exchange traded funds (ETFs) in 2007. Large amounts of metal were bought in the first quarter of 2008 alone, leading us to forecast substantial growth in demand from this sector if current market conditions persist.

Growth in electronics sector demand for palladium can be expected. The trends driving this industry have considerable momentum: memory and processing requirements continue to grow rapidly, forcing pgm use higher; and sales of electronic devices seem set to grow by more than 10 per cent again in 2008. Increased levels of recycling of consumer electronics and miniaturisation of components will not be able to prevent a rise in demand. Other industrial demand and dental sector purchases are also likely to rise.

The prospects for palladium jewellery demand are less clear. Most of the original Pd950 stock in China has now been sold or refined, and the amount of recycled metal used by manufacturers is likely to fall. With unsold stocks at retailers dropping, manufacturing demand should more closely reflect retail sales. Manufacturer purchases of metal were strong in the first quarter of 2008, suggesting some growth in demand this year is possible. The March 2008 announcement by the major

pgm producers of a concerted marketing campaign for palladium jewellery may drive consumer purchasing and demand higher in the medium-term.

Palladium supplies from mining are likely to fall in 2008 compared to 2007. Although Russian production is expected to change little, South African metal sales will be dented by the power supply problems experienced in the first quarter and by the range of other challenges facing the industry. Of note, therefore, is the question of the level of sales from Russian State stocks. We currently expect to see sales of a lower volume of Russian metal in 2008 than in recent years. We believe the shipments of roughly 500,000 oz from Russia into Switzerland in December 2007 did not reach the market that year and are therefore likely to form part of 2008 supplies. If so, the palladium market is likely to be in surplus again.

While we have reported very substantial fundamental surpluses in the palladium market over recent years, it seems likely that these have been absorbed by a limited number of large investors and institutions. The holding of amounts of palladium stock in Switzerland and elsewhere has supported the price and also depressed lease rates.

Lower palladium output from South Africa in early 2008 helped the price to firm. The behaviour of the palladium price in recent years has also been heavily influenced by movements in the prices of gold and of platinum. However, movements in the price in the final quarter of last year and the first quarter of 2008 may have been related more closely to investment in the European exchange traded funds and to other speculative activity based on a perceived correlation between the palladium price and the platinum price.

We currently forecast that palladium supplies will fall this year – subject to sales of Russian State stocks falling – and that demand will grow again in 2008. This suggests a tightening of the market and the potential for price rises to occur. If the platinum price performs strongly during the next six months, then palladium is likely to benefit and it could trade as high as \$575 within the same period. However, investor behaviour remains absolutely key. With many millions of ounces of palladium in investor hands, any widespread sell-off, whether driven by poor stock market performance or a US recession, would force the price down. We currently expect a floor price of no lower than \$400 during the coming six months.

OTHER PGM

A period of prolonged high rhodium prices has encouraged research into rhodium thrifting in a number of industries. Rhodium does, though, remain a vital material for use in gasoline catalytic converters. However, we expect to see a degree of thrifting of the average rhodium content of a catalyst. This is against a backdrop of tightening vehicle emissions legislation around the world and healthy growth rates in automotive production. Any decrease in overall rhodium usage is therefore likely to be small in the short to medium-term.

In other sectors, the effects of a high rhodium price are likely to persist. In the glass industry, new purchases of rhodium for extra LCD glass production capacity are likely. However, these will be offset by a continuing trend to reduce the rhodium content of the alloys used in order to contain costs. Glass sector demand may therefore fall in 2008.

Rhodium production is likely to suffer from the South African supply problems and may decrease in 2008. Much of the new production on the Eastern Bushveld – whether from new mines or from expansions – will be from rhodium-rich ores. Although rhodium output will rise over time as these operations expand their production, the current operating challenges in South Africa suggest a continuation of tight market conditions for at least some period of time.

The ruthenium market is also forecast to experience further price sensitivity and thrifting. The wider introduction of lower ruthenium content pastes used in the production of plasma display panels is likely to cut demand from this application again in 2008. More importantly, though, demand for ruthenium in the hard disk industry is likely to more closely reflect actual metal usage on PMR hard disks. The market share of this technology will increase in 2008, leading to higher gross demand but a continued focus on inventory control and process improvements will lead to higher recycling. It is likely that the overall trend in ruthenium demand, across all applications, will be downwards once again in 2008.

Iridium demand is unlikely to change greatly: although a worsening of economic conditions could dampen demand from the chemical industry, greater use in spark plugs can be expected.

SUPPLIES, MINING & EXPLORATION

Supplies of platinum fell by 4.1 per cent in 2007 to a global total of 6.55 million ounces, largely due to lower output from the South African producers. Palladium supplies rose by 8.0 per cent to 8.59 million ounces despite a small drop in metal sold from South Africa. Large Russian State stock shipments boosted flat primary production there to raise total Russian palladium sales.

SOUTH AFRICA

Supplies of platinum from South Africa fell by 260,000 oz in 2007 to 5.04 million ounces. A wide range of challenges faced the industry including safety, retention of skilled staff, industrial relations and geological issues. This cocktail of problems hit primary production at many mines. The pipeline releases of metal which had occurred in 2006 were not repeated, further depressing sales of platinum in 2007. Palladium sales were less affected and dropped marginally to 2.77 million ounces. Some individual mines did report improved pgm output on the back of successful expansion plans.

Anglo Platinum

Refined platinum output from the world's largest producer fell by 12 per cent in 2007, to 2.47 million ounces. However, the fall in production was exaggerated by movements in pipeline stock: inventories of unprocessed platinum fell in 2006, releasing some 180,000 oz of platinum, but were stable last year. The fall in underlying "equivalent refined

production", which more closely reflects actual output from the mines, was limited to 6 per cent.

There were declines in output at most of Anglo Platinum's mines, with the largest drops at Rustenburg, BRPM, Modikwa and Mogalakwena (formerly

PPRust). Rustenburg had a particularly difficult year: a sharp increase in fatalities in the first half resulted in a rolling suspension of operations at all shafts in order to improve safety. (This initiative was later extended to all of Anglo Platinum's mines.) Output at Rustenburg was also affected by high labour turnover and contractor

unrest, a rise in the proportion of production drawn from the lower-grade UG2, and the closure of the Turffontein shaft in November for the renewal and repair of steel work. Equivalent refined platinum production dropped by 20 per cent, to 665,000 oz.

Output at BRPM was affected by factors including mill breakdowns, difficult ground conditions, and a strike by contractor employees: equivalent platinum production fell by 11 per cent to 194,000 oz. Modikwa also suffered a month-long strike in the first quarter of 2007, which contributed to a 13 per cent fall in platinum output to 118,000 oz. At Mogalakwena, output fell 15 per cent to 163,000 oz of platinum, following the start of mining at the new North Pit in December 2006. The area of oxidised ore was more extensive than anticipated, leading to lower grades and recoveries, while unscheduled maintenance at the plant resulted in lower mill throughput.

In contrast, a number of the smaller operations recorded higher production, notably the Mototolo joint venture with Xstrata, which reported equivalent refined output of 95,000 oz of platinum in 2007, its first full year of operation. There was also growth in attributable production at Marikana, the subject of a Pool & Share Agreement with Aquarius Platinum, and higher output from the trial mine at Twickenham and from the Western Limb Tailings Retreatment plant.

At its results presentation in February 2008, Anglo Platinum forecast total platinum production of 2.4 million ounces this year, a 3 per cent decline from 2007. This figure takes into account the loss of production during January's interruptions to the power supply, the impact of severe flooding at Amandelbult which is expected to cut output from that mine by 50-70,000 oz, and the closure of the Turffontein shaft at Rustenburg (which should reopen in the second quarter of 2008).

In September 2007, Anglo Platinum announced two major black economic empowerment deals. The first was the sale of an effective 51 per cent of the Lebowa Platinum mine, along with 1 per cent of the Ga-Phasha project, to its existing joint venture partner Anooraq (which already owned half of Ga-Phasha) for R3.6 billion. The second was the sale to Mvelaphanda Resources of Anglo Platinum's stake in the Booyensdal project along with its stake in Northam.

Three new expansion projects were confirmed in 2007 and early 2008. These include an expansion of

PGM Supplies: South Africa '000 oz		
	2006	2007
Platinum	5,295	5,035
Palladium	2,775	2,770
Rhodium	666	696





The view North from Aquarius's Everest operations shows, on the left, the Booyendal and Der Brochen properties and, in the distance, the new Mototolo mine.

the base metals refinery to process additional production from Mogalakwena. The company also announced the Lebowa Middelpunt Hill Phase 3 project, which will increase UG2 production by 125,000 tonnes per month. In February 2008, the company committed to a major development at Twickenham, which will deliver 180,000 oz of platinum annually once it reaches steady state in 2016.

Impala Platinum

In 2007, Impala Platinum reported a marginal increase in platinum production from its lease area, to 1.09 million ounces. Mill throughput was stable at 16.4 million tonnes, while grades and recoveries improved in line with the replacement of open cast tonnes with underground UG2.

Marula, the company's 78 per cent owned mine on the Eastern Bushveld, increased production in 2007, with output of platinum in concentrate up 25 per cent at 68,000 oz. However, the redevelopment of the mine is behind schedule: full yearly production of 136,000 oz of platinum in concentrate is now expected in 2009.

The company is expanding smelting and refining capacity in line with its expectation that refined production from Impala Refining Services (IRS), including metal purchased in concentrate from other pgm producers as well as ounces from secondary materials, will reach 2.3 million ounces of platinum by 2010 (up from just over 2 million ounces in 2007). In February 2008, the Impala board also approved the

Impala Platinum managed to raise platinum output slightly in 2007 by increasing the production of underground UG2 ore.



development of 17 shaft, a major new shaft nearly 2 kilometres deep and with the capacity to hoist 225,000 tonnes of ore each month. This forms part of the company's strategy to maintain annual production at around 17 million tonnes of ore, yielding 1.1 to 1.2 million ounces of platinum annually.

Like other miners, Impala experienced disruption to electricity supplies in January 2008, and was subsequently limited to 90 per cent of its normal power consumption. At its February results presentation, it stated that electricity savings would be achieved by running the smelter at lower power; this will require concentrate volumes to be reduced, with a corresponding reduction in pgm recoveries. In addition to the 10,000 oz of production lost during January's shutdown, Impala has estimated that it will lose an additional 10 to 20,000 oz of platinum output over the course of this year.

Lonmin

Last year was challenging for Lonmin, with declines in both mill throughput and grade exacerbated by an increase in pgm stocks in the refining pipeline. Production of platinum in concentrate fell by 13 per cent to 837,000 oz, of which about 4,000 oz came from purchased ore; sales (including metal sold in concentrate) dropped 14 per cent to 797,000 oz.

The company's No. 1 smelter was closed for four months after a leak was discovered in December 2006, resulting in the accumulation of stocks of unprocessed concentrate. 90,000 oz of platinum in concentrate was toll-refined, and the remaining concentrate backlog was subsequently processed. However, by the year-end pipeline stocks were still higher than normal, particularly in the base metals refinery. As a result, refined output from Lonmin's refineries was only 663,000 oz of platinum in 2007, down 19 per cent.

At the company's large Marikana mine, mill throughput fell by 6 per cent to 12.5 million tonnes, despite higher tonnage from the new, mechanised Hossy and Saffy shafts. Mining operations were hit by strikes, safety stoppages, and shortages of skilled workers. Grades also fell, due to an increase in low-grade development ore from the new shafts.

The Limpopo mine on the Eastern Bushveld reported a 34 per cent decline in output of pgm in

concentrate in 2007, as mill throughput fell 16 per cent to 706,000 tonnes. Shortages of developed ore reserves constrained production. Operations were also affected by adverse ground conditions. However, the quantity of ore milled from the Pandora lease area increased by 6 per cent to 900,000 tonnes.

Lonmin experienced further difficulties in the early part of 2008, with continued high levels of absenteeism among skilled employees, lack of ore stocks ahead of the concentrators, and disruption to electricity supplies in January (which the company estimates resulted in the loss of some 15,000 oz of platinum production). Sales are forecast to total 775,000 oz of platinum in 2008, down from earlier predictions of 900,000 oz. However, Lonmin has maintained its longer term plans to increase production to reach 1.2 million ounces of platinum per annum by 2012.

Northam

Platinum sales by Northam in 2007 fell by 13 per cent to 187,000 oz, reflecting a sharp decline in Merensky tonnage and a decrease in average head grade.

The year was marred by three fatalities in the second half, which led to the loss of 23 days of production. Output was also affected by difficult mining conditions on the Merensky reef, but this was partly compensated by higher UG2 tonnage, with a record 42 per cent of production from this reef.

Unlike its larger competitors, Northam does not expect reductions in electricity supply to have a significant impact on 2008 performance, although some production was lost in late January. Tough geological conditions on the Merensky will continue to hamper output, but may be partly compensated by rising production from the lower-grade UG2.

In September 2007, it was announced that Mvelaphanda Resources was to acquire Anglo Platinum's 22.3 per cent shareholding in Northam, along with an additional 50 per cent share of the Booyssendal project. The terms of the transaction were amended in January, to extend the Booyssendal property and guarantee access to electricity and water during the development of the project. Once the transaction is complete, ownership of Booyssendal will be transferred to Northam, resulting in Mvelaphanda becoming the company's controlling shareholder.



A bankable feasibility study on Booyssendal is due to be completed in 2009, based on a mine exploiting the Merensky and the UG2 reefs at a combined rate of 400,000 tonnes of ore per month. The project will cost R7.1 billion, and initial indications are that pgm output could begin as early as 2011, although steady state production levels will not be achieved before 2014.

Mvelaphanda Resources will become the major shareholder in Northam Platinum in 2008 as part of the Booyssendal transaction.

Aquarius Platinum

The Kroondal Mine, operated under a Pool & Share Agreement with Anglo Platinum, reported an 8 per cent fall in production of platinum in concentrate, to 245,000 oz in 2007. Mill throughput rose strongly in the first half but tonnage fell by 6 per cent in the second half, due to a combination of industrial relations issues, safety stoppages, and interruptions to milling operations. Grades also fell, particularly in the final quarter of the year. However, production should grow this year and next: the mine is on track to reach peak production levels (expected to be around 280,000 oz of platinum annually) within the next two years.

At Marikana, rationalisation of mineral rights between Aquarius and its neighbour Lonmin resulted in the milling of additional open pit material, but at lower recoveries. As a result, while mill throughput rose by 48 per cent to 2.22 million tonnes in 2007, production of platinum in concentrate grew by only 30 per cent, reaching 85,000 oz. There was also an increase in underground production from the Brakfontein shaft, on Anglo Platinum ground, which Marikana is mining

under a second Pool & Share Agreement.

Mill throughput at Everest fell by 10 per cent to 2.33 million tonnes last year, but recoveries improved sharply, driving platinum output 5 per cent higher, to 104,000 oz. The transition to underground mining proceeded smoothly, with only 10 per cent of ore coming from open pits, down from about half in 2006. However, the mine suffered a setback when the underground mining contractor abandoned its contract in January 2008 following industrial relations difficulties: as a result, mining was temporarily suspended. Aquarius immediately assumed management of underground operations, allowing a rapid resumption of mining, but normal production levels are unlikely to be achieved before the middle of this year.

In February 2008 Aquarius announced the acquisition of a 50 per cent interest in Platinum Mile Resources. Platinum Mile operates a tailings retreatment facility situated within the Rustenburg Platinum lease area, producing about 20,000 oz of pgm annually.

In common with the other producers, Aquarius suffered power outages in January 2008. It has stated that power will be supplied preferentially to Kroondal (and to Everest, once production there returns to normal), in order to limit the effect on production.

ARM Platinum

ARM Platinum has stakes in three pgm-producing mines: a 55 per cent share in Two Rivers (with Impala), and 50 per cent shares in both Modikwa (with Anglo Platinum) and Nkomati Nickel – now a joint venture (jv) with Norilsk Nickel, following the latter's acquisition of LionOre in June 2007. ARM also has a majority interest in the Kalplats project, on which its partner Platinum Australia is conducting a feasibility study.

The Two Rivers mine started production in 2006. After a rapid ramp-up, it milled 2.4 million tonnes of ore last year, giving 214,000 oz of pgm in concentrate. Head grades worsened in the second half of 2007, due to potholes and areas of split reef, but are expected to improve this year, as are recoveries. Steady state production should be achieved by mid-2008.

At Nkomati, the high-grade Massive Sulphide Body (MSB) has been exhausted, and the mine is increasing production from the Main Mineralised Zone (MMZ) as part of an interim plan aimed at maintaining annual

production of around 5,000 tonnes of nickel. Pgm grades in the MMZ are much lower than in the MSB, and pgm sales fell by 21 per cent to 41,000 oz in 2007.

In September 2007, ARM and jv partner Norilsk Nickel confirmed plans for a large-scale expansion of Nkomati. Processing capacity will be raised to 625,000 tonnes per month; at steady state production, this will yield 110,000 oz of pgm (mainly palladium) annually.

Eastern Platinum

Sales of pgm from Eastern Platinum's Crocodile River Mine rose by 23 per cent to 107,000 oz last year, of which we estimate that just under 60,000 oz was platinum. Output from the Maroelabult and Zandfontein sections ramped up throughout the year, reaching 112,000 tonnes of UG2 ore per month in the final quarter, with grades averaging just over 4 grams per tonne. At full production, scheduled for late-2009, these two sections will deliver a total of 160,000 tonnes of ore per month to the mills. This will be supplemented by a monthly 40,000 tonnes from the Crocette mining area, for which a new mining right was received in March 2008.

Eastern Platinum has ambitious plans to develop a number of projects on the Eastern Bushveld, among them Spitzkop. The company believes that a 160 to 180,000 tonnes per month plant could be commissioned as early as 2009. It is also targeting an early start to production at the much smaller Mareesburg project.

Other

In the next year, three new platinum mines are due to be commissioned: Platinum Australia's Smokey Hills project, Ridge Mining's Blue Ridge mine, and Platmin's Pilanesberg. Together, these mines are scheduled to add over 250,000 oz annually to platinum supplies when they reach steady state production levels.

Mining at Smokey Hills started in early 2008 and an offtake agreement has been signed with Impala Refining Services. Ridge Mining will also deliver concentrate to IRS, starting in the final quarter of this year. Its Blue Ridge mine will exploit the UG2 and should produce around 75,000 oz of platinum annually. Platmin's Pilanesberg mine will exploit the UG2 and a package of silicate reefs via two open pits from 2009 to produce 250,000 oz of pgm in concentrate each year.

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.

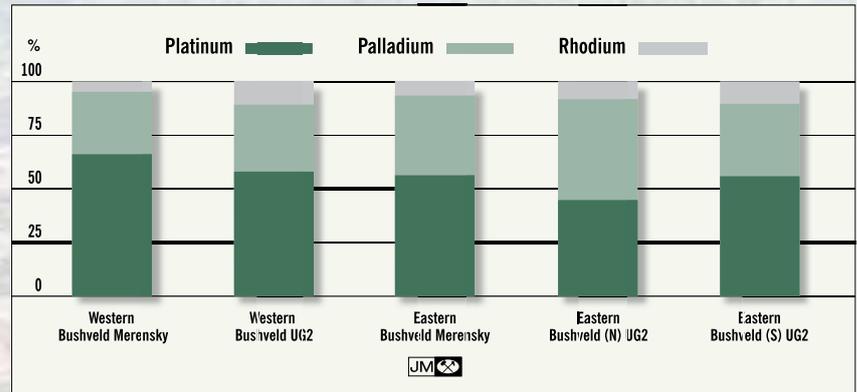
BEE/HDSA

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.

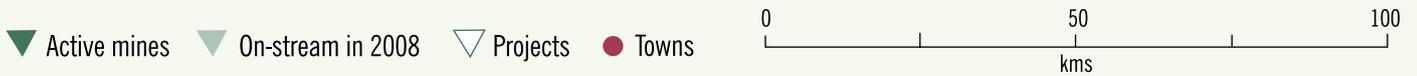
However, despite the expansion plans, the mining industry still faces significant challenges. Recently, a reduction in the amount of power supplied has caused problems, and will depress production in 2008. It is likely that implementation of some projects will be delayed by a lack of generating capacity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

SOUTH AFRICAN PGM PRODUCTION

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

STYLDRIIFT

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.

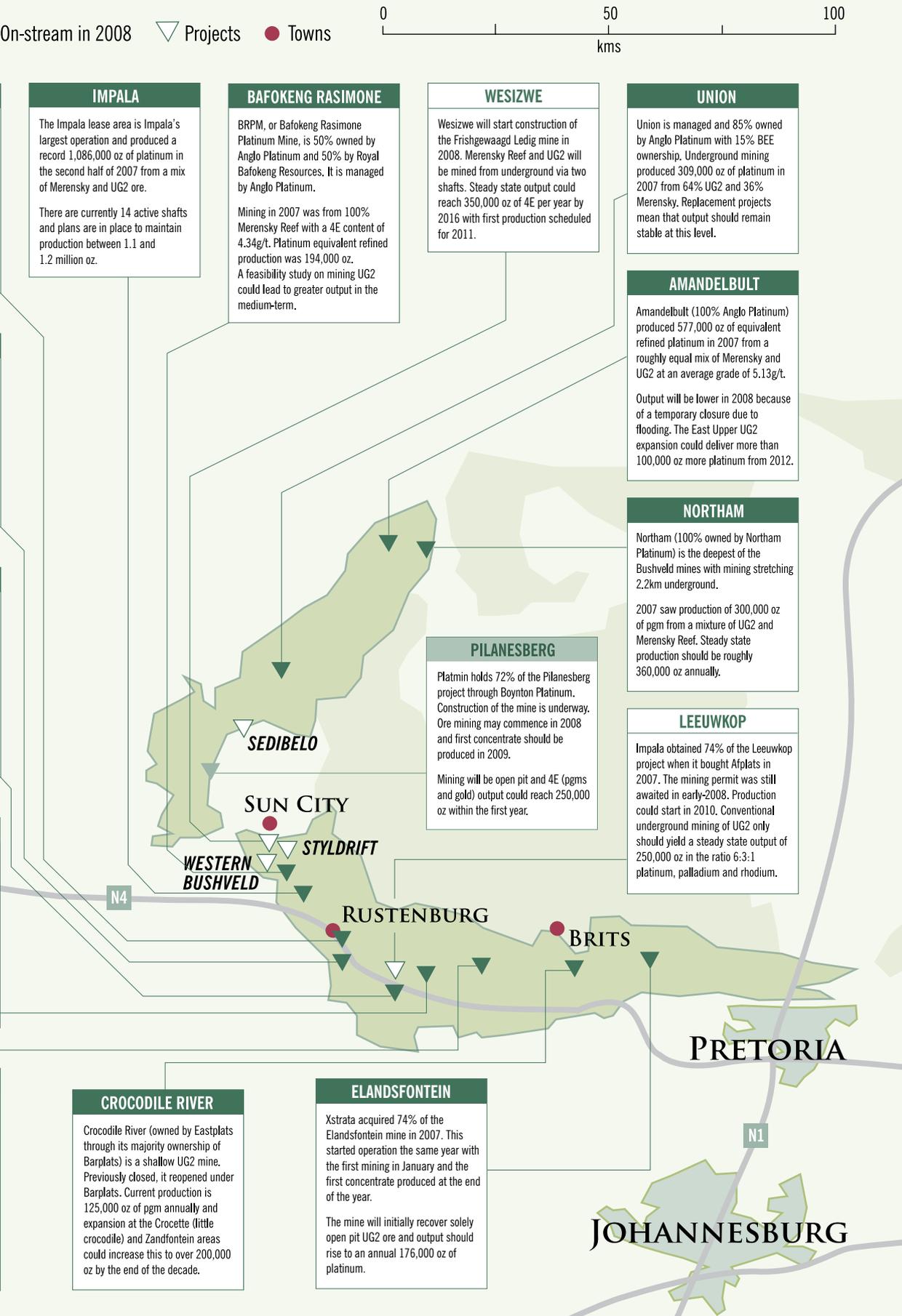
CROCODILE RIVER

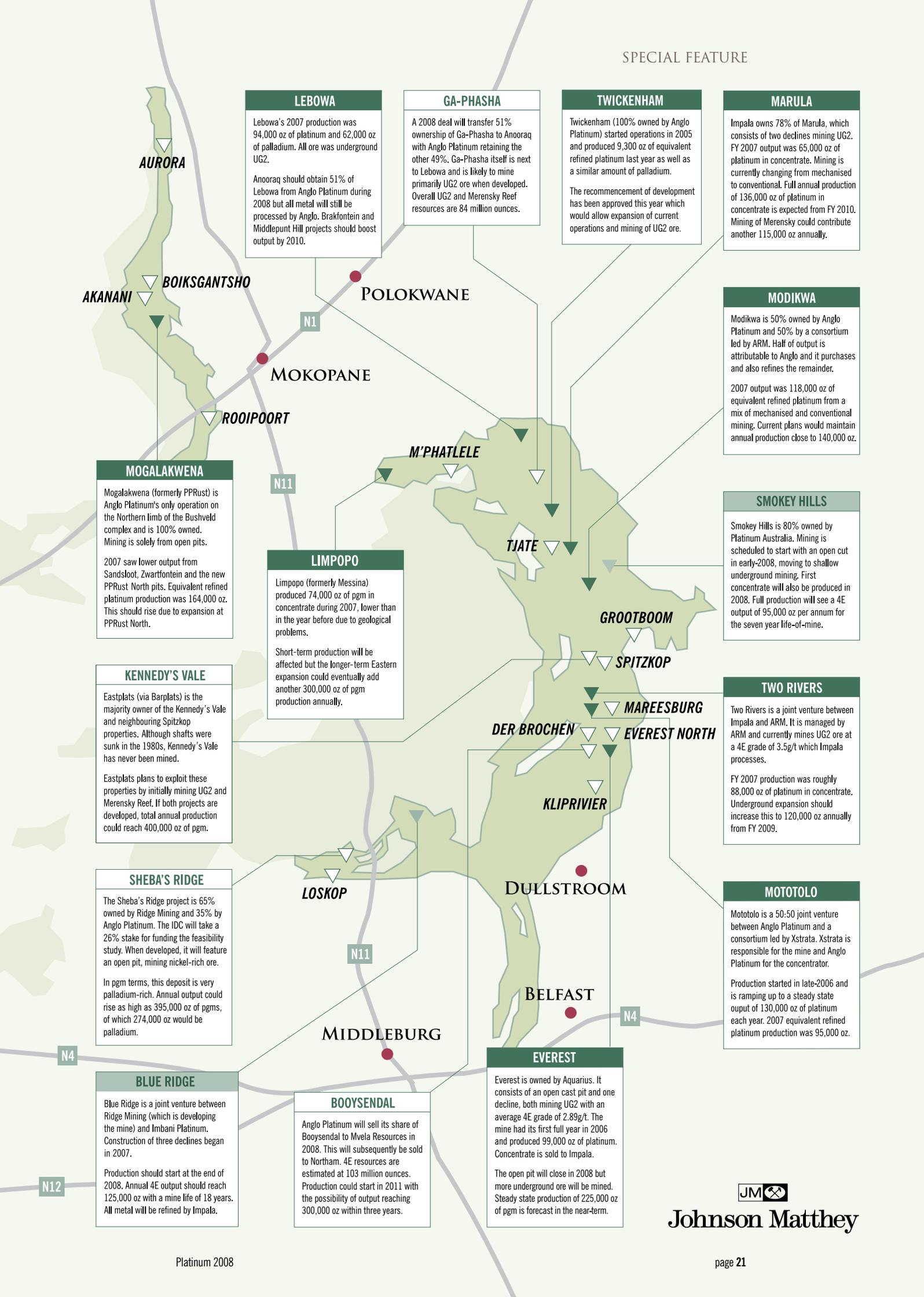
Crocodile River (owned by Eastplats through its majority ownership of Barplats) is a shallow UG2 mine. Previously closed, it reopened under Barplats. Current production is 125,000 oz of pgm annually and expansion at the Crocette (little crocodile) and Zandfontein areas could increase this to over 200,000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



RUSSIA

In 2007, Russian palladium supplies rose to 4.54 million ounces, an increase of 15.8 per cent compared with 2006. Primary production from Norilsk Nickel was marginally lower than in 2006, at 3.05 million ounces of palladium and 727,000 oz of platinum. The alluvial mines also produced several tonnes of platinum. Sales of State palladium stocks added another 1.49 million ounces to supplies. The

final shipments of metal from the Norilsk-Stillwater deal were sold in 2006 and were therefore not repeated in 2007.

We continue to report both aspects of Russian pgm supply: primary output from Norilsk Nickel, the alluvial miners and other producers; and sales from government-controlled stocks.

Output of pgm from Norilsk Nickel fell slightly in 2007. Including metal from the former LionOre assets in Africa (Nkomati Nickel in South Africa and Tati Nickel in Botswana), which were acquired by Norilsk in June last year, the company produced 3.11 million ounces of palladium and 740,000 oz of platinum. Of this, 3.05 million ounces of palladium and 727,000 oz of platinum came from ores mined in Russia, representing a decline of 2 to 3 per cent compared with 2006. The company predicts a further modest decrease in pgm output in 2008.

Alluvial mining in the far East of Russia can occasionally produce large lumps of ore which are extremely rich in platinum group metals.

PGM Supplies: Russia '000 oz		
	2006	2007
Platinum	920	910
Palladium:		
Primary Production	3,220	3,050
State Sales	700	1,490
Rhodium	100	90



Supplies of platinum from alluvial mines in the far East of Russia were slightly up in 2007, at just under 185,000 oz. The larger of the two operations, Amur, reported a decline in platinum grade, but compensated by greatly increasing the volume of sands processed.

In terms of State stocks, we believe that the 1.29 million ounces of Russian palladium shipped into Switzerland in December 2006 were not sold by Gokhran until the following year. It is therefore included in our figure for 2007 supplies. We also believe that the 500,000 oz of palladium shipped in December 2007 did not reach the market in that year and will include it in our 2008 figures. Total State sales of palladium in 2007 were close to 1.49 million ounces.

NORTH AMERICA

Supplies of platinum from North American mines fell by 5.8 per cent from the previous year's total to 325,000 oz. A fall in output from Stillwater and the ex-Inco nickel mines now owned by Vale (formerly CVRD) was responsible. Palladium supplies rose slightly to 990,000 oz, with increased underground production from North American Palladium outweighing the negative effect of industrial action at Stillwater.

Canada

Production from North American Palladium's Lac des Iles mine continued to recover, with output from the underground section (which commenced operations in 2006) contributing to higher mill throughput and grades. The total tonnage of ore milled rose by just under 10 per cent to 5 million tonnes in 2007, of which roughly 15 per cent came from underground, while the average head grade rose to 2.39 grams of palladium per tonne. As a result, palladium output rose by 21 per cent to 286,000 oz, while that of platinum was up 10 per cent at 24,000 oz.

Significant quantities of pgm are mined by Xstrata and Vale as by-products of nickel mining in Canada. The Vale Inco operations reported production of 140,000 oz of platinum and 191,000 oz of palladium in 2007, a drop of around 8 per cent compared with the previous year's figures, reflecting lower nickel output from the company's Sudbury mines. Vale currently has a number



PGM Supplies: North America '000 oz		
	2006	2007
Platinum	345	325
Palladium	985	990
Rhodium	17	17

of projects which will support its future nickel and pgm production in Canada, including the \$400 million Totten mine and the \$132 million development of the 170 orebody at the Coleman mine: both projects will extract pgm-rich ores.

At Xstrata's Sudbury operations, the existing mines are nearing the end of their lives: the amount of mined ore processed through the Strathcona mill declined by 1 per cent to 1.9 million tonnes in 2007, while nickel grades also fell. The company is currently developing new mines at Fraser Morgan and Nickel Rim South, with the latter expected to produce significant quantities of pgm when it comes on-stream in 2009. Xstrata is also expanding its Raglan mine, in northern Quebec, where capacity will rise from 1.1 million tonnes per annum in 2007 to reach 1.3 million tonnes by the end of 2008, and over 2 million tonnes from 2011.

USA

In 2007, Stillwater Mining Company's combined production of platinum and palladium from its two Montana mines was 537,000 oz, substantially below 2006's figure of 601,000 oz. Sales of palladium fell 9 per cent to 425,000 oz, while platinum shipments dropped 13 per cent to 120,000 oz; rhodium output remained steady at 4,000 oz.

Total mill throughput from the Stillwater and East Boulder mines fell by 7 per cent, largely due to labour challenges. These included loss of skilled personnel due to the implementation of new working schedules, and a seven-day strike during July. The quantity of ore produced at the East Boulder mine was also affected by changes in the mining methods employed there.

With the Stillwater mine in particular now employing less experienced miners, productivity will take some time to return to 2006 levels and the company expects only a small improvement in total pgm output to between 550,000 and 565,000 oz in 2008. Further activity this year will include extending a decline below the current Stillwater operating levels and the construction of a second smelter at the company's Columbus site to process both primary ore and scrap autocatalyst.

ZIMBABWE

Platinum supplies from Zimbabwe rose by 2.3 per cent in 2007 to a total of 171,000 oz; palladium and rhodium production stayed steady at 134,000 oz and 14,000 oz respectively.

At Mimosa, a 50:50 joint venture between Impala and Aquarius, production of platinum in concentrate rose by 7 per cent to 79,000 oz in 2007, despite a modest decline in mill throughput. Palladium and rhodium production grew in proportion to 60,000 oz and 6,000 oz respectively. This metal is refined in South Africa by Impala Refining Services (IRS).

Mimosa's Wedza Phase V project was 85 per cent complete by the end of 2007. This \$28.8 million expansion will increase concentrator capacity from 150,000 to 175,000 tonnes per month and raise annual production of pgm in concentrate to 195,000 oz.

At the Ngezi mine, which is managed by Zimplats (of which Impala owns 86.9 per cent), the volume of ore milled rose by 7.1 per cent to 2.2 million tonnes, boosting production of pgm in concentrate by 8 per cent to 205,000 oz. However, sales of pgm in matte were down 3 per cent at 181,000 oz. In the third quarter, the smelter was shut down for 43 days for relining, and some stocks of untreated concentrate accumulated during this period; these will be treated in early 2008, and will add to production this year.

The conversion of the mine from open pit to underground continued during 2007. Production from the first of the new underground mines, Portal 1, grew last year, and the development of a second, Portal 4, is underway. Together, these are scheduled to increase annual production to 160,000 oz of platinum by 2010.

The Indigenisation and Economic Empowerment Bill, which provides for 51 per cent indigenous ownership of foreign firms operating in Zimbabwe, was passed by parliament in November 2007, and received presidential assent in early March this year. Following an agreement in 2006 to release part of its resource base to the government, Zimplats already has existing empowerment credits of 29.25 per cent, and further credits may be obtained through infrastructure projects and social spending.

PGM Supplies: Zimbabwe and Others '000 oz		
	2006	2007
Platinum	270	280
Palladium	270	285
Rhodium	19	19

PLATINUM

Global demand for platinum grew by 8.6 per cent in 2007 to a record 7.03 million ounces. Autocatalyst demand grew by 320,000 oz, largely due to the strength of the diesel vehicle market. Purchases of new platinum by the jewellery trade were less affected by price than had been expected and fell by only 55,000 oz, with fabrication levels being supplemented by increased levels of recycling in China and Japan. Record platinum prices also had little impact on industrial applications which absorbed 110,000 oz more platinum in 2007 than in the previous year. The investment sector showed significant growth, buoyed by the launch of two new exchange traded funds.

AUTOCATALYST

Purchases of platinum by the autocatalyst sector rose by 8.2 per cent to a global total of 4.23 million ounces in 2007. Platinum use in catalysts fitted to European light duty diesel vehicles accounted for almost half of this total. However, the growth in demand last year derived not from this subsector but instead from booming car production in Asia and from the increasing fitment of platinum-containing aftertreatment to heavy duty diesel vehicles to meet tightening emissions legislation.

Europe

2.08 million ounces of platinum were purchased for the European autocatalyst market in 2007, an increase of 20,000 oz from 2006. The use of platinum on catalysts and filters for light duty diesel vehicles made and sold in Europe continues to be the most important segment of this demand, representing over 90 per

cent of metal consumed in the region's automotive sector.

While overall production of light duty vehicles changed little in Europe between 2006 and 2007, the proportion with diesel engines rose again to reach 53 per cent. It seems likely that this market share will continue to grow in 2008, with all of these vehicles fitted with platinum-

based oxidation catalysts. The number of cars with diesel particulate filters fitted in addition to oxidation catalysts is growing too, further augmenting platinum demand.

The heavy duty diesel (HDD) sector took an increasing amount of platinum to meet both Europe-wide emissions legislation and local rules such as London's Low Emissions Zone ahead of its launch in early 2008.

However, auto makers were encouraged by high price differentials to introduce palladium into diesel oxidation

catalysts in place of some of the platinum. With this trend accelerating last year – as a greater proportion of catalysts incorporated palladium – platinum consumption grew by less than would otherwise have been the case.

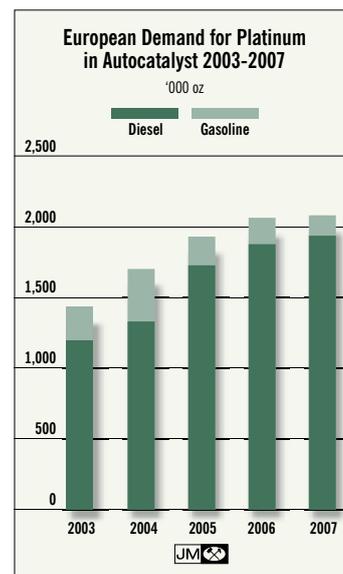
Japan

Demand for platinum from automotive manufacturers in Japan climbed by 1.6 per cent to 615,000 oz in 2007. Although most of the vehicles made in Japan have gasoline engines, platinum continues to be widely used in the principal export markets. Little platinum is used in formulations for domestic vehicles.

Light duty vehicle production rose slightly (by 1.0 per cent) to 11.1 million units in 2007. Japanese domestic sales, however, fell by 5.2 per cent and were only 5.32 million units for the entire year with the balance being exported. As might be expected, the Japanese car makers have moved to replace platinum with palladium in the catalysts fitted to most vehicles which are sold into the domestic market.

However, they have a more cautious attitude to changing catalyst formulations for their export markets. Fuel quality in much of Asia is variable and makes platinum a more suitable catalytic metal than palladium due to its higher sulphur tolerance. A 10 per cent increase in the sales to various export markets in 2007 therefore helped drive platinum use higher.

The heavy duty diesel market in Japan is also an



European purchases of platinum for use in autocatalysts grew to a record 2.08 million ounces in 2007.

Platinum Demand: Autocatalyst '000 oz		
	2006	2007
Europe	2,060	2,080
Japan	605	615
North America	705	930
China	155	215
Rest of the World	380	385
Total	3,905	4,225



The development of advanced thinner-walled substrates for autocatalysts provides opportunities for thriving catalyst pgm content without affecting performance.

important contributor to platinum demand. With the next phase of Japanese emissions legislation to be introduced in 2009, engine and vehicle manufacturers have already started to fit aftertreatment to meet it. Catalysts and filters are also fitted to many of the trucks which are destined for the European and North American export markets. With the focus on meeting new emissions rules, there has been little attention paid so far to thrifting in this sector and demand for platinum has been growing at a healthy rate.

North America

Light duty vehicle production in North America fell from 15.9 million units in 2006 to 15.5 million units in 2007. Most of this decrease in output was accounted for by a fall in the number of cars made in the USA, while the number of trucks produced remained steady. However, platinum consumption rose to 930,000 oz due to the application of tighter emissions rules to medium and heavy duty diesel trucks.

The switch to palladium-based catalyst formulations from platinum-based ones in the gasoline sector continued. Although this has been underway for a number of years, the reduction in platinum use in gasoline vehicles accelerated in 2007 due to this metal's high price.

More important for platinum uptake was the growth in catalyst fitment in the diesel sector. While very few cars have diesel engines compared to the European market, the fuel efficiency of this type of engine has allowed it to gain market share amongst larger vehicles. Recent changes in emissions legislation mean that many medium duty diesel trucks now fall under passenger vehicle legislation. As a result, they were fitted with catalysts containing a significant amount of platinum for the first time in 2007.

In the heavy duty diesel sector (mainly larger vehicles used for hauling goods long distances), new legislation which effectively forced the use of catalysts was applied in 2007. Most of the emissions reduction technology fitted employed platinum as the active catalytic material. Although there was a dip in truck sales, as many consumers either delayed or brought forward vehicle purchases to avoid the impact of the extra cost of the aftertreatment, roughly 200,000 oz of platinum was purchased for this application.

China

Chinese purchases of platinum for use in autocatalysts climbed by a hefty 38.7 per cent in 2007 to 215,000 oz, reflecting both a tightening of emissions legislation and growing vehicle production. The Chinese economy grew by more than 10 per cent in 2007. However, annual car production rose by a remarkable 26.6 per cent to 5.5 million units. Almost all of these vehicles are gasoline-fuelled and all have catalysts fitted.

New emissions legislation, equivalent to Euro 3, was scheduled to come into force in July 2007 but was delayed until mid-2008 due to concerns over fuel quality. However, this had little impact on the platinum market. The most important urban markets such as Beijing, Guangzhou and Shanghai had already implemented this legislation (and Beijing will adopt Euro 4 in the first half of 2008). Many of the Western-Chinese joint venture operations were already fitting Euro 3-compliant catalyst systems to their vehicles too, using thrifted versions of European technology.

Rest of the World

Autocatalyst platinum demand in the Rest of the World region grew by 5,000 oz to 385,000 oz in 2007. All of the fastest growing global markets (other than China) are in this region, including India, South America and, reported here for the first time, Russia (see our special feature on pages 39 - 41 for more details).

However, increased car manufacturing in Korea was responsible for the majority of platinum demand last year. Many diesel cars are manufactured in Korea for export to Europe and, just as with European-made diesels, the catalyst technology is platinum-based.

Autocatalyst Recovery

The recycling of scrapped catalytic converters contributed 30,000 oz more platinum in 2007 than in the previous year. Of the total 890,000 oz that was reclaimed globally, almost 65 per cent came from scrap collected in the North American market.

The infrastructure for

Platinum Demand: Autocatalyst Recovery		
	'000 oz	
	2006	2007
Europe	(190)	(220)
Japan	(35)	(35)
North America	(575)	(575)
China	0	0
Rest of the World	(60)	(60)
Total	(860)	(890)

collecting and processing autocatalyst scrap in North America was already well-established. Changes in the amount of metal recovered therefore reflect trends in catalyst loadings employed on vehicles in the previous decade. While a difficult economic environment might have been expected to encourage the general public to delay replacing their automobiles, it has had less impact than anticipated. Platinum recovery from end-of-life scrap catalysts in North America therefore remained flat at 575,000 oz in 2007.

In Europe, the increasing number of catalysed diesel vehicles being scrapped is boosting platinum recovery, despite hefty exports of used vehicles to countries where they are re-used rather than being scrapped. In Japan, recovery rates were static with many second hand vehicles escaping the recycling chain due to their export to East Asia and the Middle East. Combined platinum recovery for these two regions climbed to 255,000 oz. Elsewhere, the number of autocatalysts being recycled in the Chinese market has started to grow, leading to a few thousand ounces of metal being reclaimed in 2007.

JEWELLERY

Global demand for new metal (net of scrap recycling) in the jewellery industry dipped slightly in 2007, falling 55,000 oz to a total of 1.59 million ounces. While the high prices and significant price volatility of platinum created a very challenging environment at all levels of the jewellery industry, demand from both the trade and consumers alike stayed strong for the majority of the year. In fact, some markets even managed to demonstrate growth in platinum demand during 2007.

Europe

European platinum jewellery demand in 2007 rose by 7.7 per cent, despite a high metal price, to a total of 210,000 oz. Retail sales rose in some markets but retailers and manufacturers alike devoted considerable attention to rationalisation of stock levels at every point along the jewellery value chain to keep financing costs under control. While this had no direct impact on consumer purchasing, it did reduce growth in demand by a few thousand ounces in 2007.



Platinum demand grew slightly in the European jewellery market with bridal sector and high-end sales both healthy.

The positives for platinum jewellery included the UK market where consumer demand for platinum remained strong. Platinum is positioned in the bridal sector and at the top end of the market and rising prices had little impact on hallmarking figures. Likewise, in Switzerland, statistics demonstrate that platinum watch production grew. 18,000 watches were manufactured, the highest figure in five years and second highest ever, showing the strength of platinum's positioning. The global luxury market fared remarkably well in 2007 too. Rapid economic growth in China and Russia supported imports of luxury, branded platinum jewellery manufactured in Europe.

However, platinum demand declined in many areas in 2007. The German market continued to be depressed and demand there, and in markets such as Italy, dropped. Platinum's performance was affected by high metal prices in the middle market but consolidated in the bridal and high-end sectors.

Japan

Purchases of fresh platinum by Japanese jewellery manufacturers fell for the fifth successive year to 280,000 oz in 2007. This is lower than our previous estimate as high platinum prices at the end of 2007 caused jewellery recycling rates to increase still further.

Platinum Demand: Jewellery '000 oz		
	2006	2007
Europe	195	210
Japan	360	280
North America	245	240
China	760	780
Rest of the World	80	75
Total	1,640	1,585



We believe that at least 200,000 oz of second hand jewellery was returned for recycling. Most of this metal was re-used in the jewellery trade.

Platinum remains the metal of choice in the bridal market but demand is falling due to declining marriage rates. It also faces growing competition on the basis of price in other jewellery sectors, particularly from white gold. The same cost pressures have been seen in the move from high-purity gold jewellery towards lower carat products.

More important, however, in the declining demand is a rapid rise in the amount of second hand platinum jewellery returned by consumers and subsequently resold or scrapped. This trend has partly been driven by increasing metal prices (although platinum remains below its 1980s peak in Yen terms at the time of writing). However, increased awareness by the general public of rising precious metals prices has played a part in encouraging this trend. As importantly, a significant commercial opportunity has arisen in the second hand jewellery market. The rising price of diamonds, gold and platinum have allowed collectors to make higher margins. More companies are registering for antiques dealer licences in order to enter this business too. As a result, the volume of recycled platinum employed in Japanese jewellery manufacture is now approaching the amount of new metal being used.

North America

Purchases of platinum by North American jewellery manufacturers declined by 5,000 oz in 2007 to a total of 240,000 oz. A sustained period of relatively high prices has been accompanied by an economic slowdown. Both have had some negative impact on consumer purchases of platinum. With imports of jewellery made outside North America also placing pressure on local manufacturing, demand therefore fell.

Some segments of the market remain notably strong: platinum is still performing steadily in the luxury goods sector and in the bridal market. However, an increase in the price of diamonds has placed pressure on wedding budgets. Couples have sought to make economies and there is clear evidence of a move to lower cost materials for men's wedding bands at least. At the lower and middle end of the market, platinum now holds a weak position as retailers are unable to



sell attractive products at the requisite price points.

With the average platinum price much higher in 2007 than in the previous year, the pressure on working capital at retailers and manufacturers intensified further. A number of bankruptcies in the wider jewellery sector also heightened credit risk, applying yet more pressure on the levels of stock throughout the trade.

Large quantities of second hand platinum jewellery were returned for resale or recycling in 2007.

China

Net demand for new metal from the Chinese jewellery sector rose by 20,000 oz in 2007 to a total of 780,000 oz. This marked a change from the recent falls in demand. The rising platinum price created difficulties for retailers and manufacturers, and caused an increase in the recycling of old jewellery. However, platinum demand was supported by novelty products in the form of beads or so-called "pigs" and memorabilia manufactured ahead of the 2008 Beijing Olympics.

Although the platinum price rose substantially in dollar terms during the year, the affordability of platinum jewellery was not as severely affected as in some other geographical markets. Due to a strengthening currency and the rapid pace and extent of economic growth, consumer desire for platinum remained healthy. Retail sales of platinum jewellery were robust, rising in value terms, partly aided by a simultaneous increase in the prices of the other major jewellery metals (gold and palladium).

Chinese manufacturers reported slightly higher levels of platinum jewellery production than in 2006,

but a high metal price encouraged them to use a greater amount of scrap material where they could. Some of this metal came from recycled retailer stock, some from old platinum jewellery exchanged for new pieces by consumers, and some, we believe, from scrap brought into China from other countries.

The Chinese jewellery trade coped well with the rising platinum price for most of 2007 but there were signs of strain in the final quarter. During the normal lull in manufacturing activity after the October National Holiday, platinum sales on the Shanghai Gold Exchange fell below 2006 volumes. In contrast, sales in the middle of the year had been at record levels, despite the historically high price at that point.

Jewellers intensified their efforts to minimise the cost of holding stock, for example by increasing the proportion of white gold in gem-set jewellery. The same retailers also delayed their purchases of replacement stock in the hope of a decrease in the price. With manufacturing volumes lower than in the first three quarters of the year, the jewellery makers reduced their working stocks too, trimming demand for new metal a little.

Chinese jewellery demand was supported in early 2007 by the production of beads (or so-called “pigs”) to mark the Year of the Pig. These may have added as much as 30,000 oz to demand in 2007. Towards the end of the year, manufacturers in Shenzhen started to produce Olympic memorabilia ahead of the 2008 Beijing games, contributing a further few thousand

ounces of demand to the 2007 total. These are also being manufactured in the first half of this year, and are therefore likely to boost demand in 2008.

Rest of the World

Demand for platinum for jewellery manufacturing in the Rest of the World region was down slightly in 2007 at 75,000 oz. Although US import tariffs on jewellery manufactured in countries such as Thailand made manufacturing in such territories less attractive, cost pressures did still encourage some imports into Japan and the USA from this region. Our numbers also contain, for the first time, a small amount of platinum demand – 5,000 oz in both 2006 and 2007 – for jewellery manufacturing in Russia.

CHEMICAL

Chemical sector requirements for platinum fell marginally in 2007, to 390,000 oz. Platinum thriving had some impact but only just outweighed the effect of thriving bulk commodity chemical markets.

A good example was found in the silicones industry, where a number of companies revealed that they could trim the final platinum content of their products significantly by changing the raw monomer’s chemical structure. This results in a lower amount of the platinum homogeneous catalyst remaining trapped in the silicone product. However, as demand for pressure-release silicones is growing, total demand for platinum was steady in this application.

By contrast, demand for platinum from nitric acid manufacturers rose in 2007. Construction of new capacity has recently been concentrated near pockets of cheap natural gas – mainly in the Rest of the World region – as the process works by reacting natural gas with hydrogen to produce ammonia before converting this to nitric acid over the platinum-containing catalytic gauzes. Demand for nitric acid is also rising with key industries such as farming (which uses large volumes of nitrogenous fertilisers) and mining (which uses explosives) expanding once more.

Platinum Demand: Chemical '000 oz		
	2006	2007
Europe	100	110
Japan	50	55
North America	100	95
China	65	55
Rest of the World	80	75
Total	395	390

High prices had little if any impact on platinum sales, much of which is bought for the jewellery trade, on the Shanghai Gold Exchange until the final quarter of 2007.



ELECTRICAL

Demand from the global electrical and electronics sector climbed in 2007, moving from 360,000 oz to 425,000 oz. Growing production of computer hard disks was the main spur, reflecting continued strong sales of all manner of electronic devices and their increasing complexity.

Platinum Demand: Electrical '000 oz		
	2006	2007
Europe	25	30
Japan	55	60
North America	75	75
China	45	55
Rest of the World	160	205
Total	360	425

Figures suggest that global shipments of personal computers grew by 13.4 per cent in 2007 to 271 million units. Although the desktop computing market declined in value, the number of laptop devices being sold grew strongly. The blossoming market share of perpendicular magnetic recording (PMR) disks in place of longitudinal technology (LMR) had some impact on platinum demand. The amount of platinum used per disk has risen to increase storage capacity. However, the advent of PMR moderated the growth in disk production due to their inherently high capacity. While 2007 did see the launch of laptop computers using non-pgm flash memory in place of hard disk drives, these took little market share and platinum demand consequently continued to grow.

GLASS

Glass industry platinum demand grew from 405,000 oz to 430,000 oz in 2007. Purchases of metal for installation in new manufacturing plants

Platinum Demand: Glass '000 oz		
	2006	2007
Europe	10	15
Japan	100	80
North America	10	25
China	50	140
Rest of the World	235	170
Total	405	430

for various types of glass in Asia drove demand higher. More than a third of colour televisions shipped in 2007 used LCD glass and this technology is expected to capture more than half of the market in 2008. The glass manufacturers and electronics companies therefore continue to invest in new plants, particularly in Asia, to meet rocketing consumer demand. The closure of old cathode ray tube (CRT) glass factories continued



Strong growth in the flat panel display and fibre glass (shown above) markets in Asia boosted platinum demand last year.

releasing platinum back to the market as this technology loses market share to plasma display panels and LCD television sets.

The number of plants manufacturing fibre glass is also falling in Europe and in North America. However, much of this activity is simply the relocation of production capacity to China and the Rest of Asia to supply the booming construction market. Most demand for new metal for the fibre glass market therefore derives from China and the Rest of the World region.

PETROLEUM REFINING

Demand for platinum from the petroleum refining industry rose by 13.9 per cent to 205,000 oz in 2007. With oil prices high and demand for many petrochemical products buoyant, last year saw continued expansion of capacity in this sector. If oil prices remain above \$100 per barrel, further growth should occur.

This growth was seen in almost all regions with some new plant construction in Europe and North America. However, growth in refining capacity was greatest in the Rest of the World region, particularly in East Asia (outside China). 2007 demand was greatly boosted by construction of new capacity in India to meet booming regional demand.

There was, though, little effort to thrift platinum loadings. High prices encouraged refiners to run their plants at full capacity. This meant that there were few opportunities to change catalyst out where this

Platinum Demand: Petroleum Refining '000 oz		
	2006	2007
Europe	20	25
Japan	5	5
North America	35	35
China	10	10
Rest of the World	110	130
Total	180	205

was not absolutely necessary. In fact, tightening legislation on fuel quality and high economic growth meant that the priority for many companies was removing bottlenecks from their processes rather than reducing costs in any area. Looking further forward, the growing move towards green fuels should lead to additional platinum demand in this sector.

INVESTMENT

Net platinum demand for investment products rose to 170,000 oz in 2007, in sharp contrast to the net disinvestment which occurred during the preceding year. Net demand for coins and bars was negative but the launch of two platinum-based exchange traded funds, or ETFs, contributed 195,000 oz to overall demand for the first time.

Demand from platinum coins and bars was negative in 2007. In Japan, changes to one platinum accumulation plan resulted in net disinvestment. Where bars had previously been held for investors off the market, in allocated accounts, in mid-2007 subscribers to the plan were offered the choice of

Platinum Demand: Investment '000 oz		
	2006	2007
Europe	0	195
Japan	(65)	(60)
North America	20	30
China	0	0
Rest of the World	5	5
Total	(40)	170

moving to an interest-bearing account if they allowed their metal to be loaned out or otherwise employed. A significant number of investors chose to switch accounts, effectively returning metal to the market. Other investors sold large privately-stored bars back to the market too.

More importantly, though, April and May saw the creation of two exchange traded funds which were backed by physical platinum. Investor interest in the Swiss fund appeared to come mainly from institutional investors and only a relatively limited amount of metal – 55,000 oz – had been acquired by the end of 2007. Purchasing in the London-based fund started slowly but the rate of investment increased rapidly towards the end of the year as the price rose. In fact, 100,000 oz of platinum, or 70 per



cent of the 2007 total, was bought in November and December alone. Together, these two ETFs accounted for an entirely new demand of 195,000 oz in 2007.

Exchange traded funds were the most important part of the investment sector in terms of platinum demand in 2007 but some new coins were launched.

OTHER

Demand for platinum from other applications was unchanged at 490,000 oz in 2007. Signs of price sensitivity were seen in some markets but economic growth generally balanced this effect.

The spark plug sector provided a good example. There is evidence of some recycling of precious metal spark plugs and of thrifting of the platinum content in spark plug tips by manufacturers in response to rising metal prices. However, with production of platinum-based plugs starting in earnest in China last year, demand for platinum still grew marginally.

In the dental sector, the increasing use of ceramic technology for crowns and bridgework etched away at the market share of platinum, particularly as patients in the key German market have recently had to pay a greater percentage of the cost of their treatment. Purchases of new metal were also depressed by high levels of recycling as dental laboratories became ever more aware of the value of this scrap material. Net demand fell to 105,000 oz.

Platinum Demand: Other '000 oz		
	2006	2007
Europe	175	180
Japan	40	45
North America	225	230
China	10	10
Rest of the World	40	25
Total	490	490

PALLADIUM

Palladium demand grew by 3.5 per cent to 6.84 million ounces in 2007. Gross autocatalyst demand grew to almost two thirds of this total or 4.45 million ounces due to the continued replacement of platinum by palladium in autocatalysts. Demand rose in the electronics sector to 1.29 million ounces with retail sales climbing strongly. Palladium demand from the jewellery trade continued to fall from its 2005 peak to 740,000 oz in 2007. Investment demand was reignited by the launch of two palladium exchange traded funds and rose to 260,000 oz.

AUTOCATALYST

The widespread replacement of platinum by palladium in gasoline catalysts and, to a lesser extent, in diesel catalysts drove palladium autocatalyst demand 10.8 per cent higher in 2007 to 4.45 million ounces. Increases in the platinum and rhodium prices in recent years have maintained the financial incentive to make this change in catalyst formulation. Healthy growth in vehicle production in Asia also contributed to this rising demand for palladium.

Europe

European autocatalyst demand for palladium grew by 10,000 oz, to 900,000 oz in 2007. European Union production of passenger cars rose by 6.6 per cent to 17.1 million units for the year, despite weak car sales in the key German market, where demand was constrained by new rules on consumer sales taxes. However, a fall in the market share of gasoline cars

in Europe trimmed the growth in palladium purchases.

In fact, palladium usage in three-way, or gasoline, catalysts fell. While the number of gasoline-fuelled vehicles manufactured and sold was almost the same as in the previous year, a substantial amount of thrifting was carried out by the European auto makers. Euro 4 emissions

regulations, which came into force in early 2006, obliged manufacturers to increase pgm loadings. Since that date, the car companies have thrifted the average palladium content of a catalyst without adversely affecting performance. The negative effect of this fall in catalyst loadings on palladium demand outweighed the impact of further replacement of platinum in the minority of current gasoline catalysts where it was still in use.

In the diesel sector, palladium usage increased in

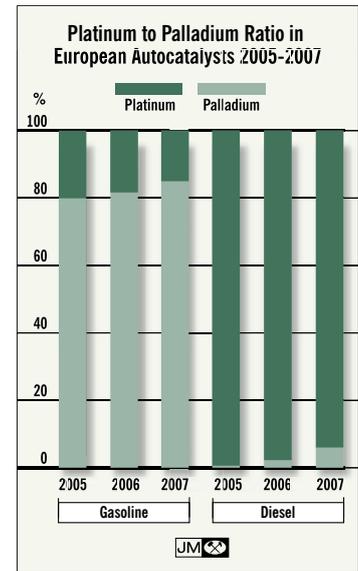
2007. However, very much less palladium is used than platinum. Until recently, diesel oxidation catalysts (DOCs) used platinum as the sole catalytic metal. However, as the price differential between these metals has grown, palladium-platinum formulations have been increasingly utilised. Current catalyst technology employs at least twice as much platinum as palladium in an individual catalyst but research is focusing on maximising the proportion of palladium that can be used. With a rise in the number of vehicle models where a mixed palladium-platinum catalyst is used, palladium usage on diesel cars and trucks increased in 2007 to above 100,000 oz.

Japan

Japanese autocatalyst demand for palladium grew by 6.3 per cent in 2007 to a total of 845,000 oz. The number of cars and light trucks produced rose by 0.9 per cent to 11.5 million units. Domestic sales, in contrast, fell and accounted for just under half of this figure.

Fuel quality issues and the desire to avoid expensive product recalls have forced Japanese car makers to use platinum in many of their catalysts used on export models. However, with improving fuel quality in many countries, the use of palladium on catalysed export vehicles is becoming feasible more often. Palladium demand in this sector consequently rose in 2007.

To limit their overall platinum consumption, the Japanese auto makers have also moved to fit



Palladium use is growing in both the diesel and the gasoline sector in Europe. However, it remains a relatively minor component in all the diesel catalysts where it is used.

Palladium Demand: Autocatalyst '000 oz		
	2006	2007
Europe	890	900
Japan	795	845
North America	1,415	1,655
China	220	275
Rest of the World	695	775
Total	4,015	4,450
Autocatalyst Recovery	(805)	(1,000)



The launch of two
new exchange
traded funds
backed by
physical palladium
contributed
280,000 oz
of investment
demand in 2007.

palladium-based technology to new models being introduced into their domestic market. Palladium use on vehicles made and sold in Japan has therefore moved higher, even in a weak sales environment. Palladium usage has been further boosted by efforts to reduce rhodium consumption. At recent price levels, some car companies have used additional palladium to replace some of the rhodium in a formulation.

North America

The North American autocatalyst sector purchased 17.0 per cent more palladium in 2007, at 1.66 million ounces, than in the previous year. Light duty vehicle sales fell from 16.6 million units to 16.2 million. The number of cars manufactured in North America also fell by almost 500,000.

The economic slowdown in the USA continued to have an impact on the North American automotive industry, with sales falling for the second consecutive year. However, the 2006 trend towards smaller vehicles, which developed as a result of fuel price rises, did not continue. Sports utility vehicle, or SUV, sales have in fact grown. High oil prices have, though, dented demand for the very largest, and least fuel-efficient, trucks and SUVs.

Despite the decline in vehicle sales, palladium usage has continued to benefit from the substantial price difference between this metal and platinum. On gasoline vehicles, the total amount of palladium is already much higher than the amount of platinum being used. In the diesel sector, platinum is the more important metal. Just as in Europe, palladium is being introduced into diesel oxidation catalysts and diesel particulate filters (DPFs) to replace some of the platinum. Palladium remains the minor component in every case but the percentage of diesel catalysts incorporating some palladium increased to the extent that consumption of palladium in the diesel sector exceeded 100,000 oz in 2007.

China

Autocatalyst palladium demand in China rose by 55,000 oz in 2007 to an annual total of 275,000 oz. As the Chinese economy continued to grow rapidly, consumer purchases of cars were very strong. With

every car now sold in this market having a catalyst, palladium consumption has been driven higher.

The Chinese passenger vehicle market is now the second largest in the world, having overtaken Japan in sales terms. However, despite growing by more than 25 per cent last year, Chinese car production is significantly lower than sales, at 5.5 million units in 2007. Only 300,000 vehicles are currently exported each year. Euro 3 equivalent emissions rules were scheduled to come into force in July of 2007 but their implementation was delayed due to questions over domestic fuel quality. However, the auto makers still fitted new catalyst formulations to their vehicles, driving the average pgm content of a new car higher.

Rest of the World

Palladium demand for autocatalysts in the Rest of the World region rose by 80,000 oz in 2007 to 775,000 oz. Light duty vehicle sales grew in most countries: in India they leapt 20 per cent to 1.7 million units. With car makers increasingly locating manufacturing in low-cost areas, production grew too in this region.

Of particular note, Korean vehicle production rose above 4 million units for the first time with a record 2.85 million of these destined for export markets. By contrast, Mexican output fell, with lower exports to the struggling US market largely responsible.

We now report Russian and ex-CIS states' autocatalyst demand in the Rest of the World region. The Russian domestic market saw sales of more than 2.3 million vehicles in 2007, although many of these were assembled elsewhere and use European autocatalyst formulations. Local manufacturers typically use palladium-rhodium catalyst technology due to its low cost relative to platinum formulations. Russian demand reached 40,000 oz in 2007.

Autocatalyst Recovery

The amount of palladium recovered from end-of-life autocatalysts rose strongly, by 24.2 per cent, to 1.00 million ounces in 2007.

The weight of metal reclaimed grew in all regions but over half of the global total was from the mature North American market. A typical end-of-life

vehicle currently being scrapped is in the region of 8 to 12 years old. Growth in the volume of palladium recycled therefore mainly reflects the amount of this metal used on autocatalysts from 1996 to 2000, the peak for palladium consumption in this market.

Roughly 10 million cars are scrapped in the European Union each year and an increasing number of these are recycled, demonstrating the impact of recent end-of-life vehicle legislation and a growing awareness of the value of used catalysts. Demand for palladium for use in European autocatalysts peaked around the end of the millennium and the average palladium content of a scrapped catalyst increased last year and will rise again in 2008. As a result, the amount of palladium recovered from spent autocatalysts in Europe rose to 300,000 oz.

The amount of palladium recovered from used catalytic converters in other regions grew too but remains small. In Japan, many end-of-life vehicles are exported to East Asia instead of being recycled in Japan. In China and the Rest of the World region, palladium recovery is low as most vehicles currently being scrapped did not have catalysts fitted originally.

JEWELLERY

Global jewellery demand for palladium, excluding purchases of jewellery scrap, fell by a weighty 25.6 per cent in 2007 to a net figure of 740,000 oz. There was some growth in the relatively small markets of Europe and North America. However, a fall in demand in the much larger Chinese market accounted for almost all of this 255,000 oz worldwide decline.

European purchases of palladium for the jewellery industry climbed to 45,000 oz last year. Palladium is

used in two different ways: as a component in some white gold alloys and as palladium jewellery itself. Palladium use in white gold manufacturing was roughly 25,000 oz and is growing due to European regulatory restrictions on the use of the traditional whitening agent, nickel. Pd950 (a 95 per cent palladium alloy) jewellery, however, is a new



Much of the European palladium jewellery being manufactured takes advantage of the metal's low density to employ chunky designs.

product and the jewellery trade is exploring possible market niches for it. Its light weight and low cost compared to gold and platinum have driven demand higher for items such as men's wedding bands and large designer pieces.

Palladium jewellery is also still in the early stages of development in North America and manufacturers and retailers are developing its market there as well. The high price differential between palladium and the better-known platinum and gold has encouraged manufacturers to start to work with this material. Substantial price increases on diamonds have placed pressure on bridal ring budgets. Some couples have therefore looked to save money on men's rings and have moved to cheaper materials, including palladium. Both of these trends have helped in driving palladium demand higher, to 50,000 oz in 2007.

Japanese jewellery manufacturers bought 120,000 oz of palladium for use as an alloying agent in white gold and platinum alloys. A sluggish economy, and pressure on jewellery sales from competition for disposable income, forced palladium demand down by 7.7 per cent last year. There is hardly any palladium-only jewellery on sale in Japan.

China, however, remains the key market for palladium jewellery, representing more than two-thirds of overall demand. This is despite a fall in purchases of metal, excluding scrap, from 760,000 oz in 2006 to 500,000 oz in 2007.

Jewellery manufacturers in China increased their use of recycled palladium last year. Most of this secondary metal came from unsold retail jewellery

Palladium Demand: Jewellery '000 oz		
	2006	2007
Europe	40	45
Japan	130	120
North America	40	50
China	760	500
Rest of the World	25	25
Total	995	740



stocks, although some was from industrial sources (it should be noted that we report palladium scrap sourced from outside the jewellery sector as demand for new metal). Much of the original stock of Pd950 which was made in 2004 and 2005 has now been returned for recycling and remaking into the higher-purity Pd990. Surveys of retail outlets in China suggest that most stock now held is in the form of Pd990. This implies that the amount of palladium recovered from unwanted Pd950 pieces may decline and that demand may begin to improve: purchases of palladium in the first quarter of 2008 by manufacturers were indeed healthy.

Palladium jewellery in China is still at an early stage of its product life cycle and the trade is working to address many issues. For instance, the range of palladium products is more limited than those manufactured in platinum and in white gold as relatively few gem-set items are produced. Manufacturing margins have decreased since the creation of this market in 2004/2005, making some manufacturers less keen to work with palladium: margins per gram in 2007 were comparable with those for platinum. However, the jewellery trade's perception of product quality continued to improve.

At the consumer level, awareness of palladium as a jewellery metal is growing but there remain many areas of the country where it is not yet well-known. Retailers also pay less of the material price when buying back second-hand palladium than they do for gold or platinum, and this has damaged the attraction of palladium jewellery for consumers somewhat.

The picture for retail sales remains varied across the country. Palladium jewellery is virtually absent from Beijing and Shanghai and is not popular in some other cities. However, large quantities of palladium are on sale – and selling well – in many metropolitan areas.

CHEMICAL

European chemical purchases of palladium fell as less metal was purchased for new plants in 2007 than in 2006. Elsewhere, however, a possible global economic slowdown has had little impact on the market for commodity chemicals, which continues to be strong, with new capacity being installed. Overall, chemical sector demand for palladium fell from 440,000 oz in 2006 to 370,000 oz last year.

In the nitric acid sector, the elevated platinum price makes the use of palladium catchment gauzes (which reduce platinum losses) economically attractive in higher pressure as well as low and medium pressure plants. However, adding extra gauzes does reduce plant throughput and the use of catchments is thus not universal. There have also been some efforts to introduce more palladium into the main catalyst gauzes, to allow a reduction in platinum inventories.

Purchases of palladium for the manufacture of purified terephthalic acid (PTA) were stable. There has been little activity in this sector in Europe, Japan or North America. Expansion continues, though, in China and the Rest of the World region. The situation is similar in the vinyl acetate monomer (VAM) industry. This uses a palladium-gold heterogeneous catalyst to produce VAM, a component of many resins and plastics. With demand for these buoyant, new production capacity was installed in 2007.

There was also growth in global hydrogen peroxide production capacity, most of which uses palladium catalysts.

Hydrogen peroxide can be reacted with propylene to form propylene oxide. This process is relatively clean and produces no side products other than water. Rising environmental costs have made this hydrogen peroxide route attractive, increasing purchases of palladium for this catalyst last year.

Palladium Demand: Chemical '000 oz		
	2006	2007
Europe	175	100
Japan	25	25
North America	80	80
China	65	65
Rest of the World	95	100
Total	440	370

DENTAL

Net dental industry demand for palladium rose marginally in 2007, to 635,000 oz or 15,000 oz higher than in the previous year. Japanese demand rose by 1.9 per cent to 275,000 oz despite downward pressure from a slow reduction in the number of dental treatments. Demand from the US dental sector also edged higher. Palladium purchases for use in the dental industry in Europe, China and the Rest of the World region remained almost flat.

In Japan, both an ageing population and a long-term trend for the patient to bear a greater part of the cost of any treatment are leading to a lower number

Palladium Demand: Dental '000 oz		
	2006	2007
Europe	75	75
Japan	270	275
North America	260	265
China	5	5
Rest of the World	10	15
Total	620	635

of visits to dentists. Resin is being used more frequently as well. Although this does also employ palladium for structural strength, the amount used is less than with the traditional Kinpala alloy of palladium and gold. However, the government subsidy for the Kinpala alloy was above the price of the component materials during 2007, allowing dentists

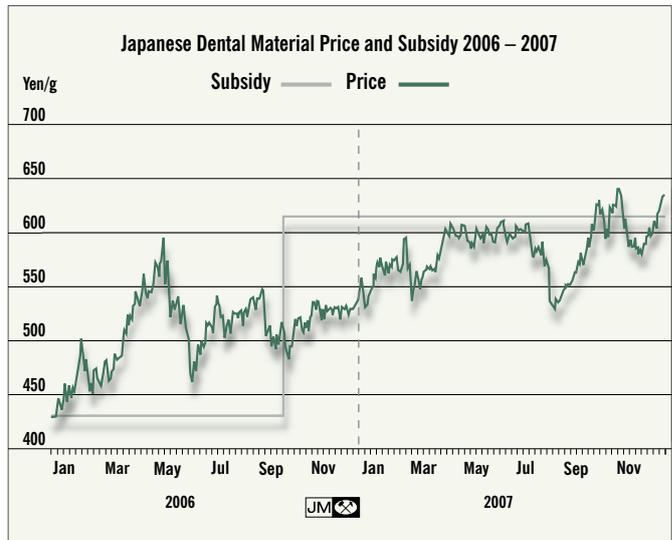
to pass on cost savings to patients. Use of palladium therefore rose slightly, by 5,000 oz, to 275,000 oz.

In North America, palladium is also used for crowns and bridgework. In these applications, it often competes with gold alloys and the price differential in favour of palladium was positive for demand. There is also competition from new, non-precious metal technology such as ceramics. However, the dental sector is conservative and, with market shares changing only slowly for dental materials, palladium demand inched higher, to 265,000 oz in 2007.

In Europe, there was little change in the amount of palladium used for restorative dental work – principally in Italy – although newer ceramic technology is slowly capturing market share. Some palladium dental alloys were launched in the German market in 2007, which could add to demand in the medium-term.

Although dental laboratories and technicians have always been keenly interested in recycling scrap materials from their production processes, high metal

Palladium is one of a range of precious metals used in dental treatments.



prices have reinforced this tendency. The final quarter of 2007 therefore saw increased amounts of material returning from this source for recycling.

ELECTRONICS

The electronics industry purchased a net 1.29 million ounces of palladium in 2007. This was 80,000 oz more than in the previous year and represented the sixth successive year of demand growth. Demand is particularly strong in China and the Rest of the World region. Electronics manufacturing is increasingly being relocated to these two areas and demand for palladium is rising here accordingly.

Palladium consumption in multi-layer ceramic capacitors, or MLCC, represents more than half of gross electronics sector demand. These components are almost ubiquitous in all types of electronic circuitry and are made of alternating layers of an insulating (dielectric) material and electrodes. The internal electrodes are typically made from palladium (or a palladium alloy with silver) or nickel.

Although there are always cost pressures in this industry, the main driver for technological development is miniaturisation. “Real estate” or space on circuit boards is at a premium

The subsidy from the Japanese Government for the use of the Kinpala dental alloy exceeded the cost of the precious metal components throughout most of 2007.

Palladium Demand: Electronics '000 oz		
	2006	2007
Europe	105	155
Japan	275	285
North America	190	195
China	315	320
Rest of the World	320	330
Total	1,205	1,285



Short lifetimes of consumer electronics means that very large quantities are scrapped. With commodity prices high, recycling is therefore growing.

and component sizes are shrinking rapidly. The very smallest 0201 capacitors (0.6 by 0.3 by 0.3 mm) have more than doubled their share of the market in only two years. This reduction in the average MLCC size has driven down palladium content per capacitor but the number of capacitors continues to grow very rapidly. Thrifting has not been seen in this market recently but there is still some slow switching from palladium technology to base metal (nickel) capacitors. Overall, therefore, palladium use in MLCC rose in 2007.

The use of palladium in other electronics applications also grew in 2007. Palladium competes with gold as a material for use in plating. The upwards progress of the gold price, towards \$1,000 an ounce, meant that palladium remained an attractive material for this purpose. Substantial amounts of palladium were also used in hybrid integrated circuits (HICs).

Recovery of palladium from end-of-life electronics remained flat. Both European legislation and a general trend towards greater environmental awareness amongst companies and individuals have driven recycling rates for scrap IT and electronic goods higher. However, miniaturisation of the individual components in the past means that the amount of palladium per scrapped device has not risen. Typical recovery processes focus on the highest value materials first at the expense of those of lower value which may or may not be reclaimed. With these trends pulling in opposite directions, the effect on palladium recycling volumes has been broadly neutral.

INVESTMENT

Net demand for palladium investment products soared from 50,000 oz in 2006 to 260,000 oz in 2007. The major change was the introduction of two palladium exchange traded funds (ETFs) which drove investment purchases sharply higher. Demand from the sale of coins and small bars – in North America – was negative as consumers sold back more of these than they purchased.

European investment demand in fact reached an unprecedented level of 280,000 oz in 2007, almost entirely due to investment in exchange traded funds. Both funds are fully backed by allocated metal, meaning that any palladium purchased is not available to the market and is therefore considered as demand.

Investor interest in 2007 was heavily biased towards the Swiss fund rather than the London-based fund. The former has larger unit sizes, in terms of weight of palladium per share, and is therefore more suitable for larger fund investors rather than individual retail investors. The legal structure of this fund also allows Swiss pension funds effectively to hold physical metal where this was previously impossible. Indeed, this was made clear when the pension fund of Swiss pharmaceutical manufacturer Novartis announced its intention to invest in this and in other precious metal exchange traded funds as they were launched.

Palladium Demand: Investment '000 oz		
	2006	2007
Europe	0	280
Japan	0	0
North America	50	(20)
China	0	0
Rest of the World	0	0
Total	50	260

OTHER

Palladium demand for other applications increased from 85,000 oz in 2006 to 95,000 oz last year (we now report investment numbers (above) separately to other applications). A number of small end uses such as in petroleum refining catalysts and gas sensors contributed to this total.

Palladium Demand: Other '000 oz		
	2006	2007
Europe	25	20
Japan	10	10
North America	30	40
China	10	10
Rest of the World	10	15
Total	85	95

THE RUSSIAN PGM INDUSTRY



Russia remains the largest producer of palladium and Soviet-era bars like these are a common sight in bank vaults.

The USSR was a command economy. There was no market in precious metals in a Western sense. From the 1920s, precious metals were subject to a State monopoly over their mining, refining, manufacturing and ownership.

Private individuals could only own precious metals in the form of jewellery. The title over all other forms of precious metals remained with the State, which accumulated them in the State treasury (Gokhran), and allocated them to industries as required. After use any residual or recovered metal, after refining, was returned to Gokhran. As a result, pgm use was not as economically efficient as in the West.

The result of this special treatment of precious metals in the USSR was that all information about reserves, production, refining, consumption and exports was a State secret. Not until 2003 was this law changed in Russia and even then historical information was not made available.

USES FOR PGM

Most pgm use reflected the structure of the Soviet economy and the bulk of metal was used for military applications or in industries such

as bulk chemical manufacture. As the military-industrial complex was the major consumer of raw materials in the USSR and any data about this sector was top secret, it is difficult for Western analysts to know exactly what pgm consumption actually was in the Soviet era. Despite the secrecy, it is clear that the major pgm-consuming industries, some of which overlapped into the military area, were:

- electronics applications
- production of nitric acid
- petroleum refining
- glass manufacture

Electronics demand was for both military and consumer products. Very large quantities of contacts and capacitors were produced and large amounts of these were found to be stored unused after the demise of the USSR. Much of this material was subsequently recycled, including some that found its way by “unconventional” routes to the West.

The nitric acid industry in the USSR was probably the largest in the world, with a high proportion of its output going into the production of nitrogenous fertilisers. Most plants were operated at high or medium pressure and there was little attempt to introduce new technologies to reduce pgm losses in operation. Catchment gauzes (which trap platinum displaced from the main gauze) were largely unused in Soviet times and recovery of pgm from downstream pipework (“low-grade recovery”) was only introduced by Western companies in the post-Soviet period. The pgm composition of Soviet gauzes

was close to Western offerings (i.e. mainly platinum-rhodium alloys) but tended to contain from 10 to 20 per cent of palladium as a minor alloy component.

The USSR’s oil and gas production led to the need for catalytic refining of petroleum to produce useful products. Although the USSR did import reforming catalysts from the West in quite large quantities, it also manufactured its own variants of these catalysts for internal use.

Other significant uses of pgm in Soviet times were in the glass industry; laboratory apparatus, including crucibles for growing crystals, for which iridium was important; and some catalysts for the control of air pollution, for example to reduce NOx emissions from nitric acid plants and to remove poisonous CO in submerged submarines.

SUPPLY OF PGM

Alluvial platinum was first discovered in the Ural mountains in 1824, and this location was the major source of Russia’s platinum until the opening of the Norilsk mine in the mid-1930s. Norilsk is a nickel and copper deposit with pgm as important by-products. The production of pgm in the

Norilsk Nickel is the world’s largest producer of palladium, which is mined in its main Siberian operations alongside large amounts of nickel and copper.





The nitric acid industry in the Former Soviet Union did decline in global importance. However, demand for pgm gauzes for nitric acid production is growing once again.

USSR was therefore determined by the need for nickel and copper and not by the demand for pgm either for internal consumption or for export to produce foreign (hard) currency. In contrast to the platinum-dominated alluvial deposits, the Norilsk region mines yield substantially larger quantities of palladium than platinum. Newer alluvial platinum deposits in the far East of Russia were only exploited relatively recently, at Kondyor from 1984 and Koryak from 1994.

GOVERNMENT STOCKS AND EXPORTS

All pgm produced in the USSR were deemed to belong to the State. Metal produced but not required for immediate use was stored by the State treasury Gokhran and was potentially available for the generation of hard currency subject to the requirements of the State budget. The Almazjuvelirexport (Almaz) State agency was the only body legally entitled to export pgm, and remains so for good delivery products at the time of writing.

It is generally believed that following the opening of the Talnakh deposits in the 1960s, the State built up substantial reserves of pgm, particularly of palladium,

which may have exceeded 30 million ounces when mine output was at its peak in the late-1980s. Sales to investors outside the USSR and to automotive manufacturers have since depleted these stocks significantly.

FABRICATORS

As in any industry under the Soviet command economy, fabrication of pgm products was concentrated in a few facilities, many of which still dominate the internal market.

The principal pgm fabricating factory was located in the Urals at Sverdlovsk (Ekaterinburg), where nitric acid gauzes, contacts, glass fibre bushings and crucibles were made. At its peak in 1990, this facility manufactured over 60 metric tonnes of pgm products. An estimated 70 per cent of this output was for military purposes. Other specialised pgm products were produced at a number of smaller operations scattered around the Soviet Union.

The transformation of the economy following Perestroika had a two-fold effect: on the one hand, the volumes of pgm fabrication at Ekaterinburg by the late-1990s were reduced to only 10 per cent of their highest levels, so the plant resumed the pgm refining it had originally been built for in 1916, accepting materials from small local operations, deposits in the far East of Russia and occasionally even from Norilsk. On the other hand, new economic policies gave room for competition and created opportunities for new fabricators.

The first one to move towards independent pgm manufacturing was the Supermetal company.

Originally based on the premises of the central research facility for the national fibre glass industry, this now manufactures bushings and other specialist glass equipment. Currently Supermetal is the leading bushings manufacturer in Russia supplying not only the FSU but also customers in China and Western Europe.

The other major player is Krasnoyarsk Non-Ferrous Metals Plant, which is located in Siberia, in the geographical centre of Russia. Set up originally to refine pgm concentrates from the Norilsk region mines, this operation has recently increased its involvement in gold refining and pgm manufacturing. Currently Krasnoyarsk refines over 95 per cent of Russian pgm and is also the leading producer of pgm compounds and platinum jewellery. It has also developed a knitted catalytic gauze business based on licensed Western technology.

PRESENT DAY DEMAND

Russia's development towards a market economy and the partial liberalisation of the State monopoly on precious metals have led to changes in pgm demand patterns. This process is still gathering momentum. A number of demand

Johnson Matthey is the first western autocatalyst manufacturer to establish a plant in Russia. The facility shown is in Krasnoyarsk and will start operations in the first half of 2008.





Demand for bushings and other glass products in the Former Soviet Union is now expanding once more, having contracted after the restructuring of the old USSR economy.

segments for the platinum group metals in Russia and the other Former Soviet Union (FSU) countries have already emerged as significant, principally industrial uses and autocatalyst production.

In the automotive sector, Russia is increasingly significant. 2.8 million new cars were bought in 2007, 35 per cent more than in 2006. This means that the Russian market is already larger than more established national markets such as the UK and France. More importantly, sales are still growing rapidly – by an expected 30 per cent in 2008 – and Russia is likely to overtake Germany within two years to become the largest car market in Europe.

Emissions limit compliance was finally made mandatory in July 2006 for cars sold in Russia and these rules were tightened in 2008 and are now equivalent to European Euro stage 3 rules. Many cars sold in Russia are fitted with low-loaded autocatalyst technology that has already been applied to the European market. One difference, however, is the choice of active metal. In Europe, both platinum and palladium are used in gasoline catalysts alongside rhodium – although much more palladium is used than platinum. However, in

the Russian market, almost every formulation employs palladium–rhodium technology. With very few diesel cars produced, there is little autocatalyst demand for platinum.

Future developments should see the introduction of Euro 4 rules into Russia in 2010. The major foreign vehicle manufacturers are increasingly investing in local production capacity – the Russian government has signed over 20 incentive agreements with the global automotive industry. Renault also recently announced its purchase of a share of the largest local auto maker (Avtovaz, the owner of the Lada brand).

With emissions limits tightening, more local manufacturing and a growing market for light duty vehicles, pgm demand in this sector will increase.

By comparison, the Russian platinum jewellery manufacturing industry is developing more slowly. With a substantial amount of metal mined in Russia, there is considerable interest in adding value locally and building a domestic market. Russian demand is still small with only 5,000 oz of platinum and 1,000 oz of palladium hallmarked in 2007. However, with Russian disposable income growing, there is potential for further growth in jewellery demand.

In the industrial sector, Russia and the other FSU countries have always consumed a significant amount of pgms, particularly palladium. The electronics and glass industries in Russia are still substantial users of metal. Pgm demand from the chemicals industry is relatively small compared to demand in other regions. However, the

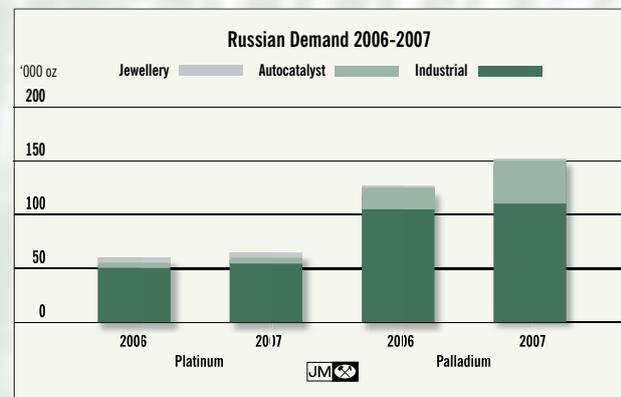
most interesting sectors in terms of industrial pgm demand are petroleum refining and nitric acid manufacturing.

Russia has become a much more important player in the global petroleum industry in recent years, particularly in relation to supplying natural gas. Downstream processing activity remains relatively limited but is expected to grow as the economies in the region expand.

The nitric acid industry in Russia now produces an annual 9 million tonnes or more than 10 per cent of total global output, making it again the largest producer. Most of this Russian production goes to the growing fertiliser industry but its use in the manufacturing of explosives (e.g. for mining) has further boosted demand. Strong production in Russia reflects a growing global trend to concentrate nitric acid plants near sources of cheap natural gas.

Recent Russian economic growth has been at an annual rate of 6 to 8 per cent and the corresponding influx of foreign direct investment (close to US \$50 billion in 2007) has created further opportunities for the development of local fabrication. As the economy continues its rapid expansion, pgm demand looks set to grow still further.

The graph below shows demand for platinum and palladium in Russia in 2006 and 2007.



OTHER PLATINUM GROUP METALS

Demand for rhodium, principally from the automotive sector, rose to 856,000 oz in 2007 while supplies rose 2.5 per cent to 822,000 oz. Ruthenium demand fell to 1.14 million ounces despite the widespread adoption of new perpendicular magnetic recording technology by the hard disk industry. Iridium demand dropped to 119,000 oz.

RHODIUM

Net rhodium demand increased by 2.1 per cent in 2007, to a global total of 856,000 oz. Growth in automobile production in China and the Rest of the World region outweighed the effect of thrift of rhodium in catalytic converter formulations. Net metal use by the glass sector fell, however, under the pressure of a high price. Rhodium supplies rose slightly to 822,000 oz in 2007. Overall, therefore, the rhodium market was in deficit – by 34,000 oz – for

the fourth successive year.

Autocatalyst Demand

Rhodium demand from the global automotive market grew by 1.9 per cent in 2007, driven by healthy manufacturing growth in China and much of Asia. The net effect was that gross rhodium autocatalyst demand increased once again to a new record of 879,000 oz.

Rhodium consumption in North America rose slightly despite a difficult year for its manufacturers. They bought 296,000 oz of this metal, or 10,000 oz more than in 2006, for use in autocatalysts, including increasing use in NOx traps. This

was despite a drop in light duty vehicle production.

European purchases of rhodium dropped by 7.4 per cent to 150,000 oz. Continued growth in the market share of light duty diesel vehicles has eroded the market for three-way, or gasoline, catalysts, reducing the requirement for rhodium. The auto manufacturers also took the opportunity provided by a gap between

bouts of new emissions legislation to thrift the rhodium content of their catalysts in response to high metal prices. This thrift is expected to continue in 2008, driving rhodium usage lower in this market.

Japanese auto makers bought 241,000 oz of rhodium last year, 19,000 oz less than in 2006 with some metal used from inventory. While the domestic vehicle sales of the Japanese car makers were unexciting, manufacturing volumes were up, primarily due to growth in the main Asian export markets, supporting rhodium usage at levels close to those seen in 2006. Rhodium demand in China and the Rest of the World region was driven 21.5 per cent higher, to 192,000 oz, by rocketing production of light duty vehicles.

More rhodium was also reclaimed from end-of-life autocatalysts in 2007 than in 2006 (183,000 oz). Recovery rose in every region. The average rhodium content of a scrapped three-way, or gasoline, catalytic converter has risen during recent years. With a growing proportion of end-of-life vehicles being recycled too, rhodium recovery has increased. Overall, net rhodium demand from the autocatalyst sector was only 4,000 oz higher than in the previous year, at 696,000 oz.

Other Demand

Purchases of rhodium by the glass sector fell by 1.6 per cent to 64,000 oz despite strong growth in Asia. Manufacturers of LCD and other types of glass are still investing heavily in new furnaces to build their production capacity, outweighing the effect of closures of conventional cathode ray tube, or CRT, glass facilities. However, a high metal price has encouraged the industry to move to lower rhodium content alloys where possible, trimming demand a little.

Chemical sector rhodium demand rose to 64,000 oz in 2007 due to the construction of new facilities, including a small number of oxo-alcohol plants in Asia. Demand from electrical and other applications was static at 32,000 oz.

Supplies

Global rhodium supplies climbed 2.5 per cent to 822,000 oz last year. Russian shipments fell to 90,000 oz. While primary production remained unchanged, sales from State stocks were lower than in the previous year.

Rhodium Supply and Demand '000 oz			
		2006	2007
Supply			
South Africa		666	696
Russia		100	90
North America		17	17
Others		19	19
Total Supply		802	822
Demand			
Autocatalyst:	gross	863	879
	recovery	(171)	(183)
Chemical		49	64
Electrical		9	9
Glass		65	64
Other		23	23
Total Demand		838	856
Movements in Stocks		(36)	(34)



The interruption to Russian shipments in early 2007 due to the lack of appropriate export rules did not affect the total amount of metal shipped during the year.

South African supplies grew slightly. Safety problems, technical issues and a number of strikes did have an impact upon primary rhodium production. However, there was additional output from a number of expansion projects while some metal was also sold from refined stocks.

RUTHENIUM & IRIDIUM

Demand

Ruthenium demand fell by almost a third in 2007, from 2006's 1.69 million ounces to 1.14 million ounces. Gross metal purchases of ruthenium for the manufacture of perpendicular magnetic recording (PMR) hard disks rose in 2007. However, net consumption fell due to reductions in working stocks. Demand for iridium across its range of industrial uses dipped by 12,000 oz to 119,000 oz despite growth in demand for making spark plugs.

In the hard disk sector, perpendicular magnetic recording technology continued to capture market share from its longitudinal (LMR) predecessor. In fact, this proceeded more quickly than many had forecast. By the end of 2007, PMR had more than doubled its share of the hard disk market from the previous year, to greater than sixty per cent.

There have been substantial efforts from the hard disk manufacturers to reduce the amount of ruthenium per disk. Although this is already extremely

small, thrifted efforts have been successful in decreasing it still further. Nonetheless, this was not enough to prevent rapid growth in gross ruthenium demand from this application due to the rise in the number of disks produced.

However, high volume recycling of the scrap produced in the manufacturing process

started late in 2006. We have therefore adjusted our net demand figures for 2006 to account for this. Large amounts of scrap are produced in the manufacturing both of ruthenium sputtering targets and of the hard

disks themselves. The pgm industry has invested substantial amounts to expand ruthenium refining capacity and high volumes of ruthenium were processed last year. With the rapid ramp-up of this industry, the amount of metal recovered grew strongly throughout 2007, ensuring that net demand fell some way below the 2006 figure.

Elsewhere, ruthenium use in chip resistors remained flat with component miniaturisation and growth in the electronics market balancing one another in their

effect on metal consumption. The use of ruthenium paste in flat plasma display panels fell heavily as thrifed pastes were introduced and took market share.

Ruthenium use in the chemical sector fell from 223,000 oz to 101,000 oz in 2007. Ruthenium catalysts can be used in a range of processes from the manufacture of acetic acid to that of ammonia. Ruthenium remains an attractive catalytic material for many of these processes despite the price rises of 2006 and early 2007. However, there were fewer purchases for new plants than in the previous twelve months and demand therefore fell. Combined metal purchases for electrochemical and other applications slipped 5,000 oz lower to 186,000 oz.

Iridium demand slipped by 9.2 per cent to 119,000 oz with demand falling to 24,000 oz in the process catalyst sector. Although iridium is used in some acetic acid plants, the number of new chemical factories using iridium-based catalysts was lower in 2007 than in 2006. Iridium consumption in aerospace and automotive spark plugs pushed higher to 28,000 oz as auto makers looked to use higher-quality, longer-life precious metal-tipped plugs as standard in their products.

Supplies

Ruthenium supplies fell in 2007 due to the challenging environment for the South African mining industry which limited the amount of ore mined and processed there. Expansion of mining in the Eastern Bushveld, where the minor pgm content of the ore is typically higher, supported output and some ruthenium was sold from producer stocks. Sales of iridium fell too.

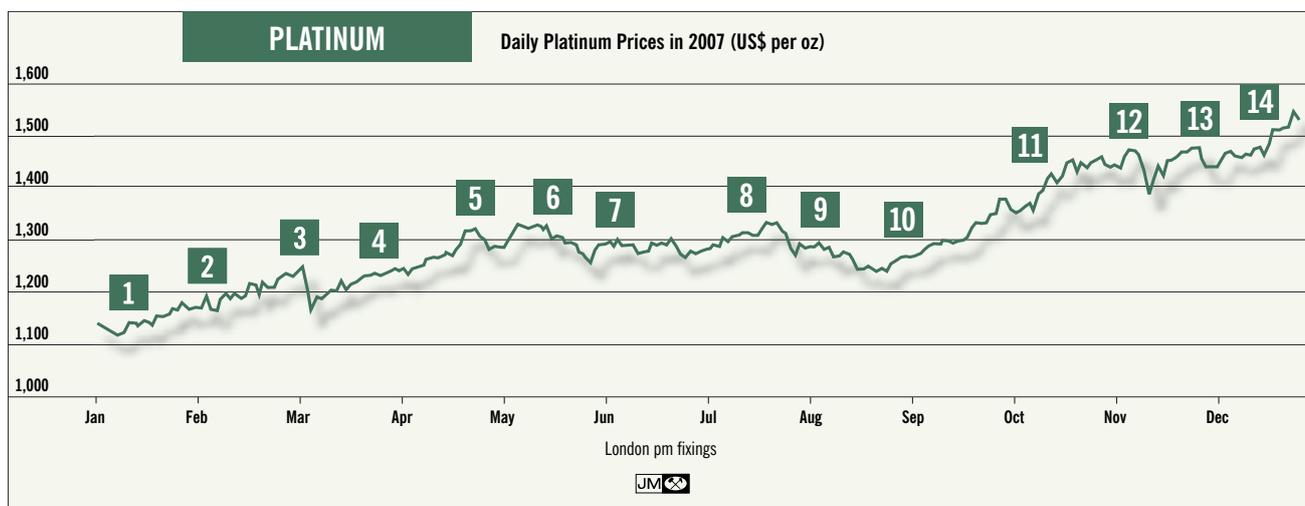
Iridium Demand by Application '000 oz		
	2006	2007
Chemical	33	24
Electrochemical	34	34
Electrical	28	25
Other	36	36
Total Demand	131	119

JM

Ruthenium Demand by Application '000 oz		
	2006	2007
Chemical	223	101
Electrochemical	137	119
Electrical	1,272	857
Other	54	67
Total Demand	1,686	1,144

JM

PRICES & FUTURES MARKETS



The platinum price hit a series of record highs throughout the year, driven by currency movements, investors and a tight supply-demand balance.

Platinum reached its highest ever average price in 2007, \$1,304, 14.2 per cent higher than the \$1,142 average for 2006. The price climbed early on and remained at elevated levels for the first eight months of the year. However, in September, concerns over South African production ignited a strong price rise. Platinum moved relentlessly higher and hit a series of all-time highs before reaching a new record of \$1,544 in late-December.

A weak dollar, a buoyant gold price and a succession of problems relating to global platinum supply created a bullish price environment. Platinum responded by adding \$393 from its first fix of 2007 (\$1,136) to a final fix of \$1,529, gaining some 34.6 per cent during the year.

1 Platinum started the year at \$1,136 and softened to \$1,112, the year's low point, on the 8th of **January** amidst quiet trading conditions. The price immediately

rebounded on market news that lengthy delays in the implementation of new precious metal export regulations had interrupted Russian exports of platinum.

2 Strong Chinese physical demand ahead of the Chinese New Year applied upward pressure to the price. Lonmin also announced that it had closed its No.1 furnace at Marikana for

a rebuild (due to a matte leak). This was to be only the first of many supply-side problems throughout 2007 and the news drove the price higher. The first strike of the year by mineworkers in South Africa, at Modikwa, helped the price climb to a month-end \$1,169.

The steady price rise continued into **February** – platinum gained 4.7 per cent during the month. A rising gold price provided support. However, more supply concerns emerged too: Northam announced poorer-than-expected production results; Lonmin revealed that its smelter rebuild would take longer than previously thought; and there was a short-lived strike at the Impala Lease Area.

Short-covering in New York took the gold price to a seven-month high on the 8th and platinum moved higher too, reaching \$1,200 for the first time in 2007 on the 9th. Futures buying on TOCOM provided support until the Shanghai Gold Exchange reopened after the Chinese New Year at the end of the month. Good physical purchasing there helped platinum end February just below its monthly peak, at \$1,239.

3 In early **March**, problems started to emerge from the US sub-prime mortgage sector. With the American economy apparently slowing, mortgage defaults had been rising, exposing a large number of international financial institutions to very significant, and unknown, losses. As investors started to realise this fact, global equity markets fell heavily. Fund sales forced gold below \$650 on the 2nd and platinum lost \$45 in one day, falling to \$1,203.

The dollar then strengthened and applied further

Average PGM Prices in \$ per oz			
	2006	2007	Change
Platinum	1,141.85	1,303.70	14%
Palladium	320.35	354.85	11%
Rhodium	4,551.60	6,190.55	36%
Ruthenium	193.40	579.60	200%
Iridium	348.85	446.95	28%

Platinum and palladium prices are averages of London am and pm fixings. Other pgm prices are averages of Johnson Matthey European base prices.



downward pressure on commodity prices, taking platinum to a monthly low of \$1,165 on the 5th. Physical buying – in Shanghai and in London – reappeared on this weakness and forced the price to rebound. Tightness in the availability of platinum sponge (much had been converted into ingot following the November 2006 price spike) added some momentum. Platinum bounced back over \$1,200 in late trading in New York on the 8th. It did not fall back below this level for the remainder of the year.

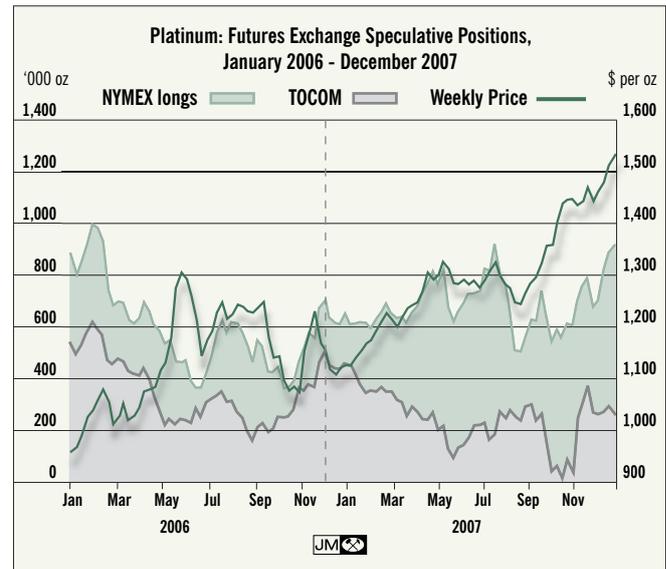
4 Equities started rising once more in mid-March and platinum followed, with forward purchasing being seen. Short-covering in gold and a weakening US Dollar provided another fillip. The oil price climbed too, approaching \$60 per barrel in late March. Platinum rested briefly between \$1,240 and \$1,250 at the end of the month, having recovered all of its earlier losses.

The price moved up to \$1,251 before Easter in thin trading conditions. Buying on TOCOM, followed by dollar weakness, led to platinum fixing at \$1,269 on the 13th of **April**. Rumours had also been circulating of the imminent launch of an exchange traded fund (ETF) in platinum. These came to fruition that day as the Zürcher Kantonalbank (ZKB) announced that it would launch such a fund. However, some pressure was released as Norilsk Nickel revealed that it was meeting its platinum supply commitments despite continued problems in exporting metal from Russia.

Platinum Prices in 2007 London am and pm fixings, \$ per oz			
	High	Low	Average
January	1,180.00	1,112.00	1,147.85
February	1,253.00	1,165.00	1,205.00
March	1,248.00	1,165.00	1,219.00
April	1,325.00	1,235.00	1,278.35
May	1,336.00	1,257.00	1,302.35
June	1,302.00	1,266.00	1,286.75
July	1,333.00	1,270.00	1,303.65
August	1,296.00	1,237.00	1,264.40
September	1,377.00	1,268.00	1,307.30
October	1,462.00	1,352.00	1,410.10
November	1,484.00	1,389.00	1,448.75
December	1,544.00	1,450.00	1,486.20
Annual	1,544.00	1,112.00	1,303.70

5 NYMEX net long speculative positions rose in response to the impending ETF launch, climbing 77,000 oz in only one week. However, the price did not move higher. On the 19th, though, ETF Securities announced the launch of a second platinum ETF. This time, the platinum price did respond, climbing above \$1,300. Tightening lease rates and heavy physical purchasing of metal in Shanghai pulled platinum higher and it shot to a monthly peak of \$1,325 on the 24th as the first fund started trading.

Lonmin restarted its No. 1



furnace and Norilsk revealed that it was now able to resume platinum exports. Slow ETF trading and a dollar-driven fund sell-off of precious metals came at the same time. The price dropped back 3.0 per cent to fix at \$1,286 at the end of April.

NYMEX long positions kept on growing in the first half of **May**, while many of the Asian markets were closed for Golden Week. When TOCOM trading reopened, platinum pushed past the 5,000 Yen per gram mark on the April 2008 contract. Strikes at several mines boosted the price too and platinum reached a monthly peak of \$1,336 twice, on the 9th and on the 14th.

NYMEX and TOCOM positions show only a part of overall investment interest in platinum and palladium due to the launch of a number of ETFs in 2007.

6 From here, platinum fell back. Limited amounts of physical purchasing provided some support to the price. However, an upward move in the dollar overcame this. As gold ETF positions were sold-off, the price of that metal fell, dragging platinum with it. TOCOM sales took its price to a low of \$1,257 on the 30th of May.

7 Increasing tension over industrial relations in South Africa added some strength to the price at the start of **June**. In the middle of the month, Anglo Platinum closed its Rustenburg operations briefly to allow extra safety training. The price firmed somewhat unconvincingly but softened as the prospects of widespread strikes appeared to recede.

8 However, the spectre of supply disruption remained and the price ground higher in **July**. Although there

was little concrete information on the progress of the two-yearly wage negotiations, speculation in the market about potential disruption was supportive of the price. Anglo Platinum, Aquarius, Impala and Lonmin also released figures indicating likely reductions in annual output – due to a cocktail of safety issues, processing problems and labour relations challenges.

Platinum encountered resistance at \$1,300 in the spot market in New York ahead of US Independence Day. This was only a brief lull, though, and it sailed past this point in the October contract on NYMEX as soon as the market reopened.

The dollar weakened too, partly driven by problems in the sub-prime mortgage market, and oil prices neared \$75. Turkish troops massed near the Iraqi border on the 9th, increasing geopolitical tension and driving oil and gold prices higher. Platinum rose to a monthly high of \$1,333 on the 24th of July, slightly below its May peaks.

9 Nissan issued a press release suggesting that it could reduce pgm loadings in its autocatalysts. This provided the opportunity for fund sales of platinum. These were followed by 100,000 oz of net purchasing on TOCOM on the 27th and 10,000 oz of metal changing hands on the Shanghai Gold Exchange on the 30th. Nonetheless, despite this drop at the end of the month, platinum did record its highest-ever monthly average price.

The fall continued into **August**, however. The sub-prime mortgage crisis deepened, driving equity prices lower. With these falling quickly, many funds sold-off some of their comparatively-liquid investments in commodities (including NYMEX positions). The agreement of wage deals between the South African mining unions and Impala and Northam were regarded as bearish signals for the price.

On the 9th, the European Central Bank moved to address the crisis in the banking sector by injecting funds into the banking system. This weakened the Euro against the US Dollar and drove precious metal prices down. Heavy Chinese physical purchasing slowed the fall and platinum reached its low point for August of \$1,237 on the 22nd.

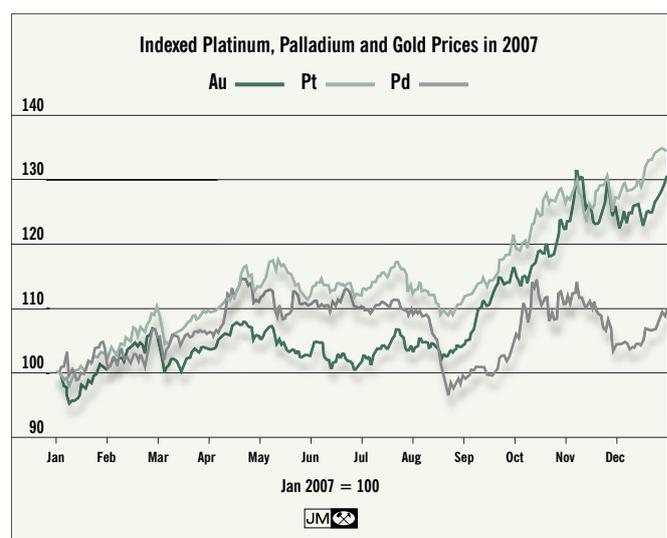
10 Slowly, the selling pressure eased and the platinum price began to firm again. A weakening US Dollar once more supported the whole precious metal complex. Gold moved higher and platinum followed, with

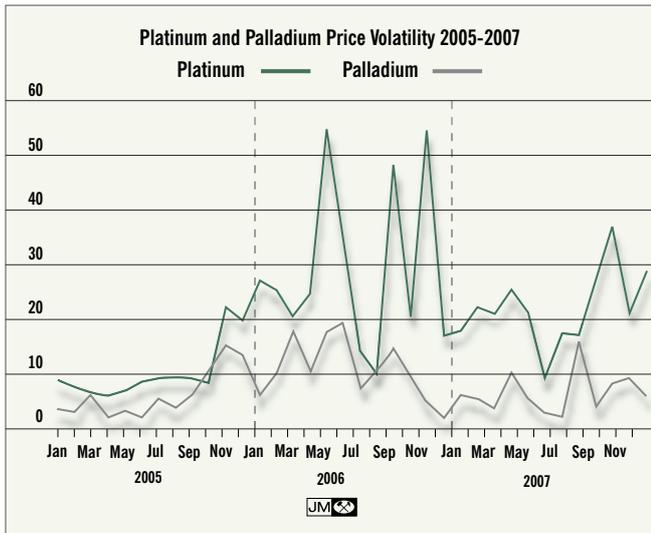
lease rates rising too. Fund buying of platinum futures on TOCOM on **September** 6th was followed by gold moving over \$700 later that day. Growing political tension between Syria and Israel boosted gold further.

The US Dollar continued its slide – it reached fifteen-year lows against most major currencies on the 11th on the back of poor domestic payroll data – and boosted commodity prices. Oil and gold rose and platinum followed suit, hurdling the \$1,300 barrier on the 12th. A 50 basis point decrease in the US Federal Reserve interest rate weakened the dollar again on the 18th. Gold hit a three-decade high and platinum reached \$1,336 for the third time in 2007. Long NYMEX positions rose by over 200,000 oz in the month and platinum ended September with a final fix of \$1,377, as speculation intensified again that there could be significant disruption to South African supplies due to possible strike action. Platinum fixed at a new all-time record of \$1,396 on **October** 11th and leapt above \$1,400 the following day.

11 South Africa came to the fore again later in October – fatal accidents at a number of mines led to shaft closures under a new government-led safety regime. News of the resulting production losses came piecemeal throughout the month and kept the price climbing. The gold price rose too, aiding platinum, due to continuing tension between Turkey and Iraq. Lease rates rose and platinum moved into backwardation, peaking at a new record of \$1,462 on the 29th before some month-end profit-taking appeared.

The rising gold price reflected investor interest in commodities and helped strengthen the platinum and palladium prices.





Volatility in the platinum market has increased markedly in the last two years, particularly when compared to palladium.

12 November was a volatile month for platinum but the price showed no clear direction. Funds led a move into platinum as the dollar weakened early on. The South African unions also proposed a nationwide strike to protest against deaths in the mining industry, stimulating platinum to a peak of \$1,476 on the 7th. The price fell heavily back to \$1,389 on the 12th as market participants fretted over the prospects of a slowdown in global growth. Large volumes started to change hands on the fixes at this point and “bargain-hunters” emerged. General Public buying on TOCOM added 100,000 oz of longs on the 13th and platinum bobbed back over \$1,400 – it did not fall back below this point for the rest of the year.

More safety-related South African stoppages provided another boost to the price and investors continued to add to their positions on NYMEX and TOCOM. The amount of metal being taken by the exchange traded funds also increased markedly with roughly 80,000 oz bought in November overall.

A buoyant oil price, of nearly \$99 per barrel, showed the strength of the whole commodity complex (it had been only \$50 in January). With macroeconomic factors assisting, platinum reached another record of \$1,484 on the morning of the 26th before falling back to end the month at \$1,440.

13 December, though, saw no respite for platinum’s end users. Investment on NYMEX and TOCOM and through the ETFs helped push the price higher but challenges in the South African mining industry

also played their part. Despite the record prices, buying remained healthy on the Shanghai Gold Exchange at the start of the month. This strength was reinforced by news of another fatality in South Africa and a nationwide one-day strike across the entire mining industry. Platinum moved back higher, to reach \$1,472 on the 5th.

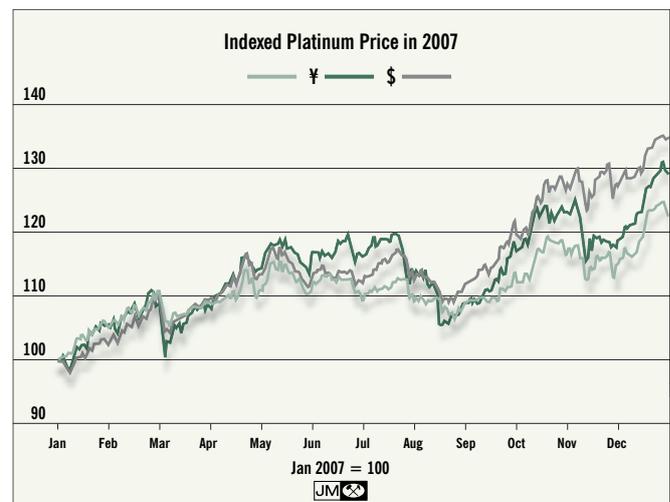
While a few investors started liquidating positions ahead of the year-end, others continued to build their investments. Chinese buying supported the price temporarily at \$1,460 before TOCOM buying pulled it higher. Lease rates started to rise, as did the price, on news that Ridge Mining had effectively hedged its first few years of production from its Blue Ridge operation.

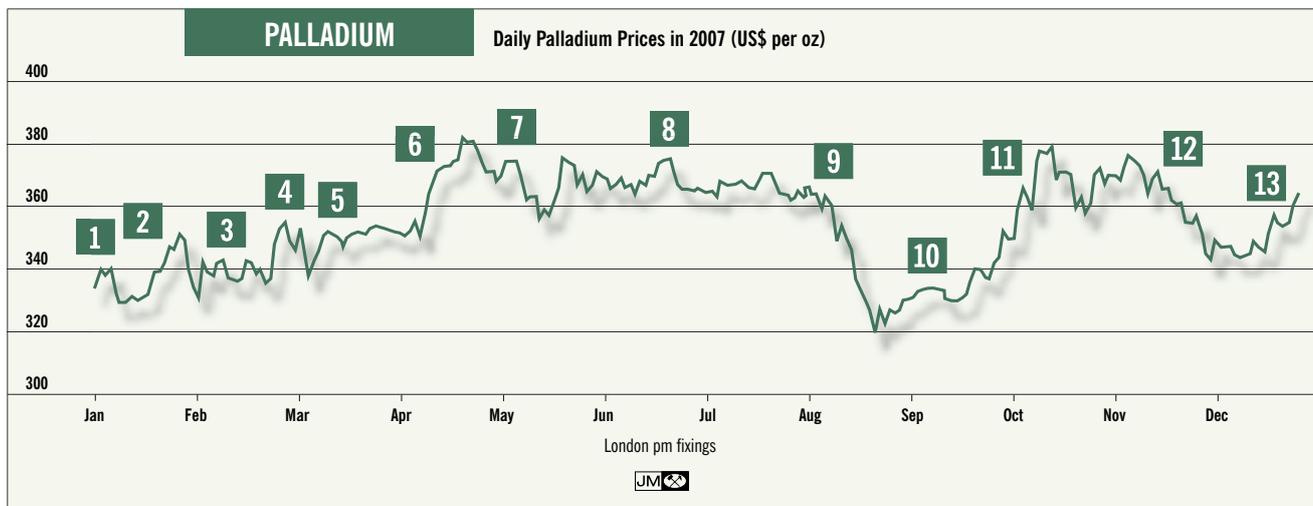
With Chinese end users still buying weighty amounts of metal, the price kept on rising. The January 2008 NYMEX contract rose over \$1,500 for the first time and platinum fixed in London at that price on the 18th.

14 A general sense of nervousness existed by now in the platinum market and, in tight market conditions, almost any news was capable of raising the price. However, end-of-year profit-taking provided an equal and opposite impetus. Nonetheless, purchasing by ETF investors did push the price to \$1,526 on the 24th. In thin trading after Christmas, the assassination of Pakistani opposition leader Benazir Bhutto created ripples in the gold market. As gold rose, platinum climbed too, to a 2007 high of \$1,544.

Platinum drifted gently lower to end the year at \$1,529, 5.4 per cent up during December and 34.6 per cent higher than at the start of the year.

The platinum price rose in almost every currency but the weakness of the US Dollar was one notable driver of price movements in 2007.





The palladium market was rather less dramatic than that of platinum, although the price did gain 10 per cent during the year.

Palladium gained \$33 during 2007, moving from an initial \$332 to a final fix of \$365, driven by movements in the dollar and gold and platinum prices, rather than by market fundamentals. Investor interest remained key to palladium's strength.

Although palladium kept pace with platinum for the first half of 2007, the remaining months were broadly neutral. The supply issues which affected platinum had little effect on palladium which traded between \$320 and \$380 for almost the entire year.

1 Palladium opened 2007 at \$332 and firmed to reach \$343 on **January 5th**. Net long positions on NYMEX and TOCOM grew due to buying by speculators and fund investors in early January. When investors realised that Russian palladium shipments were not subject to the same delays as platinum exports, the price fell to a monthly low of \$328 on the 11th.

2 In mid-January, a stirring in the gold price boosted palladium. Fund-buying of platinum inspired some activity in palladium. As oil prices rose, net speculative NYMEX long positions grew to almost 800,000 oz, driving palladium to a peak of \$351 on the 25th.

3 As soon as palladium rose above the psychologically-important \$350 mark, it gave up some of its gains to profit-taking. Heavy selling of the March NYMEX contract dominated the end of the month as funds took some of their profits, pushing the price as low as \$331.

Palladium settled into a \$5 range either side of \$340 in the first half of **February**. News of the very large

Russian palladium exports to Switzerland in November surprised the market but did little to the price.

Precious metal prices strengthened but palladium derived little support from this. It drooped to a mid-month low of \$335 on NYMEX selling before opening limit-up on TOCOM on the 22nd. Crude oil rose too, providing more support. Gold reached a nine-month high on a weak US Dollar and heaved palladium over \$350 to a monthly high of \$355.25 on the 26th.

4 With many stock markets falling, investors sold-off some positions in palladium to raise cash and the price fell. The burgeoning US sub-prime mortgage crisis affected US confidence too but the effect was short-lived: palladium reached a low of \$338 on **March 5th** before buying reappeared. In percentage terms, palladium's drop was less than any of the other precious metals over this period.

5 The palladium price inched higher over the following month. It crept back over \$340 and established itself in a range of \$340-\$355 with encouragement from a bout of dollar weakness. Strong physical demand followed after Easter, taking palladium over \$360 for the first time since mid-2006. NYMEX long positions grew to over one million ounces and palladium climbed to \$373 on **April 12th**, as the Euro hit a two-year high against the US Dollar, before encountering resistance.

6 The Swiss Zürcher Kantonalbank (ZKB) announced its plans to launch an exchange traded fund (ETF) based on physical palladium on the 13th. Surprisingly,

the market was little affected and the price moved only grudgingly to \$376 and a new range of \$370-\$380. Some profit-taking by funds was seen but net long NYMEX positions continued to grow to a weighty 1.23 million ounces, demonstrating the considerable appetite and power of investors. The announcement of the launch of a second palladium ETF nudged the price higher, to its peak for 2007 of \$382 on April 20th.

7 A falling platinum price and a rally in the dollar placed pressure on palladium and it dipped to \$368 on April 27th. The price firmed in early **May** with large amounts of metal changing hands on the fixes. For once, the palladium and platinum prices moved in different directions. Palladium peaked at \$375 on the 8th after an arduous week-long climb. NYMEX net longs reached 1.44 million ounces. As these were sold-off – with a drop of 130,000 oz in the second week of May – the palladium price subsided to a monthly low of \$356 on May 15th, with platinum close to its monthly peak.

More fund investor activity a week later drove palladium to a monthly high of \$375.50 on the 22nd. Profit-taking immediately revisited the market. A strengthening dollar drove commodity prices lower at the end of May and palladium settled below \$370.

8 Palladium traded from \$360 to \$370 in early **June**. However, NYMEX net speculative long positions grew to reach 1.27 million ounces before the investment flow

was turned off. The price gained some ground in the second half of June with industrial demand responsible. It edged as high as \$375 on the 21st before platinum fell and dragged it lower.

July was no more exciting: palladium started at \$367 and ended at \$365, without moving more than \$5 in either direction. A falling dollar continued to support commodity prices; however, investor interest was reflected in large volumes of metal changing hands during the month.

9 In late July, Nissan issued a press release on its ability to

reduce pgm loadings in its autocatalysts. Palladium was sold-off and drifted to a month-end \$365.

This downward move continued into the first half of **August**. Global credit worries intensified with the sub-prime crisis re-emerging. Palladium's price decline was slow initially but accelerated as the European Central Bank injected considerable liquidity into the banking system. This supported the dollar and palladium fell to \$349 on August 10th.

The weakness in the financial markets persisted, prompting further sales. NYMEX net long speculative positions fell by almost 200,000 oz in a week, driving technical selling. Palladium spiralled down by over 10 per cent to a yearly low of \$320 on the 22nd.

10 Platinum ended August strongly but palladium was held back by heavy selling on the futures exchanges (NYMEX positions fell by some 500,000 oz during the month). However, as gold rose, palladium crawled higher. The release of poor US housing data on **September** 27th hit the dollar again and drove palladium to a monthly high of \$344.

11 In early **October**, currency movements dominated. Oil and gold prices kept rising. Palladium followed as investors bought physical metal and TOCOM futures. However, the supply concerns in the platinum market were not reflected in palladium. Fund sales capped the price rise at \$380 and the price shrivelled to close to \$360. Later in the month, increased political tension between the USA and Iran boosted gold. Palladium followed and closed October at \$370.

12 Palladium lost all of its recent gains in a month-long slide throughout **November**. Investors evaporated and the price slipped through various support levels. The fall intensified as Japanese investors sold-off gold and other precious metals. Palladium came to rest at \$343 on the 28th before generating any interest. It remained between \$340 and \$350 until mid-**December**.

13 Palladium finally broke the resistance at \$350 on December 17th. Technical traders bought into this rise. With the downward pressure removed, the price rose on news of political turmoil in Pakistan late in the month. It jumped to close the year at \$365, 10 per cent higher than it was at the start of 2007.

Palladium Prices in 2007			
London am and pm fixings, \$ per oz			
	High	Low	Average
January	351.00	328.00	336.85
February	355.25	335.00	341.75
March	354.00	338.00	349.95
April	382.00	350.50	368.65
May	375.50	356.00	367.45
June	375.00	363.50	368.50
July	370.50	362.00	366.25
August	366.00	320.00	343.55
September	344.00	330.00	334.80
October	380.00	348.00	365.45
November	379.00	343.00	363.00
December	365.00	344.00	350.95
Annual	382.00	320.00	354.86



OTHER PGM

Rhodium traded at a record average of \$6,191 during 2007, compared to \$4,557 in 2006, hitting an annual high of \$6,850 in late-December. The price movements were led simply by the shifting balance between daily supply and demand.

Rhodium started 2007 at \$5,550. The first signs of volatility were immediate: with Russian shipments suspended due to export licence issues, market bids drove the price to \$6,000 in February. The closure of Lonmin's No.1 furnace caused more nervousness. Heavy physical purchasing and a sense of apprehension drove rhodium to a mid-April peak of \$6,500.

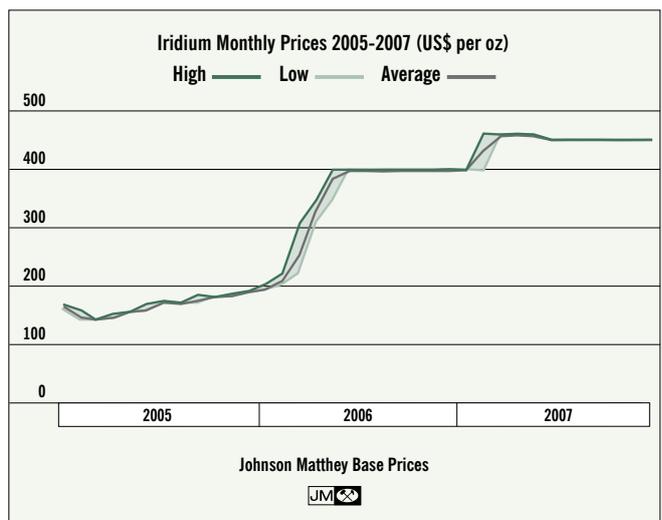
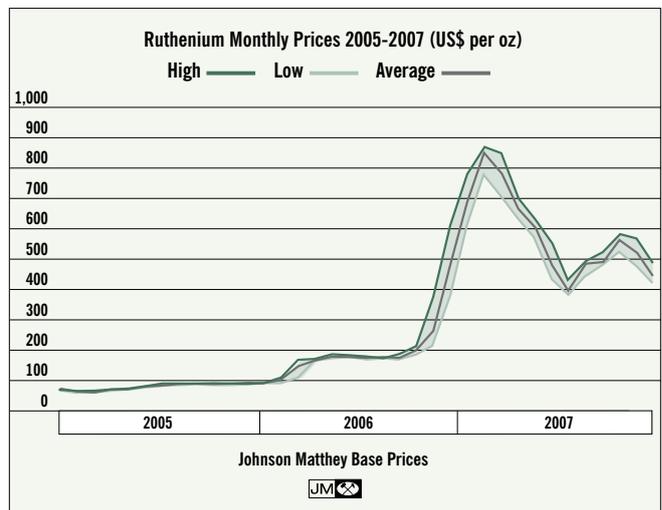
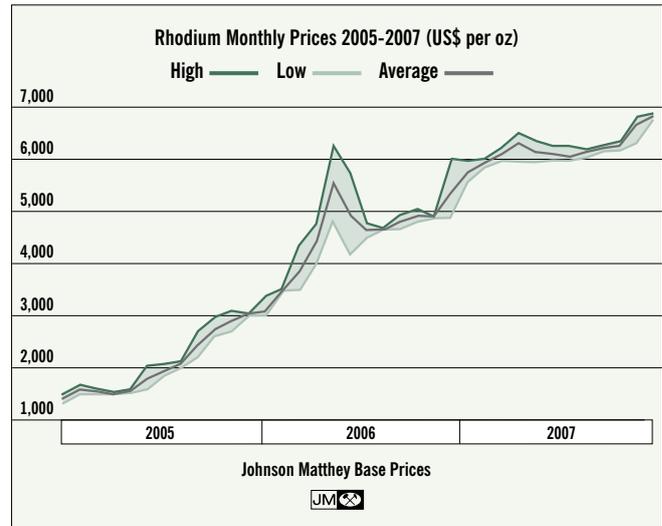
When news emerged of the grant of the Russian export licences, the price started to drop. Lonmin restarted its furnace and the price crumbled to \$5,950 by the start of May. Lease rates started to rise, encouraging further buying instead of leasing by industrial customers, further reducing metal availability. The price climbed to \$6,350 before market offers reappeared.

Rhodium dipped below \$6,000 in July but this was the last time it was this low. End user buying drove a recovery to \$6,250 in September. Concerns over safety-related shutdowns in South Africa started to affect the market in November. Rhodium climbed steadily in the final months of 2007 and closed on the year's highs of \$6,850, close to its July 1991 peak of \$7,000.

Ruthenium had a rocky ride in 2007 – it started at \$610 and climbed as high as \$870 before plummeting to end December at \$415. Although the price had risen by over 600 per cent in 2006, considerable buying interest remained from both speculators and the electronics industry. Ruthenium reacted by rocketing to \$870, the year's high, on February 9th. Rumours of speculator sales then began to dog the market and the price eventually softened by \$20 on the 26th.

Now, the price could not stop falling and it hit a low of \$380 in July. Industrial purchasing was weaker than in 2006 but the market remained tense. Buying returned in August and intensified in September, driving the price to \$580 in October. End user purchasing then dwindled and the price dropped to end the year at \$415.

The Johnson Matthey iridium base price started 2007 at \$400. Speculative buying drove it to \$460 in February. It stayed at this level until June when it lost \$10. The price did not move again and ended 2007 at \$450.



EXCHANGE TRADED FUNDS

2007 saw the launch of two separate sets of exchange traded funds backed by physical platinum group metals. In Switzerland, funds based on platinum and palladium were launched by the Zuercher Kantonalbank (ZKB). In London, two similar funds were launched by ETF Securities, as well as one based on a basket of precious metals. None of these has any exposure to the minor platinum group metals.

The first exchange traded funds, or ETFs, focused on replicating stock market indices using equities as the underlying investment. Instead of buying a range of stocks and shares, the fund purchased these on a customer's behalf. The investor instead bought shares in the fund which were backed by these assets. These shares in the fund were then traded just like shares in a conventional listed company.

Soon, however, commodity ETFs were launched, allowing a simple way to invest in a commodity, such as gold, without the need to physically hold and store it. Gold ETFs were amongst the first to be launched and have been relatively successful. The launch of platinum group metal exchange traded funds

in April and May of last year therefore did not surprise the market greatly.

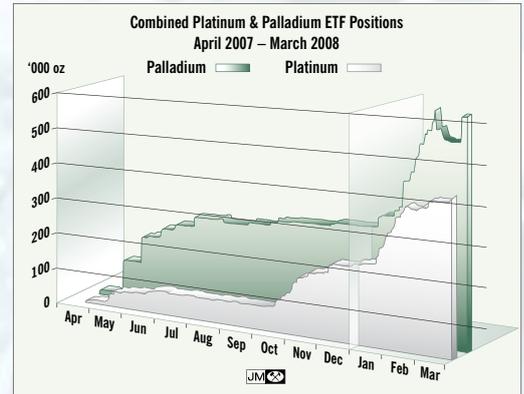
Both of these sets of pgm funds work in a similar way, being 100 per cent backed by the physical metal, with the funds unable to lend or sell metal themselves. At launch, the two fund managers anticipated total combined investments of 150,000 oz of platinum and 400,000 oz of palladium after the first year of trading. By late-September 2007, the total amount of metal held was 60,000 oz of platinum and 255,000 oz of palladium.

However, as the platinum price rose in November and December 2007, and, more especially, in January 2008, investors charged into the London platinum fund in particular. Over 40,000 oz of platinum were purchased for this fund in the last week of January alone – just as the South African power supply problems were coming to light.

It seems likely, therefore, that, in a scenario of rising metal prices, ETF investment – whether from funds or from retail investors – can cause positive feedback, increasing short-term volatility and reinforcing price rises by removing metal from the open market.

What is not yet known is whether the same positive feedback can be expected should prices drop, with net sales of metal expected to accentuate any fall in the price. However, experience from gold ETFs suggests that a falling price does encourage sales, again intensifying price movements.

Nonetheless, the growth in stocks of metal held has been impressive. Almost 195,000 oz of platinum were accounted for by the ETFs at the end of 2007. A further net



165,000 oz was bought by investors in January and February of 2008 alone. At the end of March 2008, 390,000 oz of platinum bars were held in the full set of ETFs.

With the palladium price less volatile, growth in the palladium funds was much less spectacular. However, investment flows still grew strongly and stocks reached a combined total of 280,000 oz by the end of 2007, and 580,000 oz by the end of the first quarter of 2008.

In terms of future developments, there is still no evidence of the launch of platinum or palladium ETFs either in Japan or in North America, markets where significant investor interest might be expected. We do not anticipate the launch of any such fund in the near future. A rhodium fund is equally unlikely.

March 2008 did, however, see a new short platinum fund created in London. This allows investors to gamble on prices falling and may attract attention whenever precious metal prices start to soften.

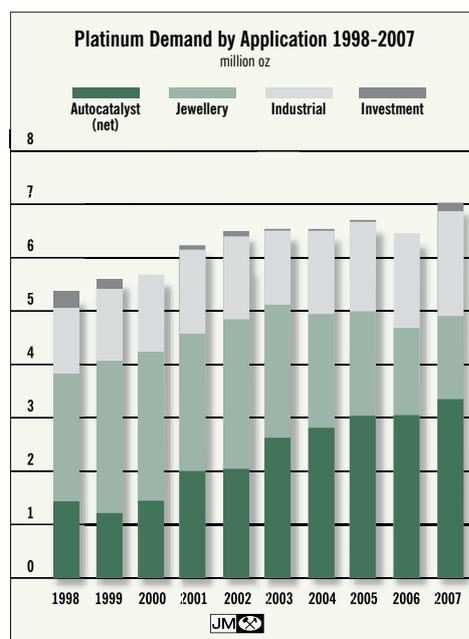
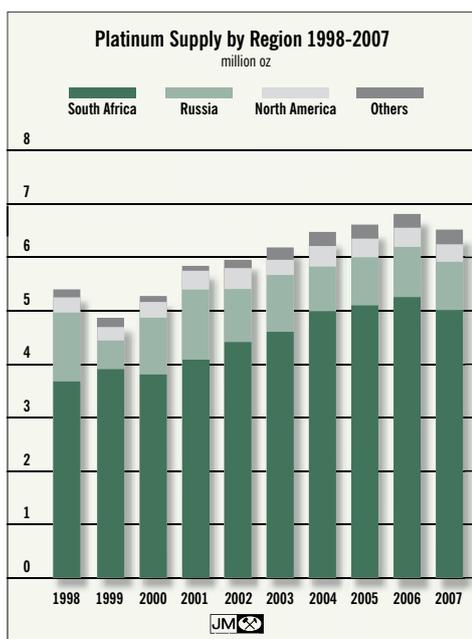
However, this fund and the new leveraged and classic funds launched on the same date are backed by futures contracts rather than physical metal and should therefore have no immediate impact on the physical market.

The combined holdings of all pgm exchange traded funds grew sharply at the end of 2007 and in the first quarter of 2008.

Platinum bars owned by exchange traded funds are stored separately to other metal and are not available for sale or leasing to the market.

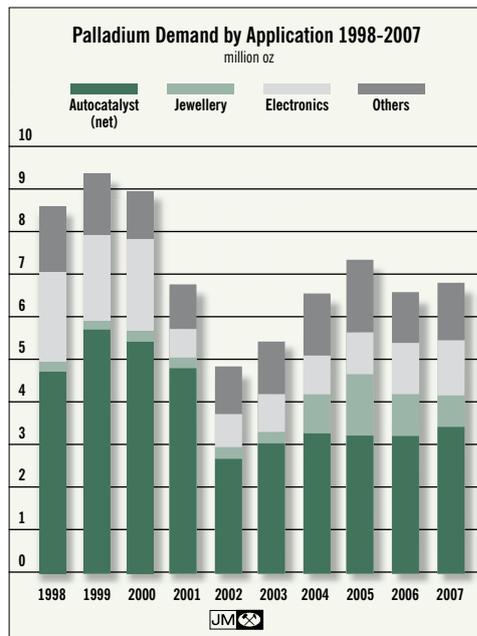
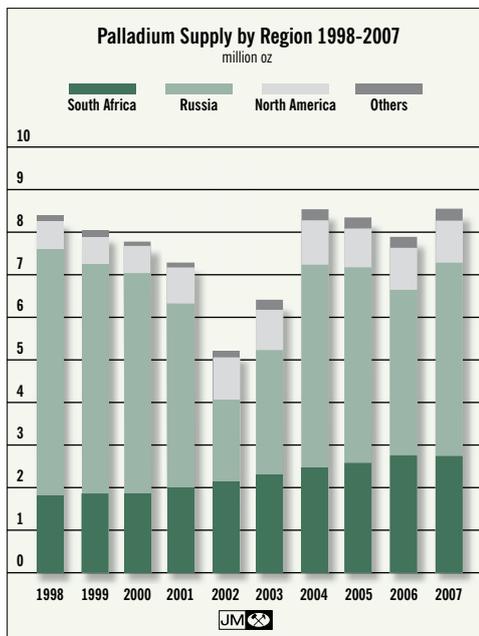


Platinum Supply and Demand											
	'000 oz	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Supply ¹	South Africa	3,680	3,900	3,800	4,100	4,450	4,630	5,010	5,115	5,295	5,035
	Russia ⁸	1,300	540	1,100	1,300	980	1,050	845	890	920	910
	North America	285	270	285	360	390	295	385	365	345	325
	Others	135	160	105	100	150	225	250	270	270	280
	Total Supply	5,400	4,870	5,290	5,860	5,970	6,200	6,490	6,640	6,830	6,550
Demand by Application ²	Autocatalyst: gross ³	1,800	1,610	1,890	2,520	2,590	3,270	3,490	3,795	3,905	4,225
	recovery ⁴	(405)	(420)	(470)	(530)	(565)	(645)	(690)	(770)	(860)	(890)
	Chemical	280	320	295	290	325	320	325	325	395	390
	Electrical	300	370	455	385	315	260	300	360	360	425
	Glass	220	200	255	290	235	210	290	360	405	430
	Investment ⁷	315	180	(60)	90	80	15	45	15	(40)	170
	Jewellery	2,430	2,880	2,830	2,590	2,820	2,510	2,160	1,965	1,640	1,585
	Petroleum	125	115	110	130	130	120	150	170	180	205
	Other	305	335	375	465	540	470	470	475	490	490
	Total Demand	5,370	5,590	5,680	6,230	6,470	6,530	6,540	6,695	6,475	7,030
Movements in Stocks ⁵	30	(720)	(390)	(370)	(500)	(330)	(50)	(55)	355	(480)	
Average Price (US\$) ⁶	372	377	545	529	540	691	846	897	1,143	1,304	



Platinum Demand by Application: Regions											
	'000 oz	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Europe	Autocatalyst: gross	545	560	680	1,060	1,210	1,455	1,680	1,960	2,060	2,080
	recovery	(30)	(30)	(40)	(70)	(90)	(115)	(145)	(170)	(190)	(220)
	Chemical	60	80	100	105	115	105	115	100	100	110
	Electrical	45	70	80	65	40	35	40	40	25	30
	Glass	25	20	20	10	10	10	5	10	10	15
	Investment	5	5	0	0	0	0	0	0	0	195
	Jewellery	160	185	190	170	160	190	195	195	195	210
	Petroleum	15	15	15	15	15	15	15	15	20	25
	Other	85	90	105	155	190	185	190	175	175	180
	Total		910	995	1,150	1,510	1,650	1,880	2,095	2,325	2,395
Japan	Autocatalyst: gross	240	250	290	340	430	500	615	600	605	615
	recovery	(55)	(60)	(60)	(55)	(55)	(60)	(55)	(35)	(35)	(35)
	Chemical	20	20	20	25	30	40	40	50	50	55
	Electrical	55	75	90	80	55	40	50	65	55	60
	Glass	80	65	65	85	60	85	90	95	100	80
	Investment	130	110	(95)	45	40	(10)	15	(15)	(65)	(60)
	Jewellery	1,290	1,320	1,060	750	780	660	560	510	360	280
	Petroleum	5	5	5	5	5	5	5	5	5	5
	Other	30	35	35	35	55	40	40	45	40	45
	Total		1,795	1,820	1,410	1,310	1,400	1,300	1,360	1,320	1,115
North America	Autocatalyst: gross	775	535	620	795	570	885	800	820	705	930
	recovery	(310)	(315)	(350)	(370)	(380)	(420)	(435)	(505)	(575)	(575)
	Chemical	80	95	100	100	100	95	90	100	100	95
	Electrical	105	120	145	120	100	85	90	95	75	75
	Glass	20	25	50	35	30	(30)	(10)	5	10	25
	Investment	175	60	35	45	40	25	25	25	20	30
	Jewellery	270	330	380	280	310	310	290	275	245	240
	Petroleum	40	40	35	40	45	40	35	35	35	35
	Other	170	190	210	250	265	215	205	220	225	230
	Total		1,325	1,080	1,225	1,295	1,080	1,205	1,090	1,070	840
China ^a	Autocatalyst: gross	0	5	10	15	35	60	75	120	155	215
	recovery	0	0	0	0	0	0	0	0	0	0
	Chemical	20	15	20	10	10	10	10	10	65	55
	Electrical	20	20	20	15	15	15	20	25	45	55
	Glass	30	25	35	65	40	30	60	70	50	140
	Investment	0	5	0	0	0	0	0	5	0	0
	Jewellery	620	950	1,100	1,300	1,480	1,200	1,010	875	760	780
	Petroleum	15	10	15	15	5	5	5	5	10	10
	Other	5	5	5	5	5	5	5	10	10	10
	Total		710	1,035	1,205	1,425	1,590	1,325	1,185	1,120	1,095
Rest of the World ^a	Autocatalyst: gross	240	260	290	310	345	370	320	295	380	385
	recovery	(10)	(15)	(20)	(35)	(40)	(50)	(55)	(60)	(60)	(60)
	Chemical	100	110	55	50	70	70	70	65	80	75
	Electrical	75	85	120	105	105	85	100	135	160	205
	Glass	65	65	85	95	95	115	145	180	235	170
	Investment	5	0	0	0	0	0	5	0	5	5
	Jewellery	90	95	100	90	90	150	105	110	80	75
	Petroleum	50	45	40	55	60	55	90	110	110	130
	Other	15	15	20	20	25	25	30	25	40	25
	Total		630	660	690	690	750	820	810	860	1,030

Palladium Supply and Demand											
	'000 oz	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Supply ¹	South Africa	1,820	1,870	1,860	2,010	2,160	2,320	2,480	2,605	2,775	2,770
	Russia ⁸	5,800	5,400	5,200	4,340	1,930	2,950	4,800	4,620	3,920	4,540
	North America	660	630	635	850	990	935	1,035	910	985	990
	Others	120	160	105	120	170	245	265	270	270	285
	Total Supply	8,400	8,060	7,800	7,320	5,250	6,450	8,580	8,405	7,950	8,585
Demand by Application ²	Autocatalyst: gross ³	4,890	5,880	5,640	5,090	3,050	3,450	3,790	3,865	4,015	4,450
	recovery ⁴	(175)	(195)	(230)	(280)	(370)	(410)	(530)	(625)	(805)	(1,000)
	Chemical	230	240	255	250	255	265	310	415	440	370
	Dental	1,230	1,110	820	725	785	825	850	815	620	635
	Electronics	2,075	1,990	2,160	670	760	900	920	970	1,205	1,285
	Jewellery	235	235	255	240	270	260	930	1,430	995	740
	Investment ⁷	0	0	0	0	0	30	200	220	50	260
	Other ⁷	115	110	60	65	90	110	90	265	85	95
Total Demand	8,600	9,370	8,960	6,760	4,840	5,430	6,560	7,355	6,605	6,835	
Movements in Stocks ⁵	(200)	(1,310)	(1,160)	560	410	1,020	2,020	1,050	1,345	1,750	
Average Price (US\$) ⁶	284	358	681	603	337	201	230	201	320	355	



Palladium Demand by Application: Regions											
	'000 oz	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Europe	Autocatalyst: gross	1,370	1,530	1,900	1,730	1,370	1,220	1,105	975	890	900
	recovery	(5)	(10)	(15)	(30)	(45)	(70)	(110)	(165)	(225)	(300)
	Chemical	65	65	95	65	70	65	70	155	175	100
	Dental	210	180	100	50	55	70	80	75	75	75
	Electronics	270	255	265	35	85	85	115	80	105	155
	Jewellery	50	50	45	35	35	35	35	35	40	45
	Investment	0	0	0	0	0	0	0	0	0	280
	Other	25	25	20	20	15	20	25	20	25	20
	Total		1,985	2,095	2,410	1,905	1,585	1,425	1,320	1,175	1,085
Japan	Autocatalyst: gross	480	600	510	505	520	550	635	660	795	845
	recovery	(50)	(55)	(50)	(40)	(40)	(40)	(40)	(30)	(30)	(35)
	Chemical	20	20	20	20	20	25	25	25	25	25
	Dental	590	545	470	475	505	515	520	475	270	275
	Electronics	1,060	980	990	260	140	225	235	265	275	285
	Jewellery	105	105	150	140	165	160	155	145	130	120
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	10	10	15	10	10	5	10	10	10	10
	Total		2,215	2,205	2,105	1,370	1,320	1,440	1,540	1,550	1,475
North America	Autocatalyst: gross	2,820	3,490	2,805	2,375	640	1,205	1,445	1,430	1,415	1,655
	recovery	(115)	(125)	(155)	(200)	(260)	(270)	(345)	(390)	(500)	(605)
	Chemical	70	75	65	75	75	70	85	85	80	80
	Dental	390	350	230	190	215	225	235	250	260	265
	Electronics	460	405	485	250	210	215	185	195	190	195
	Jewellery	10	10	10	10	10	10	10	20	40	50
	Investment	0	0	0	0	0	30	200	220	50	(20)
	Other	55	50	5	15	45	65	30	215	30	40
	Total		3,690	4,255	3,445	2,715	935	1,550	1,845	2,025	1,565
China ⁹	Autocatalyst: gross	0	0	15	40	55	90	105	170	220	275
	recovery	0	0	0	0	0	0	0	0	0	0
	Chemical	25	30	30	30	40	40	50	55	65	65
	Dental	0	0	0	0	0	5	5	5	5	5
	Electronics	35	150	175	100	75	240	275	275	315	320
	Jewellery	45	40	20	25	30	25	700	1,200	760	500
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	5	5	5	5	5	5	10	5	10	10
	Total		110	225	245	200	205	405	1,145	1,710	1,375
Rest of the World ⁹	Autocatalyst: gross	220	260	410	440	465	385	500	630	695	775
	recovery	(5)	(5)	(10)	(10)	(25)	(30)	(35)	(40)	(50)	(60)
	Chemical	50	50	45	60	50	65	80	95	95	100
	Dental	40	35	20	10	10	10	10	10	10	15
	Electronics	250	200	245	25	250	135	110	155	320	330
	Jewellery	25	30	30	30	30	30	30	30	25	25
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	20	20	15	15	15	15	15	15	10	15
	Total		600	590	755	570	795	610	710	895	1,105



Rhodium Supply and Demand											
	'000 oz	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Supply ¹	South Africa	400	410	457	452	490	544	587	627	666	696
	Russia ⁸	110	65	290	125	90	140	100	90	100	90
	North America	16	18	17	23	25	26	17	20	17	17
	Others	4	8	3	4	10	14	16	17	19	19
	Total Supply	530	501	767	604	615	724	720	754	802	822
Demand by Application ²	Autocatalyst: gross ³	483	509	793	566	599	660	758	829	863	879
	recovery ⁴	(57)	(65)	(79)	(88)	(99)	(124)	(140)	(137)	(171)	(183)
	Chemical	31	34	39	44	39	39	43	48	49	64
	Electrical	6	6	7	6	6	6	8	10	9	9
	Glass	34	35	42	41	37	26	46	57	65	64
	Other	10	9	10	10	10	13	14	20	23	23
Total Demand	507	528	812	579	592	620	729	827	838	856	
	Movements in Stocks ⁵	23	(27)	(45)	25	23	104	(9)	(73)	(36)	(34)
	Average Price (US\$) ⁶	617	907	1,998	1,604	838	530	986	2,056	4,552	6,191



NOTES TO TABLES

¹**Supply** figures represent estimates of sales by the mines of primary pgm. Additionally, we continue to report sales of metal which we do not believe has previously been priced - principally sales of Russian state stocks - as supplies.

²With the exception of the autocatalyst sector, **demand** estimates are net figures: i.e. demand in any individual sector is the total of purchases by consuming industries less any sales back to the market. Annual demand totals therefore represent purchases of new primary metal by consumers in a given year.

³**Gross autocatalyst demand** represents purchases of pgm by the auto industry for the manufacture of catalytic converters and is allocated to the region where the vehicle is manufactured.

⁴**Autocatalyst recovery** is metal recovered from scrapped catalytic converters and is allocated to the region in which the converter was scrapped as a negative contribution to demand.

⁵**Movements in stocks** in any given year reflect changes in stocks held by fabricators, dealers, banks and depositories but excluding stocks held by primary refiners and final consumers. A positive figure (sometimes referred to as a "surplus") reflects an increase in market stocks. A negative value (or "deficit") indicates a decrease in market stocks.

⁶**Average price** figures for platinum and palladium are the mean of all daily fixing values in a given year. Average price figures for rhodium are based on Johnson Matthey base prices.

CHANGES TO TABLES

⁷The **investment** demand category combines the previous **investment: small** and **investment: large** categories for platinum. This category now comprises the long-term holding of coins and minted bars of 1 kg or less; investments held in allocated accounts for subscribers to accumulation plans; and metal held in exchange traded funds. For palladium, investment figures are now shown separately, having previously been included in the **other** demand category.

⁸Prior to 2006, **Russian supply** figures are net of Russian and ex-CIS states' demand. From 2006 onwards, Russian supply figures represent the total pgm shipped to all regions including Russia and the ex-CIS. Demand in Russia and the ex-CIS states is included in the Rest of the World region from 2006 onwards.

⁹Demand for platinum and palladium in **China** has been separated from demand in the Rest of the World region for the whole of the 1998-2007 period.

GLOSSARY

4E	Four Element (Pt, Pd, Rh and Au)	pgm	Platinum Group Metal(s)
BEE	Black Economic Empowerment	Platreef	A platiniferous ore body in South Africa
CIS	Commonwealth of Independent States	PM	Particulate Matter
CO	Carbon Monoxide	PMR	Perpendicular Magnetic Recording
CSF	Catalysed Soot Filter	ppm	Parts Per Million
DMFC	Direct Methanol Fuel Cell	ppt	Parts Per Thousand
DOC	Diesel Oxidation Catalyst	PTA	Purified Terephthalic Acid
DPF	Diesel Particulate Filter	SCR	Selective Catalytic Reduction
ETF	Exchange Traded Fund	SUV	Sports Utility Vehicle
FY	Financial Year	TOCOM	Tokyo Commodity Exchange
g	Gram	ton	Short ton (2,000 pounds or 907 kg)
HC	HydroCarbons	tonne	1,000 kg
HDD	Heavy Duty Diesel	TWC	Three-Way Catalyst
HIC	Hybrid Integrated Circuit	UG2	A platiniferous ore body in South Africa
JV	Joint Venture	ULEV	Ultra Low Emissions Vehicle
kg	Kilograms	VAM	Vinyl Acetate Monomer
LCD	Liquid Crystal Display		
Merensky	A platiniferous ore body in South Africa		
MLCC	Multi-Layer Ceramic Capacitor		
NOx	Oxides of nitrogen		
NYMEX	New York Mercantile Exchange		
OBD	On-Board Diagnostics		
oz	Ounces troy		
PDP	Plasma Display Panels		
PEMFC	Proton Exchange Membrane Fuel Cell		
PET	PolyEthylene Terephthalate		

NOTE ON PRICES

All prices are quoted per oz unless otherwise stated.

R	South African Rand
£	UK Pound
\$	US Dollar
¥	Japanese Yen
€	Euro
RMB	Chinese Renminbi

PICTURE CREDITS

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Johnson Matthey

Precious Metals Marketing, Orchard Road, Royston, Hertfordshire, SG8 5HE, England
Telephone: +44 (0)1763 256315 Fax: +44 (0)1763 256339 E-mail: ptbook@matthey.com
www.platinum.matthey.com