Platinum 2003

Johnson Matthey

Interim Review

Acknowledgements

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The front cover photograph shows the front and reverse of the 5101P "10 Day Tourbillon" platinum watch, launched by Patek Philippe of Geneva, Switzerland in April 2003. This highly complex tourbillon wristwatch contains two mainspring barrels, the power reserve of which mean that the watch only has to be wound once every ten days.

The photograph on this page is a close-up of woven glass fibres for use in reinforcement applications. Textile fibreglass is produced using platinum bushings.

Platinum 2003

by Tom Kendall

Supply and Demand Tables

Johnson Matthey

Interim Review

Summary and Outlook

Platinum

• Platinum demand is forecast to increase slightly to 6.59 million oz in 2003 – the slowest growth in over a decade.

• Jewellery demand for platinum is expected to fall 13 per cent to 2.45 million oz due to lower purchases of metal by both Chinese and Japanese manufacturers.

• Demand from the autocatalyst industry will surge to 3.18 million oz as diesel car sales grow strongly in Europe and US auto makers use less platinum from inventories.

• Industrial applications are forecast to consume 1.6 million oz of platinum in 2003, almost the same as the previous year.

• Supplies of platinum will grow moderately to 6.11 million oz. South African output will rise, but by less than had been planned, while North American production will fall sharply.

• An increase in fund buying of platinum, plus the continuing market deficit, drove the price up in a series of rallies from $600 in January to $760 by the end of October.

Overview

Demand for platinum is forecast to grow slightly in 2003, rising by just 30,000 oz to 6.59 million oz. A fourth successive year of strong growth in purchases of platinum by the auto industry will largely be offset by reduced demand for platinum from jewellery manufacturers in the key markets of China and Japan.

Supplies of platinum are expected to grow by 140,000 oz to reach 6.11 million oz. South African output will rise by 4.5 per cent in 2003 and expansions in Zimbabwe have gathered pace. However, offsetting some of this growth will be a steep drop in North American production and a slight fall in Russian sales. Overall, supplies will rise by more than demand and the market deficit will narrow somewhat, but at 480,000 oz it will remain substantial.

The price of platinum has strengthened throughout much of the year to date, hitting $760 by the end of October. Whilst the physical market remains fundamentally tight, much of the impetus for the rally has come from funds and speculators, and is representative of a marked increase in the flow of investment money into hard commodities as a whole during 2003.

Purchases of platinum by the **autocatalyst** sector are projected to surge by 540,000 oz in 2003 to reach a new high of 3.18 million oz. A conjunction of factors will be responsible for the growth: European demand will be driven by another rapid increase in diesel car sales; purchases of platinum by the US auto industry will rise as less stockpiled metal is used; whilst in Japan, the retrofitting of catalysts and particulate filters to trucks and buses in the Tokyo area will push up platinum consumption. In addition, emissions regulations are continuing to tighten in many countries, leading to higher platinum loadings in some instances.

In contrast, demand for platinum from the **jewellery** industry is forecast to slip by 370,000 oz to 2.45 million oz in 2003. A combination of the SARS outbreak in the first half of the year and the strong rally in the platinum price since May will see demand from Chinese jewellery fabricators drop by 19 per cent, the first fall since development of the market began in the mid-1990s. In Japan, a substantial volume of platinum has been recycled from the inventories of bankrupt manufacturers.

Little year-on-year change is expected in demand for platinum in **industrial** applications, the total edging up to 1.6 million oz. Consumption of platinum in catalysts for the chemical industry is likely to be stable, reflecting the sluggish economic climate. Glass industry demand is forecast to be slightly lower than in 2002 as less new capacity comes on stream in Asia, whereas use of the metal in electrical applications will grow moderately.

As the platinum price climbed during the first nine months of 2003, net sales of **investment** bars back to the market in Japan increased, and are forecast to outweigh purchases made during the year. Purchases of platinum coins in the USA, meanwhile, have fallen behind the level of buying in 2002. Net demand for investment products in 2003, therefore, is projected to drop to just 10,000 oz.

Global **supplies** of platinum are forecast to rise by only 2 per cent to 6.11 million oz this year. South African output will again increase, advancing by 4.5 per cent to 4.65 million oz, and Zimbabwean production will expand significantly. Sales of platinum from Russia, however, are expected to ease back towards the level of mine production, as sales from government stocks decline. North American output will slide sharply due to a three-month strike at Inco's operations in Canada and the exhaustion of a pgm-rich ore-body at one of the company's mines.

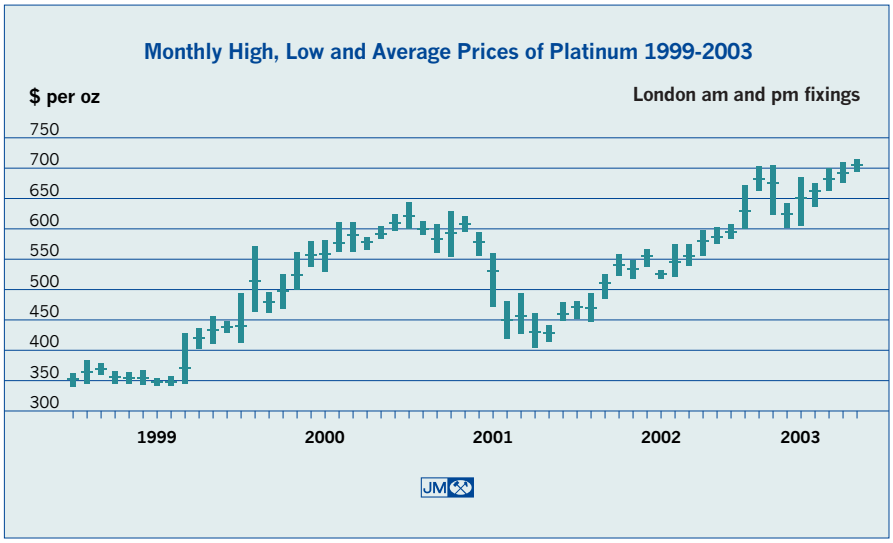
The platinum **price** climbed rapidly from $600 at the start of the year to reach $700 in February and March, as funds and investors bought into the metal on the NYMEX and TOCOM futures exchanges. After the price dipped back towards $600 in April, speculative fund

Platinum Supply and Demand
'000 oz

	2002	2003
Supply		
South Africa	4,450	4,650
Russia	980	950
North America	390	285
Others	150	225
Total Supply	**5,970**	**6,110**
Demand		
Autocatalyst: gross	2,640	3,180
recovery	(570)	(650)
Jewellery	2,820	2,450
Industrial	1,590	1,600
Investment	80	10
Total Demand	**6,560**	**6,590**
Movements in Stocks	**(590)**	**(480)**

buying of platinum resumed. This was primarily responsible for driving the price upwards from May through into October, although the market was also underpinned by a solid rate of physical demand from end users. By the end of October, the platinum price had reached $760, its highest level since 1980.

The increase in speculative buying of platinum in 2003 has partly been a function of the move by fund managers to diversify away from equities and fixed income assets. In addition, industrial metals including platinum have been bought on the prospects for strengthening global economic growth. In the case of platinum, the possibility of a worsening supply/demand deficit should planned South African expansions be deferred or cancelled has also contributed to bullish investor sentiment.



Supply

Supplies of platinum from **South Africa** are forecast to increase by 200,000 oz to a new high of 4.65 million oz in 2003. Ongoing expansion projects at Anglo Platinum will help to raise the group's output to 2.3 million oz. This, however, will be 100,000 oz short of the level of production the group had anticipated. The simultaneous commissioning of new converting, slag cleaning, and smelting facilities tied up 164,000 oz of platinum temporarily in the processing pipeline. Most but not all of this metal will be released before the end of the year.

Impala's operations during the first half of the year were adversely affected by a 10-day strike, although the effects of this were offset by a subsequent increase in mining of Merensky Reef ore. The Crocodile River mine, however, has had an extremely difficult year, with numerous geological problems underground causing production to slump. Impala, which holds an 83 per cent interest in the operation, is evaluating the sale or closure of the mine.

Output from Lonmin's operations will grow substantially in 2003, despite the disruption caused by an explosion at its new smelter in December last year. Production from Northam should also strengthen, while Aquarius will produce higher volumes of platinum in concentrate as mining at its Marikana mine ramps up. Output is also building at SouthernEra's Messina mine.

Russian sales of platinum are predicted to slip to 950,000 oz in 2003, down from 980,000 oz the previous year. Mine production from Norilsk Nickel and the alluvial producers in the east of Russia is expected to remain fairly stable but it appears likely that less metal will be sold from central government stocks this year.

Supplies of platinum from **North America** are forecast to fall by over 100,000 oz in 2003 to 285,000 oz. Inco is expected to ship less than half the volume of platinum that it produced in 2002, having exhausted a pgm-rich ore-body and suffering a three-month strike. Production of platinum in **Zimbabwe**, however, will almost double to 141,000 oz as a result of expansions implemented by ZCE Platinum and Zimbabwe Platinum Mines Ltd.

Demand

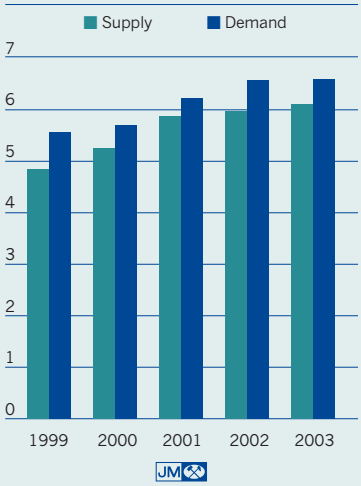
A record total of 3.18 million oz of platinum are forecast to be purchased for **autocatalyst** manufacture in 2003, up by 20 per cent on the previous year. A 310,000 oz surge in US purchases of platinum to 880,000 oz will lead the growth. Buying has increased because certain US auto companies have used far less platinum from inventories during 2003 than they did in 2002.

In addition, as a result of the sometimes considerable lead times required to implement changes to autocatalyst pgm ratios, platinum demand in the USA has continued to benefit this year from decisions taken in 2000 and 2001 to switch certain emissions systems from palladium-rich to platinum-rich catalyst formulations.

In Europe, autocatalyst demand for platinum will be powered to a new high of 1.37 million oz by another impressive rise in sales of diesel cars. Diesels are forecast to account for over 43 per cent of the new car market in 2003.

Supply and Demand for Platinum 1999-2003

Million oz



The approach of more stringent emissions regulations in Europe will also contribute to the growth in platinum demand in 2003. An increasing number of new vehicle models already meet the Euro IV standards that will become effective in 2005. These will require substantial reductions in emissions of all major pollutants and in some cases auto manufacturers have increased overall pgm loadings across catalyst systems in order to achieve them. In the diesel sector, platinum-catalysed diesel particulate filters (DPF) are also being introduced on some larger, heavier car models to ensure compliance with tighter particulate matter emission limits.

Japanese autocatalyst demand for platinum will be boosted substantially in 2003 by a new regulation ordering the retrofitting of oxidation catalysts and DPF to heavy-duty diesel vehicles operating in the Tokyo metropolitan area. This will be largely responsible for total Japanese autocatalyst demand for platinum increasing by a predicted 14 per cent to 490,000 oz.

In the Rest of the World, rising light vehicle output and tightening emissions regulations (notably in China and India) are expected to produce a 16 per cent increase in autocatalyst demand for platinum to 440,000 oz.

Lower purchases of metal by Japanese and Chinese manufacturers are forecast to result in demand for platinum in **jewellery** fabrication dropping by 13 per cent in 2003 to 2.45 million oz. In China, demand for platinum for jewellery fabrication is projected to slide to 1.2 million oz – 280,000 oz lower than in 2002 but still the second highest year of demand on record. The SARS outbreak in the first half of the year caused a temporary slump in retail sales of virtually all non-essential items in China, including platinum jewellery. On top of this, many manufacturers of platinum jewellery have held back from purchasing metal on a number of occasions when Chinese retail prices have lagged behind the rapidly rising platinum spot price.

There has not, however, been any discernable weakening of Chinese consumers' demand for platinum jewellery. Leading jewellery stores noted a rebound in platinum sales over the summer once the SARS epidemic had faded. Trade was also reported to be good over the National Day holiday period in early October, despite higher retail prices.

Purchases of platinum by the Japanese jewellery industry are expected to tumble by 15 per cent in 2003 to 665,000 oz – around half the level of demand four years ago. Although retail sales of platinum jewellery are predicted to fall year-on-year, the drop in platinum demand from the industry will mainly be due to an unexpectedly high level of platinum jewellery being recycled. In addition to further cuts in inventories held by the jewellery trade, stock liquidated from bankrupt companies has resulted in a substantial volume of secondary metal being reused. There is also evidence that sales back to the market of old jewellery by consumers have increased.

Industrial applications are expected to consume 1.6 million oz of platinum in 2003, broadly in line with 2002. The use of platinum-based process catalysts by the chemical industry will increase in Asia as demand for silicones grows. This, however, will be offset by softer demand for platinum catalysts from the bulk chemicals industry in Europe and USA. Consumption of platinum gauze by the nitric acid industry will also weaken – the net result is forecast to be a slight drop in total chemical demand for platinum to 325,000 oz.

The use of platinum in electrical applications is forecast to rise by 4 per cent to 395,000 oz due to small but growing consumption of the metal in fuel cell development programmes and an upturn in demand for high temperature thermocouples. Purchases by the glass industry will soften but remain good by historical standards. Use of platinum in petroleum reforming catalysts and most other applications is projected to be stable in 2003.

The rising price of platinum during the first 10 months of 2003 led to an increase in sales back to the market of large **investment** bars of platinum in Japan. Over the course of the year, the rate of disinvestment is expected to outweigh new purchases of the metal. Higher platinum prices have also reduced sales of coins to collectors in North America and the net level of demand for physical investment products is predicted to drop to 10,000 oz.

Outlook

In the autocatalyst market, another rise in diesel car sales in Europe is expected to drive a further strong increase in demand for platinum in the region in 2004. The tightening of emissions regulations in Europe, Japan, China and elsewhere is also expected to lead to higher average loadings of platinum, particularly on light-duty diesel vehicles as particulate matter emissions become more closely controlled. In the USA, however, thrifting is continuing at some

manufacturers and is likely to lead to a reduction in the underlying consumption of platinum on autocatalysts in 2004. There is also a question mark over how well light vehicle sales will hold up in the USA next year, particularly if interest rates start to rise or if auto makers scale back their incentive programmes.

The price differential of over $500 between platinum and palladium has led to the assumption that auto manufacturers will change pgm ratios on gasoline vehicle catalyst systems in favour of palladium at the expense of platinum, reversing the trend of the past two years. This may occur to a certain extent but changes are likely to be phased in gradually as new car models are launched; the cost involved in recalibrating and recertifying existing models is often prohibitive.

Furthermore, the attitude of auto companies to pgm purchasing and use varies considerably. Many remain wary of becoming too heavily dependent on palladium in light of the volatile behaviour of its price over the last four years. In addition, the cost of the entire emissions system and its durability and performance are of greater concern than short-term changes in the relative prices of platinum and palladium.

A resumption of growth in demand for platinum from Chinese jewellery fabricators in 2004 will depend to a large extent on the relationship between the platinum spot price and retail prices of jewellery in the country. When retail prices are static and the spot price rises, manufacturers' margins become squeezed and they tend to defer purchases of platinum until either the spot price of the metal falls or retail prices are raised.

It would be surprising if purchases of platinum by Japanese jewellery manufacturers did not improve in 2004, following the exceptionally high level of stock recycling seen this year. At the retail level, however, further increases in the platinum price would put more pressure on sales of lower-priced fashion products. That is also true of the US market, where the popularity of platinum bridal jewellery has been growing but retailers face having to cut margins on fashion items in order to accommodate higher metal prices. The UK market remains the high point in Europe, where sales of platinum engagement rings and wedding bands continue to grow.

Demand for platinum-based chemical catalysts and from most other industrial applications is expected to be more or less flat in 2004. On the investment side, further increases in the platinum spot price could lead to a greater volume of sales back to the market of investment bars in Japan and the start of significant disinvestment in the USA.

Platinum supplies from South Africa are projected to increase substantially in 2004, as all the major producers raise output from both existing and developing operations. The outlook is clouded by some uncertainty, however, as the appreciation of the South African rand in 2003 and the proposed Royalty Bill are causing companies to re-evaluate a number of potential new projects.

North American production of platinum should also improve markedly in 2004 as Inco's output this year has been badly affected by a three-month strike. Russian sales are expected to be at or close to the level of mine production. Data on the latter are likely to be declassified in 2004, enabling Norilsk Nickel to publish pgm production figures for the first time.

Overall, we expect supplies to rise faster than the growth in platinum demand in 2004, leading to a continuing but substantially reduced market deficit. Fund activity is likely to continue to have a major, if unpredictable, influence on the platinum price in the short term, whether through additional buying of the metal or liquidation of existing long positions. We therefore expect prices to trade between $700 and $820 over the next six months.

Sales of diesel cars have continued to climb in Europe, spurring autocatalyst demand for platinum.

Palladium

● Demand for palladium is forecast to rebound by more than 16 per cent in 2003 to 5.65 million oz.

● Purchases of palladium for autocatalyst manufacture are projected to jump by 19 per cent to 3.67 million oz as auto makers source much less metal from stocks than in 2002.

● At 985,000 oz, demand for palladium from the electronics industry will also rise substantially in 2003, stocks having been exhausted the previous year.

● The use of palladium in dental alloys will improve by 6 per cent to 815,000 oz as lower prices enable the metal to regain some market share.

● Supplies of palladium will surge to a forecast 6.32 million oz in 2003 as Russian sales bounce back to become more closely aligned with production.

● With the market increasingly oversupplied, the palladium price slid from a high of $271 in January to $144 in April. Strong speculative buying by funds then fuelled a rally that peaked at $232 in September.

Overview

Global demand for palladium is forecast to recover to 5.65 million oz in 2003, an increase of 800,000 oz on the previous year. Most of the growth, however, will result from much lower use of stockpiled palladium by the auto industry – actual consumption of the metal is projected to weaken by 5 per cent as thrifting continues in the autocatalyst and electronics markets.

Supplies of palladium are expected to surge compared with 2002, when little Russian metal was sold on the spot market. Russian sales will more closely match production in 2003 and total supplies will rise by 20 per cent to 6.32 million oz. As a result, the surplus of supply over demand will expand to 670,000 oz.

The palladium spot price fell from $271 in early January to $144 in April, a reflection of the weak market fundamentals. Speculative buying by funds then produced a rally to $232 in September.

Purchases of palladium for **autocatalyst** manufacture are forecast to climb by 580,000 oz to 3.67 million oz in 2003. US auto makers have continued to run down stocks of palladium but the rate of inventory use has been far lower than in 2002. However, ongoing thrifting programmes will reduce actual use of palladium on autocatalysts. In Europe, demand for palladium will fall due to lower gasoline vehicle production as diesel car sales continue to grow.

In the **electronics** industry, component manufacturers ran down excess palladium inventories in 2002 and so purchases of the metal are projected to increase by 31 per cent this year to 985,000 oz. The use of palladium in component production, however, will decrease as thrifting and miniaturisation continue.

The use of palladium in **dental** alloys is expected to improve to 815,000 oz in 2003 as the fall in the price of the metal (and the rise in that of gold) has enabled palladium alloys to regain market share.

In contrast to 2002, Norilsk Nickel is expected to sell all of its palladium production in 2003 and so **supplies** from Russia are forecast to jump to 2.95 million oz. Growing output in South Africa and Zimbabwe will outweigh a fall in North American production.

With total supplies rising faster than purchases, the palladium **price** fell sharply during the first four months of 2003. Thereafter, the price has been influenced more by fund activity; speculative purchasing of futures, options and physical metal propelled the palladium price from $144 in April to $232 in September. A degree of long liquidation during the first half of October, however, pushed the price back under $200.

Supply

In an effort to support the palladium price, Norilsk Nickel held back from the spot market in 2002. This year, however, Norilsk expects to sell its full production of palladium and so total **Russian** shipments are forecast to rebound by 53 per cent to 2.95 million oz.

South African supplies of palladium are projected to rise to 2.28 million oz in 2003, with an increasing contribution from projects mining UG2 ore. The UG2 ore generally has a higher palladium content than the Merensky Reef, particularly on the Eastern Bushveld where several major new mines are being developed.

Palladium output will also rise significantly in **Zimbabwe**, in line with growing platinum production, but will fall in **North America** due to lower output from both Stillwater Mining and Inco.

Stillwater gained just over 877,000 oz of palladium when the acquisition by Norilsk Nickel of a majority shareholding in the company was completed in June 2003. This metal had not been sold by mid-October and is not included in our supply figures.

Demand

Total demand for palladium used in **autocatalysts** is forecast to jump by 19 per cent to 3.67 million oz in 2003. We predict that US auto makers will use around 1 million oz less palladium from stocks in 2003

Palladium Supply and Demand
'000 oz

	2002	2003
Supply		
South Africa	2,160	2,280
Russia	1,930	2,950
North America	990	850
Others	170	240
Total Supply	**5,250**	**6,320**
Demand		
Autocatalyst: gross	3,090	3,670
recovery	(370)	(410)
Dental	770	815
Electronics	750	985
Other	610	590
Total Demand	**4,850**	**5,650**
Movements in Stocks	**400**	**670**

than they did last year. Purchases of metal by the US auto industry, therefore, will rise dramatically from 640,000 oz in 2002 to 1.31 million oz in 2003.

Although light vehicle sales have held up well in the USA in 2003, vehicle production is set to fall year-on-year as inventories of new cars at showrooms are reduced. In Europe, production of gasoline light vehicles will also fall as diesels take further market share, leading to a drop in palladium demand.

In Japan, higher average palladium loadings to meet lower emissions targets will contribute to a moderate increase in demand. In the Rest of the World, thrifting and lower gasoline vehicle production in countries such as Mexico and South Korea will outweigh the effect of higher car output in China and India.

Demand for palladium from the **electronics** industry is projected to improve by almost a third in 2003 to 985,000 oz – a consequence of the fact that substantial inventories were worked off during 2002 and so manufacturers have purchased more metal this year. However, the underlying use of palladium in electronics will weaken due to thrifting and a reduction in the average size of components. In addition, nickel-based multi-layer ceramic capacitors (MLCC) have continued to increase their market share.

Dental alloys based on palladium will regain some ground in 2003, and total demand is expected to recover to 815,000 oz. The fall in the price of palladium (coupled with the strength of the gold price) has improved the competitiveness of palladium alloys.

Outlook

Auto industry demand for palladium is forecast to increase further in 2004. Average loading levels are expected to rise in Europe and Japan in the run up to the introduction of tighter emissions regulations. With inventories reduced sharply, purchases by US auto makers are likely to increase again.

A shift towards greater use of palladium in preference to platinum on gasoline vehicle autocatalysts by a number of auto companies is also likely to provide a moderate boost to palladium demand in Europe and Asia in 2004. In Europe, however, output of gasoline cars is expected to fall once again as diesel sales continue to rise and this will offset some of the growth expected through switching. Some US auto manufacturers may also shift pgm ratios more in favour of palladium but this will be substantially outweighed by further thrifting.

Monthly High, Low and Average Prices of Palladium 1999-2003

In the electronics industry, component orders are expected to accelerate, but a combination of further thrifting, miniaturisation and substitution of palladium by nickel in MLCC will reduce demand for palladium.

Supplies of palladium are forecast to rise rapidly in 2004 as output accelerates from new mines in South Africa. North American demand should also rebound as Inco's pgm output recovers from the effects of a three-month strike this year.

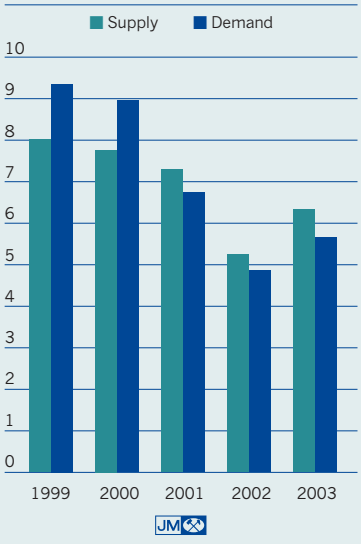
Russian palladium shipments are again expected to be broadly in line with mine production in 2004. Norilsk Nickel may soon be able to release detailed figures on its reserves, production and sales of pgm following the passage of a bill through the Russian parliament in October 2003. This will now be sent to the President for final approval. Data on government stocks of pgm will remain classified for the time being.

Fund purchasing of palladium provided considerable support to the price during the second and third quarters of 2003 and undoubtedly led to the build up of substantial inventories of palladium through over-the-counter trades. A further 195,000 oz were held in NYMEX warehouse stocks as of October 2003, and the 877,000 oz of metal transferred from Norilsk to Stillwater Mining earlier in the year remained unsold.

As mine supply is forecast to rise faster than demand in 2004, the palladium market surplus will increase further. With the potential of long liquidation of fund positions, and the sale of metal from Russian government and other stocks also possible, little upside to the price is foreseen. Consequently, we expect palladium to trade between $140 and $220 for the next six months.

Supply and Demand for Palladium 1999-2003

Million oz



Supplies, Mining and Exploration

South Africa

Supplies of platinum from South Africa are forecast to grow by 4.5 per cent in 2003, reaching 4.65 million oz. A substantial build-up of metal in processing pipelines occurred during the first half of the year due both to new plant construction and to the repair and rebuilding of existing facilities. Palladium output is expected to climb to 2.28 million oz, while rhodium sales should reach 520,000 oz.

Anglo Platinum

Anglo Platinum's production of platinum in concentrate grew significantly during the first half of 2003 but refined platinum production slid by 12 per cent year-on-year to 915,100 oz due to a 205,000 oz increase in pipeline stocks. This was a result of the simultaneous commissioning of the Anglo Platinum Converting Process (ACP), a slag cleaning furnace at Rustenburg, and the new smelter at Polokwane. A substantial proportion of the inventory should be released by the end of 2003 and refined platinum output for the full year is expected to reach 2.3 million oz. This, however, would be 100,000 oz short of the 2.4 million oz of production planned for the year.

Of Anglo Platinum's established mines, PPRust performed well during the first half of the year, recovering from the problems caused by mining a low grade intrusion in 2002. At Union, mining of UG2 boosted the tonnage of ore milled by 30 per cent, while there was an improvement in recoveries at Rustenburg. At Amandelbult, output of platinum in concentrate fell due to lower mill throughput and grades.

At the group's developing operations, grades and recoveries improved at the Bafokeng-Rasimone Platinum Mine and there was a jump in the tonnage milled from the Rustenburg UG2 Phase 1 project. On the eastern limb of the Bushveld Igneous Complex, the ramp up of production at Modikwa accelerated.

In June, Anglo Platinum concluded a Pool and Share Agreement with Aquarius Platinum under which the assets of the Kroondal Platinum mine will be combined with a proportion of Anglo Platinum's UG2 reserves to the north and east of Kroondal. This will enable production at Kroondal to be more than doubled to around 500,000 oz pgm per annum by 2006. Output will be split 50:50 between the two partners once Kroondal's existing offtake agreement with Impala Platinum expires.

PGM Supplies: South Africa
'000 oz

	2002	2003
Platinum	4,450	4,650
Palladium	2,160	2,280
Rhodium	490	520

Impala Platinum

Impala Platinum produced a total of 495,000 oz of refined platinum from its core lease area during the first six months of 2003, a 4.4 per cent decrease compared with the previous year. Mill throughput was affected by a 10-day strike in March, although the effects of this were partly offset by the mining of additional Merensky ore from opencast operations.

At the new Marula mine on the eastern Bushveld, production from stoping is expected to begin before the end of 2003. A feasibility study on the Two Rivers joint venture with Anglovaal Mining and the TISO consortium is in its final stages and a decision on the project's development is expected shortly.

The Crocodile River mine, in which Impala holds an 83 per cent interest, experienced numerous difficulties during the first half of 2003 as the operation moved to fully underground mining. Unstable hanging walls, undulating reef and poor ground conditions all hampered mining and increased costs. As a result, the operation yielded just 8,210 oz of platinum during the first six months of the year. A decision on the future of Crocodile River is expected by the end of 2003.

Impala raised its stake in Zimbabwe Platinum Mines Ltd (Zimplats) to 82.5 per cent (as of mid-September) via the acquisition of Absa Bank's 14.8 per cent shareholding and a subsequent offer to minority shareholders. Meanwhile, Impala has committed to the sale of its 27 per cent interest in the operations of Eastern Platinum Ltd and Western Platinum Ltd (Lonmin owning the balance). Under the proposal, Lonmin will acquire a further 9 per cent stake in the operations from Impala. The remaining 18 per cent will be vested into a new company in which a black economic empowerment partner will be sought to acquire a controlling share.

Lonmin

Lonmin's expanding mining operations performed well during the first nine months of 2003, with production at the Newman shaft ramping up quickly and the introduction of opencast UG2 mining proving highly successful. Production of platinum in concentrate for the financial year ending 30th September was forecast to exceed Lonmin's target of 870,000 oz. After an explosion at its new smelter in December 2002, the company recommissioned four older furnaces to smelt a proportion of its concentrate output and signed a toll refining contract with Impala

Supplies

for the remainder. Lonmin's rebuilt and modified smelter is due to be brought back into service in December 2003, and the company intends to produce 910,000 oz of platinum in its 2004 financial year.

Northam Platinum

Northam Platinum produced just under 333,000 oz pgm in concentrate in the year ended 30th June 2003, a 22 per cent rise on the previous strike-hit year and the company's highest output to date. The availability of Merensky Reef ore reserves increased substantially and accounted for a greater proportion of output, while the total tonnage of ore milled climbed to 2.22 million tonnes. A scheduled rebuild of the company's smelter was completed during the first quarter of the year and the inventory accumulated during that time is steadily being released.

Aquarius Platinum

Aquarius Platinum's pgm output climbed to 150,727 oz during the first half of 2003, up by 25 per cent compared with the preceding six months. A fall in production at Kroondal was more than offset by the ramp up of mining at Marikana and the expansion of the Mimosa mine in Zimbabwe (operated by ZCE Platinum, a 50:50 joint venture with Impala).

Operations at the Kroondal mine were adversely affected during the first half of 2003 by geological problems but these difficulties had largely been overcome by the middle of the year. Aquarius is now targeting a 10 per cent increase in output to over 22,000 oz pgm per month. The Pool and Share Agreement with Anglo Platinum will see output at Kroondal rise to just over 500,000 oz pgm per annum by 2006, of which half will be attributable to Aquarius. The mine life will be extended by eight years to 2016.

At Marikana, the proportion of competent, unweathered ore mined is steadily rising and recoveries are expected to improve into 2004 as a result. Construction at the Everest South project is scheduled to start in early 2004, subject to financing, while in Zimbabwe the underground expansion at Mimosa is due for completion by the end of 2003.

SouthernEra

The rapidly developing Messina mine produced 16,500 oz of pgm plus gold during the first half of 2003. The mine will reach a production rate of 80,000 tonnes of ore per month during the fourth quarter, slightly behind schedule, and is expected to hit planned capacity of 120,000 tonnes per month (around 200,000 oz per annum of pgm plus gold) during the second quarter of 2004. A feasibility study currently underway on possible joint development of phases 2 and 3 at Messina is due to be completed early in 2004.

Banks of flotation cells at Norilsk Nickel's Talnakh operation on the Taimyr Peninsula in Siberia.

Russia

Sales of platinum and palladium by Russia in 2003 are expected to be close to mine production. At an estimated 950,000 oz, platinum shipments will be similar to last year, but those of palladium are expected to climb by 53 per cent to 2.95 million oz. Norilsk Nickel was absent from the palladium spot market for much of 2002 but expects to sell all its output in 2003 through a mixture of contracts and spot sales. Shipments of rhodium, at 100,000 oz, are once again expected to exceed production.

In March 2003 the board of Norilsk Nickel approved a 'Production Plan to 2015' for its nickel-copper-pgm operations in the Taimyr and Kola Peninsulas. Under the plan Norilsk intends to adjust metal production in line with expected market demand; increase production and cost efficiencies; mitigate the environmental impact of its operations; and ensure their sustainability. Mine production in the Taimyr Peninsula, where the vast majority of the company's pgm originates, is forecast to remain at approximately 14 million tonnes of ore per year. Although the mix of ores mined will change, production of platinum and palladium are expected to stay close to current levels.

PGM Supplies: Russia
'000 oz

	2002	2003
Platinum	980	950
Palladium	1,930	2,950
Rhodium	90	100

PGM Supplies: North America
'000 oz

	2002	2003
Platinum	390	285
Palladium	990	850
Rhodium	25	21

However, Norilsk has the potential to expand pgm output by processing stored pyrrhotite and other concentrates, if market developments warrant it.

Norilsk completed the acquisition of a majority shareholding in Stillwater Mining during the first half of the year. Under the terms of the deal, the two companies may subsequently negotiate an agreement under which Stillwater would market up to 1 million oz per annum of Norilsk's pgm output to North American consumers. However, no progress on this had been reported by October 2003.

The two other main sources of platinum in Russia are the alluvial operations at Kondyor and Koryak in the Far East region. Both operations have already mined the richest parts of their deposits, but production at Kondyor, at least, is being sustained by treating larger volumes of slightly lower grade materials than in the past.

North America

North American shipments of platinum will fall substantially in 2003, due primarily to exhaustion of a high pgm-grade ore zone and a three-month strike at Inco's Ontario operations. Production is likely to increase at North American Palladium but will fall at Stillwater Mining. The overall result is forecast to be a 27 per cent slide in platinum output to 285,000 oz and a 14 per cent decrease in palladium production to 850,000 oz.

The acquisition by Norilsk Nickel of a 50.8 per cent shareholding in Stillwater Mining in exchange for $100 million and approximately 877,000 oz of palladium was completed in June. Norilsk, through its subsidiary Norimet, subsequently increased its holding to 55.5 per cent via a cash offer to shareholders.

Over the first nine months of 2003, Stillwater produced a total of 337,000 oz palladium and 100,000 oz platinum, down by around 7 per cent year-on-year. At the Stillwater mine, emphasis has been placed on reducing costs and improving profitability rather than on maximising volumes. The mine produced 322,000 oz of palladium plus platinum during the first three quarters of 2003 compared to 380,000 oz in the same period of 2002 as mill throughput fell. The developing East Boulder mine produced 115,000 oz of pgm over the first nine months of 2003, a 28 per cent increase year-on-year.

As of October, Stillwater was continuing to seek long-term sales contracts with North American consumers for the 877,000 oz of palladium inventory it gained under the Norilsk deal.

North American Palladium's Lac des Isles mine produced 195,000 oz palladium during the first nine months of 2003, with platinum output reaching 16,000 oz. The company's new primary crusher was commissioned in June and as a result, mill throughput in the third quarter was the mine's highest ever.

Inco's production of by-product pgm from its nickel mining and smelting operations will fall substantially in 2003 from the record 431,000 oz pgm produced last year. The company had expected output to drop to around 355,000 oz of pgm in 2003 following the exhaustion of a high grade ore zone at its Copper Cliff North Mine. However, the 13-week strike that affected Inco's Ontario operations during the summer will reduce annual output by around a further 85,000 oz. The company predicts that pgm output will recover to around 400,000 oz in 2004.

At Falconbridge's Sudbury nickel mines, lower tonnages and grades during the first half of the year were offset by improved recoveries at the company's smelter. Overall output at the Raglan mine in northern Quebec improved year-on-year as higher grades and recoveries outweighed lower mine output.

Zimbabwe

The Zimbabwean pgm industry is expanding rapidly as the operations of ZCE Platinum (Mimosa) and Zimplats (Ngezi) build towards capacity. Total platinum production is forecast to almost double this year to 141,000 oz.

Zimplats, in which Impala Platinum now holds an 82.5 per cent interest, continued to build production from its open pit operations at Ngezi during the first half of 2003, with total output of pgm in matte from the Selous metallurgical complex expected to reach 170,000 oz for the year. Trial underground mining is well underway and a bankable feasibility study based on a decline shaft capable of producing an additional 190,000 oz pgm plus gold per annum is due for completion before the end of the year.

At Mimosa the volume of ore produced and milled has expanded rapidly since a new crusher and concentrator were commissioned in the second half of last year. In the first six months of 2003, the operation milled 566,000 tonnes of ore yielding 26,600 oz platinum and 18,450 oz palladium.

PGM Supplies: Zimbabwe & Others
'000 oz

	2002	2003
Platinum	150	225
Palladium	170	240
Rhodium	9	14

Platinum

Platinum

Autocatalyst

Demand for platinum from the autocatalyst sector is forecast to increase by 20 per cent in 2003 to 3.18 million oz. Purchases of platinum by the North American auto industry will rise significantly because less metal has been sourced from inventories compared with 2002. In Europe, growth in diesel car sales continues to be the primary driver of increasing platinum demand. The retrofitting of catalysts and particulate filters to heavy-duty diesel vehicles in Tokyo will boost Japanese platinum demand this year, whilst surging car sales in China will also increase platinum consumption.

Europe

Demand for platinum from auto makers in Europe is projected to climb by 9 per cent to 1.37 million oz this year. The growth in sales of diesel powered cars continues to drive rising autocatalyst demand for platinum in the region. Sales of diesels in January through to July increased by almost 4 per cent, at a time when the overall European car market was contracting. The market share of diesel powered cars is forecast to reach 43 per cent by the end of 2003, equivalent to well in excess of 6 million vehicles.

The approach of new Euro IV emissions standards is also causing greater use of pgm in the emissions systems of certain models. This is particularly true of the diesel sector – average platinum loadings on oxidation catalysts have increased and some larger passenger vehicles are also being fitted with platinum-coated diesel particulate filters in order to meet Euro IV standards. However, other particulate filter systems are available that do not utilise platinum – an alternative based on a fuel-borne cerium catalyst is in use.

The large price differential between platinum and palladium has led some European auto manufacturers to re-examine their use of pgm on gasoline cars. There was a degree of switching to greater use of platinum following the palladium price spike in 2000 and 2001, and this trend may be reversed. However, any reduction in platinum demand from switching will be outweighed by continuing growth in diesel car sales and further rises in average loadings as emissions legislation tightens. Industry forecasts suggest that diesels could account for more than half of all new car sales in Europe by 2006, and manufacturers continue to expand their ranges of diesel models.

Japan

Japanese car production is forecast to fall by 3.8 per cent in 2003 due to a drop in the number of vehicles produced for export. However, despite the predicted fall in Japanese auto production, platinum demand in 2003 is forecast to increase by 14 per cent to 490,000 oz, more than double the level of demand five years ago. A substantial proportion of the growth this year will be attributable to a Tokyo Government regulation that came into effect in October. This lowered particulate matter emission limits for heavy-duty diesel vehicles operating within the Tokyo metropolitan area. Vehicles that do not meet the new standards must be modified and in most cases this will involve the fitment of an oxidation catalyst or diesel particulate filter.

Voluntary NOx and particulate matter emissions standards for new heavy-duty diesel trucks and buses were also introduced nationwide in October but will not necessitate the fitment of after-treatment equipment to all vehicles. Tighter statutory limits, however, will follow in 2005 and are likely to result in the widespread use of exhaust after-treatment devices.

Japanese auto manufacturers' pgm purchasing strategies have not tended to be influenced by short-term price volatility. Most Japanese auto companies, therefore, remain significant users of platinum in autocatalysts fitted to gasoline vehicles for the domestic market and are unlikely to alter pgm ratios on current models.

North America

Purchases of platinum by the US auto industry are forecast to increase by 54 per cent in 2003 to 880,000 oz. Although some US manufacturers have continued to run down platinum inventories, the scale of stock use has been much lower than in 2002. The result is that purchases of platinum will rise by 310,000 oz.

The effect of decisions taken in 2000 and 2001 to switch from palladium-rich to platinum-rich catalyst formulations on certain new vehicle models will continue to influence platinum demand in the USA this year. This reflects the long lead times that can occur between design and certification of an emissions system and the launch of the vehicle model it is fitted to.

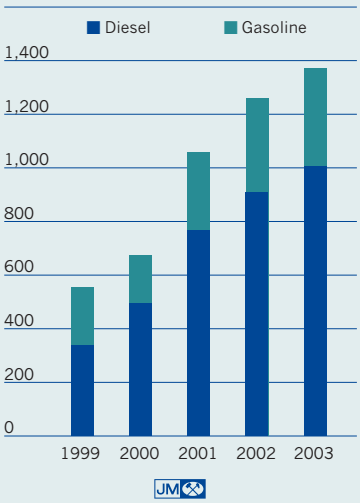
In addition, an increasing number of heavy-duty diesel trucks, buses and construction vehicles in the USA are being retrofitted with oxidation catalysts and diesel particulate filters under a voluntary programme

Platinum Demand: Autocatalyst
'000 oz

	2002	2003
Europe	1,260	1,370
Japan	430	490
North America	570	880
Rest of the World	380	440
Total	**2,640**	**3,180**
Autocatalyst recovery	**(570)**	**(650)**

JM

European Demand for Platinum in Autocatalysts 1999-2003
'000 oz



JM

Lambda or oxygen sensors, which contain platinum electrodes, are essential components of auto emissions control systems. By continuously monitoring the engine exhaust composition they enable catalytic converter efficiency to be maximised.

administered by the Environmental Protection Agency. This will also contribute to the increase in autocatalyst demand for platinum in 2003.

After slowing during the first four months of the year, when economic uncertainty and the Iraq conflict damaged consumer confidence, light vehicle sales in the USA have accelerated and are on course to reach 16.4 million for the year. Production, however, has fallen as inventories of unsold cars have been reduced and imports have claimed a larger share of the US market. Total light vehicle output in 2003 is forecast to slip by 2.6 per cent to 11.7 million units.

Given the differential between the platinum and palladium price, the use of platinum in autocatalysts is likely to be minimised on some new vehicle models launched over the next two to three years through switching to palladium-dominant catalysts. However, a high degree of caution remains amongst auto companies due to the past price volatility of palladium. Many will leave pgm ratios unchanged, regardless of short-term price movements, and will prefer to focus on thrifting overall pgm loadings further.

Rest of the World

Platinum demand in the Rest of the World is predicted to rise by 16 per cent in 2003 to 440,000 oz, driven by the continuing rapid growth of car sales in China and the introduction of more stringent emissions regulations.

The car market in China, although still relatively small, is growing at a tremendous rate: sales of passenger cars during the first eight months of 2003 soared by almost 90 per cent to 1.25 million. The Chinese National Statistics Bureau forecasts that total car production for the full year could reach 1.8 million.

China is rapidly following the European model of emissions regulation. Euro II standards were introduced in Beijing at the start of 2003 and will be enforced nationwide from July 2004. Beijing is targeting a substantial improvement in air quality ahead of the 2008 Olympic Games in the city and Euro III emissions limits may apply from 2005.

Indian light vehicle production and sales are also on course for a strong year, with light vehicle output expected to near 1 million units in 2003.

Autocatalyst Recovery

The total volume of platinum recovered from scrapped autocatalysts is projected to grow to 650,000 oz in 2003, an increase of 14 per cent. Recovery will rise in all regions, due in part to the strength of the platinum price. As in 2002, however, the fastest growth will be seen in Europe where collection rates are improving from a relatively low level and a rising proportion of cars being scrapped are fitted with catalytic converters. The European End of Life Vehicle directive that comes into effect in 2005 has also stimulated the development of recycling infrastructure. The collection of catalytic converters from scrapped vehicles in regions such as Latin America and Asia is also increasing, although from very low initial rates.

Jewellery

Total demand for platinum used in jewellery fabrication is forecast to slip by 13 per cent to 2.45 million oz in 2003. Chinese purchases of platinum for jewellery fabrication will drop for the first time in more than a decade as manufacturers react to increases in the spot price. Japanese purchases will also drop sharply as yet more metal is recycled from inventories, notably from the liquidation of stock from companies that have gone out of business. This will greatly outweigh a small improvement in platinum demand in the US jewellery market.

Europe

European jewellery demand for platinum is predicted to grow modestly in 2003, rising by 3 per cent to 165,000 oz. The volume of platinum jewellery hallmarked in the UK jumped by almost a third over the first nine months of 2003, exceeding 60,000 oz.

The volume of both domestic and imported jewellery submitted for certification climbed. The growth of the UK market is primarily a result of increasing penetration of the bridal market by platinum.

In contrast, German retail sales of platinum jewellery remain depressed by the weakness of the economy. In the current economic climate, retailers are better able to market white gold and non-precious metal jewellery to price-conscious consumers. Jewellery fabricators' demand for platinum is likely to fall by up to 10 per cent in 2003, with most major manufacturers targeting export sales in order to offset the tough conditions at home.

The Italian market is expected to be broadly flat in 2003, supported by the core bridal sector. Demand for platinum from the Swiss jewellery industry is expected to soften for the second year in succession in 2003, following exceptionally good sales in 2001. Fabrication of platinum jewellery other than watches is forecast to increase moderately but this will be offset by a drop in the number of platinum watchcases manufactured.

Japan

The Japanese jewellery industry as a whole continues to suffer from the uncertain economic outlook, with consumer spending on luxury items under pressure. Platinum purchases by jewellery fabricators are forecast to drop by 15 per cent in 2003 to 665,000 oz – half the level of demand four years ago.

Retail sales of platinum jewellery in Japan are set to fall again this year, and purchases of platinum by manufacturers have also been affected by an unexpected increase in the level of inventory being recycled. This is due, in part, to ongoing efforts by retailers and wholesalers to keep stock levels to a minimum. However, bankruptcies in the jewellery industry have been running at a high rate and the liquidation of the assets of bankrupt companies has contributed a substantial volume of secondary platinum to the jewellery supply chain in 2003.

At the retail end of the market, sales of jewellery of all precious metal types declined during the first half of the year. Sales of platinum fashion jewellery continued to face strong pressure from white gold, with the average price of platinum climbing from around ¥2,400 per gram in January to ¥2,600 in September. In the bridal and luxury sectors of the market platinum has fared better and the metal's share of wedding ring sales has actually increased, although overall sales of platinum jewellery are still expected to fall year-on-year. It is noticeable, however, that white remains the preferred colour of precious metal jewellery for Japanese consumers – sales of yellow gold jewellery continue to be heavily cannibalised by white gold.

North America

Platinum demand from jewellery fabricators in North America is forecast to rise by 5 per cent in 2003 to reach 325,000 oz. Platinum's position in the bridal market continues to strengthen in the USA, underpinning demand, but meeting price points at the fashion end of the market remains challenging.

Consumer confidence in the USA has improved but remains fragile. Retailers, therefore, are cautious about prospects for the remainder of the year. Although demand for platinum benefited from a degree of stock replenishment during the second quarter of 2003, most jewellery stores and wholesalers continue to keep inventory levels to a minimum. The level of retail sales over the Christmas 2003 holiday period will have a strong influence on manufacturer demand for platinum in the first quarter of 2004.

Rest of the World

Purchases of platinum for jewellery fabrication in the Rest of the World region are forecast to fall by 18 per cent in 2003 to 1.295 million oz, due almost entirely to weaker demand from Chinese manufacturers. After a decade of rapid growth, Chinese purchases of platinum for jewellery fabrication are expected to drop to 1.2 million oz this year, down 19 per cent from the peak of 1.48 million oz in 2002.

Demand from Chinese jewellery fabricators was noticeably weak during the first half of the year, due to a combination of the rapidly rising and volatile platinum spot price, and the impact that the SARS outbreak had on retail sales. While the platinum spot price climbed retail prices remained static, and jewellery manufacturers and wholesalers saw profit margins decline sharply. A swift correction downwards in the spot price in early April resulted in margins recovering, and Chinese fabricators subsequently stepped up their purchasing ahead of the Labour Day holiday period. However, as the SARS crisis began to deepen, retail sales slumped and demand for metal from manufacturers lagged behind the levels seen in 2002. Much of the consumer spending, however, was only deferred for a short time and leading retailers

Platinum Demand: Jewellery
'000 oz

	2002	2003
Europe	160	165
Japan	780	665
North America	310	325
Rest of the World	1,570	1,295
Total	**2,820**	**2,450**

Platinum Demand: Industrial
'000 oz

	2002	2003
Chemical	330	325
Electrical	380	395
Glass	255	245
Petroleum	130	130
Other	495	505
Total	**1,590**	**1,600**

Platinum Demand: Investment
'000 oz

	2002	2003
Coins and small bars		
Europe	0	0
Japan	5	5
North America	40	25
Rest of the World	0	0
	45	**30**
Large bars in Japan	**35**	**(20)**
Total	**80**	**10**

reported good sales of platinum jewellery over the summer.

The advent of platinum trading on the Shanghai Gold Exchange (SGE) in mid-August was a positive development for the Chinese platinum jewellery trade. It marked a continuation of the liberalisation of the Chinese precious metals sector, and brought the taxation of platinum closer in line with that of gold. The volume of platinum traded through the SGE climbed during the first three weeks of September, and totalled almost 80,000 oz for the month as a whole, as fabricators stocked up ahead of the National Day holiday week in early October. Early indications suggest that retail sales of platinum jewellery were firm over the holiday period, despite higher retail prices – platinum jewellery remains tremendously popular with Chinese consumers.

Industrial

Industrial demand for platinum is expected to be broadly stable in 2003, the total edging up to 1.6 million oz. Little change is forecast for most of the chemical sector, reflecting the ongoing weakness of economic growth in much of continental Europe and the subdued level of activity in the USA during the first half of the year. A moderate fall is expected in Asian glass industry demand for platinum, whereas purchases in the electrical sector will grow due to an upturn in orders for thermocouples.

Consumption of platinum in the chemicals industry is forecast at 325,000 oz in 2003, slipping slightly compared to 2002. The largest catalyst application is for the production of silicones, and operating rates in much of the silicones industry have been stable. Although demand for silicones in China continues to rise rapidly, it is increasing from a low base. Demand for paraxylene has strengthened throughout the year to date but prices have not yet improved to the point at which investment in new capacity would be justified. Platinum consumption in this sector is primarily linked to new plant construction, as losses during catalyst operation are low.

Purchases of platinum catalyst gauze for nitric acid production are expected to fall moderately compared to 2002, producers having suffered high and volatile natural gas costs in the first half of the year. Little investment in new manufacturing capacity is expected during 2003.

Demand for platinum used in electrical applications is projected to improve by 4 per cent to 395,000 oz in 2003. Thermocouple demand for platinum is expected to increase on the back of rising steel output. In the hard disk sector, personal computer sales are recovering in North America and are growing strongly in China. Corporate spending on IT equipment globally is also improving. Platinum demand, however, will not expand at the same rate due to the current trend to use fewer disks per hard drive.

Consumption of platinum in the glass industry will soften in 2003, dropping to 245,000 oz. Whilst demand for liquid crystal display glass in Asia and fibreglass in China remains strong, less new capacity will be commissioned in 2003 compared with the previous year. Demand in Europe and North America is forecast to be largely stable.

With no substantial increases in reforming capacity due on stream in 2003, little change in demand for platinum-based catalysts is expected from the petroleum refining industry. Consumption of platinum in dental alloys is also forecast to be flat, whereas demand from other applications will rise due to the growing use of platinum-based biomedical products.

Investment

Net demand for platinum investment products is forecast to drop to 10,000 oz in 2003, down from 80,000 oz the previous year. Higher platinum prices have stimulated increased sales back to the market of large investment bars in Japan and have reduced sales of platinum coins by the US Mint.

Demand for the US Mint's platinum American Eagle bullion coins during the first nine months of 2003 totalled 15,850 oz, a fall of almost 30 per cent compared to 2002. The rising price of platinum appears to have deterred some investors, although sales of proof coins to collectors are expected to remain stable.

The sale of large investment bars back to dealers by Japanese investors has increased during 2003 to date in light of higher platinum prices.

The price strengthened from approximately ¥2,320 per gram at the start of the year to exceed ¥2,650 by the end of August, although a sharp appreciation of the yen in September pulled the local platinum price back to around ¥2,550. Overall, purchases for the year are forecast to be outweighed by sales back to the market, resulting in negative net demand of 20,000 oz.

Palladium

Palladium

Autocatalyst

Purchases of palladium by the autocatalyst sector are forecast to recover by almost 19 per cent in 2003 to 3.67 million oz as US auto companies use far less metal from inventories than in 2002. The underlying use of palladium on autocatalysts in the USA will fall, however, as intensive thrifting has continued to reduce metal loadings. Japanese autocatalyst palladium demand is forecast to rise in advance of tighter emissions regulations but European purchases will weaken in line with a drop in gasoline car production.

Europe

European demand for palladium in autocatalysts is forecast to fall by 7 per cent in 2003 to 1.31 million oz. Auto industry forecasts suggest sales of gasoline cars in western Europe could decline by as much as 6.5 per cent in 2003, dropping to between 8.2 and 8.3 million vehicles as diesels gain further market share. With the majority of gasoline vehicle catalysts in Europe based on palladium, the fall in car output will have a direct impact on demand for the metal.

A minority of auto manufacturers in Europe moved to greater use of platinum versus palladium in gasoline autocatalysts when the price of the latter soared to over $1,000 in early 2001. That process may now be reversed as the palladium price has fallen back and the discount between palladium and platinum has widened to more than $500 per oz.

For those companies that produce a substantial volume of diesel cars, a move back to palladium on their gasoline models would help to offset their growing requirement for platinum as sales of diesels in Europe increase. Any switch back towards palladium, however, is not expected to affect metal demand materially until 2004 at the earliest.

Japan

Demand for palladium in autocatalysts in Japan is forecast to rise to 540,000 oz in 2003, an increase of 4 per cent. Car output is projected to fall by 3.8 per cent as manufacturing of vehicles for export markets is increasingly carried out overseas. However, purchases of palladium will rise in comparison to 2002, as there has been little or no use of metal from inventories by Japanese auto makers in 2003.

Consumption of palladium on autocatalysts will also rise as average loadings of pgm on autocatalysts are edging higher in Japan in advance of more stringent exhaust emissions limits that are due to be applied from the end of 2005.

Given the relatively conservative purchasing strategies adopted by most Japanese car companies towards pgm, no significant changes to overall metal ratios on autocatalysts are forecast in the short-term.

North America

The North American auto industry is expected to purchase 1.31 million oz of palladium in 2003 – a dramatic increase on the previous year when very heavy use of metal from inventories reduced purchases to just 640,000 oz. The reduction in stock levels, as well as the sale of some palladium back to the market, has continued in 2003 but at a much lower rate than in 2002.

In contrast to the increase in purchases of metal, however, use of palladium on autocatalysts by US manufacturers will drop sharply in 2003. The volatility of the metal's price in 2000 and 2001 resulted in pgm thrifting programmes being accelerated in the USA, where there had been relatively intensive use of palladium on autocatalysts. The success of auto companies and catalyst manufacturers in reducing palladium loading levels has had a substantial impact on their use of the metal in 2003.

Lower light vehicle production will also have an impact on the US auto industry's palladium requirements – vehicle output is forecast to slip by 2.6 per cent to 11.7 million units in 2003.

In May, General Motors commented that it was looking closely at the economic benefits to be gained by altering pgm ratios in favour of palladium at the expense of platinum in gasoline autocatalysts. Indeed, the company noted that moves to switch from one metal to the other had already been initiated in some applications. Other manufacturers, however, have not announced any significant changes in their approach to pgm use and the overriding emphasis throughout the industry in North America remains one of thrifting overall pgm loadings.

Rest of the World

Auto industry demand for palladium in the Rest of the World region is projected to weaken in 2003 to 510,000 oz, a fall of 2 per cent.

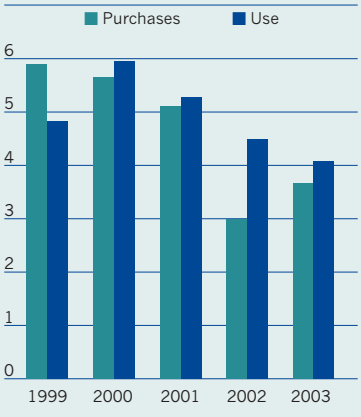
Chinese demand for palladium is expected to rise strongly in line with the rapid growth in car sales and

Palladium Demand: Autocatalyst
'000 oz

	2002	2003
Europe	1,410	1,310
Japan	520	540
North America	640	1,310
Rest of the World	520	510
Total	**3,090**	**3,670**
Autocatalyst recovery	**(370)**	**(410)**

JM

Palladium Autocatalyst Demand 1999-2003
Million oz



JM

Palladium

Palladium Demand: Dental
'000 oz

	2002	2003
Europe	45	45
Japan	505	530
North America	210	230
Rest of the World	10	10
Total	**770**	**815**

production. South Korean car output is also expected to grow in 2003. This growth, however, will be offset by weaker light vehicle output in Japan, Western Europe and Mexico. On top of this, thrifting of palladium on autocatalysts, particularly on vehicles manufactured in Mexico for the US market, will have a noticeable impact on metal demand in 2003.

Autocatalyst Recovery

The recovery of palladium from recycled autocatalysts is projected to grow by 11 per cent to 410,000 oz in 2003. As is the case with platinum, recovery of palladium will grow the most in Europe. An increasing proportion of cars now being scrapped in the region are fitted with catalytic converters, while the percentage of converters removed prior to cars being shredded is also rising. Recovery is also set to increase in the USA, where the palladium content of catalysts entering the recycling chain is starting to rise – a reflection of the use of palladium-intensive catalysts from the mid-1990s onwards.

Dental

Demand for palladium in dental alloys is expected to recover further in 2003, lower prices stimulating demand in North America and Japan. Permanent substitution of palladium has occurred in the European market, however, and demand in this region is forecast to remain flat. Overall palladium demand is projected to increase by 6 per cent to 815,000 oz.

In Europe, palladium-based dental alloys have lost much of their market to alternative alloys and non-metallic materials due to the rapid run up in the price in 2000. This substitution increasingly appears to be permanent – the fall in the price of palladium in 2002 and 2003 has had little effect on demand. The European dental industry has shown no desire to move back to palladium, having invested heavily in the use of competing formulations and remaining wary of the volatility of the metal's price.

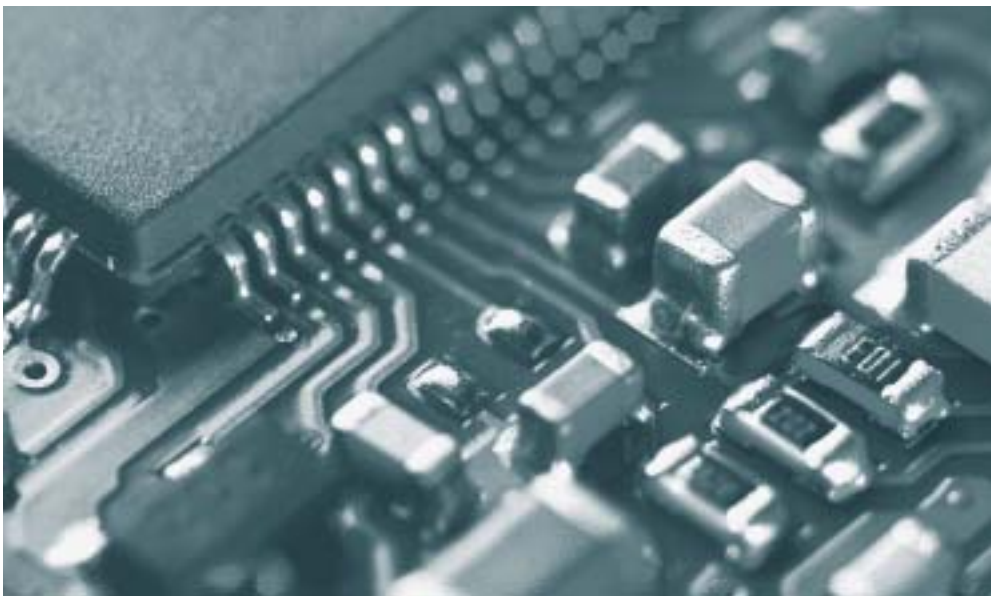
In Japan, where patients can reclaim a proportion of the cost of the commonly used 'kinpala' palladium-based alloy, demand is set to improve in 2003. The fall in the palladium price has made dental treatment with kinpala alloy more affordable and total palladium demand is forecast to rise to 530,000 oz. On the negative side, however, patients now have to pay an increased proportion of the cost of treatment.

Lower metal prices also led a recovery in North American demand for palladium in dental alloys during the first nine months of the year and demand for 2003 as a whole is forecast to rise 9.5 per cent to 230,000 oz. The competitive position of palladium-based products has been further improved by the strength of the gold price during 2003, which has seen high-gold alloys losing market share.

Electronics

Purchases of palladium by the global electronics industry are expected to rise by 31 per cent in 2003 following two years of very weak demand.

Although purchases of palladium by the electronics industry will improve in 2003 following a run down in stocks the previous year, miniaturisation and thrifting have continued to reduce use of the metal in components.



Palladium Demand: Electronics
'000 oz

	2002	2003
Europe	90	125
Japan	150	230
North America	225	240
Rest of the World	10	10
Total	**750**	**985**

With excess inventories of both palladium and components having largely been eliminated in 2002, purchases of metal are forecast to climb to 985,000 oz this year. The underlying consumption of palladium in electronic components, however, is projected to weaken by 7 per cent in 2003 due mainly to the continued miniaturisation of capacitors and thrifting of palladium by manufacturers of capacitors and hybrid integrated circuits.

Shipments of multi-layer ceramic capacitors (MLCC) have grown rapidly in 2003, with total sales for the year forecast at almost 600 billion, up from a little over 500 billion in 2002. Rising demand for mobile phones (particularly the latest generation of handsets incorporating digital imaging technology) and strong growth in the overall Chinese market for electronic goods are driving component orders.

A 14 per cent increase forecast for palladium-based MLCC production in 2003 will not, however, translate into higher palladium demand. In fact, use of the metal by the MLCC industry is predicted to decrease slightly. The ongoing trend in miniaturisation will have a significant effect on capacitor raw materials demand. The latest generation of MLCC was launched in the second half of 2003. These capacitors are approximately 70 per cent smaller in volume terms than the smallest existing products (which in turn, are over 78 per cent smaller than their predecessors) and are expected to be widely used in mobile communications applications.

In addition, MLCC producers have continued to thrift the palladium content of the palladium-silver conductive pastes used in capacitor manufacture. Over the last five years, the palladium content of pastes used in certain product lines has decreased from around 30 per cent to 20 per cent.

Furthermore, nickel products are expected to take additional market share from palladium-based MLCC in 2003. Although the pace of substitution has slowed as the price of palladium has dropped, further replacement by nickel is predicted in the future.

At the same time, manufacturers of hybrid integrated circuits (HIC) have also successfully thrifted palladium use in conductive pastes by up to a quarter in some instances. This will result in a substantial reduction in palladium consumption in HIC in 2003.

Demand for palladium used in surge resistors is also set to fall but this will be countered by growing use in varistors and actuators. Use of palladium in the plating of lead frames is expected to be largely stable as movements in the price of palladium and gold have made the former more competitive.

On a regional basis, demand for palladium in the electronics sector is shifting increasingly towards China and South East Asia. Manufacturers in North America and Japan in particular have established production facilities in Asia to take advantage of lower costs and proximity to the fastest growing markets.

Other

Palladium demand from other applications is forecast to weaken slightly in 2003 to 590,000 oz. Demand from the jewellery sector will fall in line with lower production of alloys containing palladium in Japan and China. Chemical industry demand for palladium-based process catalysts will also soften although this will largely be offset by an upturn in the use of palladium gauze by nitric acid producers.

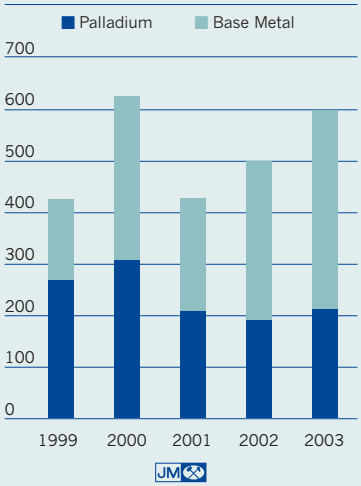
Demand for palladium in jewellery alloys is expected to drop by 6 per cent to 245,000 oz in 2003. Palladium is a common constituent of platinum alloys used in the Japanese jewellery market; palladium-platinum alloys offering good all-round casting and machining properties. Palladium purchases by Japanese fabricators will fall in 2003 because of the same combination of lower retail sales and inventory recycling that will affect platinum demand. The scale of the drop, however, will be moderated somewhat due to the increased market share taken by white gold, in which palladium is often used as a whitening agent.

In contrast, Chinese jewellery manufacturers are tending to use less palladium in white gold alloys, substituting cheaper metals such as nickel, contributing to a projected drop in palladium demand.

Purchases of palladium for use in the chemical industry are forecast to weaken marginally to 250,000 oz in 2003. The fall in the price of palladium has made palladium catchment gauze more cost-effective for nitric acid producers but as costs and margins in the sector have been under heavy pressure, demand will grow only moderately. In the process catalyst sector, expansion of purified terephthalic acid manufacturing capacity in Asia continues to support good demand for palladium-based catalysts in the region, but demand from the bulk chemicals industry in North America and Japan is expected to soften. The global market for palladium hydrocracking catalysts will be largely stable.

MLCC Production by Electrode Type 1999-2003

Billions



Palladium Demand: Jewellery & Other

'000 oz

	2002	2003
Europe	125	125
Japan	195	190
North America	120	115
Rest of the World	170	160
Total	**610**	**590**

Other Platinum Group Metals

Rhodium

Global demand for rhodium is forecast to rise by 6 per cent in 2003, reaching a total of 641,000 oz. Use of the metal in autocatalysts in the USA will grow as average rhodium loading levels increase. Demand will also rise in China and elsewhere in Asia in line with escalating car production. However, the growth rate will be tempered by continued use of rhodium stocks by some US-based auto companies. Recovery of rhodium from recycled autocatalysts will also climb. Chemical industry demand is expected to soften slightly.

Autocatalyst

Auto manufacturers are projected to purchase 673,000 oz of rhodium in 2003, a rise of 64,000 oz on 2002. The underlying use of the metal on autocatalysts will be considerably higher than this as some US auto companies have continued to run down rhodium inventories in lieu of purchasing metal this year. The rate of stock use, however, is expected to fall compared with 2002.

Much of the growth in demand will be due to tightening emissions standards that have necessitated a rise in average rhodium loadings in some regions. In addition, thrifting of platinum and palladium by auto manufacturers has been achieved in part by increasing the use of rhodium in some catalyst formulations. Rising light vehicle sales and production in developing car markets such as China and India will also contribute to the overall expansion of the market.

Several North American-based auto manufacturers have been making strenuous efforts to reduce total pgm loading levels in their catalyst systems for a number of years, and these thrifting programmes have continued throughout 2003. In many instances reductions in platinum and palladium loadings can be achieved by increasing rhodium loadings. This is cost-effective as rhodium is used in much smaller proportions than platinum and palladium. The fall in the price of rhodium from over $1,000 per oz at the beginning of 2001 to around $500 by the third quarter of 2003 reinforced its cost-effectiveness.

Tier 2 emissions regulations will start to be phased in on new light-duty vehicles in the USA from 2004 onwards. The regulations require a substantial reduction in NOx emissions. To meet the new NOx standards, particularly on heavier vehicles, some manufacturers have increased the proportion of rhodium used in their catalyst systems.

In Japan, rhodium loadings have also increased as auto manufacturers have implemented tighter voluntary emissions standards ahead of legislation due to take effect in 2005. The effect on rhodium demand, however, will be moderated somewhat in 2003 by lower light vehicle production.

In Europe, as in the USA, thrifting of palladium and platinum by some manufacturers has been achieved in part by boosting average rhodium loadings. The introduction of Euro IV compliant vehicles, which are required to meet substantially lower NOx emissions standards than their predecessors, has also had a small but positive impact on metal loadings. However, these increases will be offset by the forecast 7 per cent fall in gasoline car production in 2003 and so the net result is expected to be little change in total autocatalyst rhodium demand in the region.

Elsewhere, the spread of more stringent vehicle emissions legislation in China and India, coupled with strong growth in car production throughout much of Asia, is forecast to drive a 14 per cent increase in autocatalyst demand for rhodium.

Recovery of rhodium from recycled autocatalysts is projected to increase by approximately 21 per cent in 2003 to 120,000 oz. Recovery will grow as autocatalyst collection and recycling rates improve in Europe and North America. In addition, overall rhodium loadings increased in the mid-1990s as auto makers in Europe and the USA worked to comply with more stringent NOx emissions limits. As increasing numbers of cars from that period are being scrapped, rhodium recovery levels are rising.

Other Demand

Demand for rhodium catalysts in the manufacture of bulk chemical intermediates, such as oxo-alcohols and acetic acid, is forecast to drop by 10 per cent this year to 36,000 oz. The year-on-year decline will result from a reduced rate of capacity expansion in the Rest of the World region, coupled with the conversion of a number of acetic acid plants from rhodium-based catalyst technology to iridium-ruthenium catalysts.

Global demand for rhodium-containing alloys used in the glass industry is expected to be little changed in 2003. Similarly, purchases of rhodium-platinum gauze by nitric acid producers, and sales of rhodium-platinum thermocouple wire are also forecast to be stable.

Rhodium Supply and Demand
'000 oz

	2002	2003
Supply		
South Africa	490	520
Russia	90	100
North America	25	21
Others	9	14
Total Supply	**614**	**655**
Demand		
Autocatalyst: gross	609	673
recovery	(99)	(120)
Chemical	40	36
Electrical	6	6
Glass	37	36
Other	11	10
Total Demand	**604**	**641**
Movements in Stocks	**10**	**14**

Ruthenium & Iridium

Ruthenium demand is forecast to jump by 14 per cent to 461,000 oz in 2003. Strong chemical industry demand for catalysts containing ruthenium will be responsible for much of the increase, while demand for ruthenium pastes from the electronics sector will also improve. Purchases of iridium are forecast to rise by 17 per cent overall to 96,000 oz. Again the growth will be driven by increasing use of the metal in chemical process catalysts; it will also benefit from an upturn in orders for iridium crucibles.

Demand for ruthenium from the chemical process catalyst sector is forecast to surge from 101,000 oz in 2002 to 139,000 oz in 2003, a rise of over 37 per cent. The construction of new acetic acid manufacturing capacity based on the Cativa® process, which utilises an iridium-ruthenium catalyst, and the conversion of existing plants to the technology will boost demand in Europe, North America and Asia. The process offers a number of benefits compared to older technologies, including high selectivity, high reaction rates and reduced output of by-products.

Consumption of ruthenium in electronic components such as resistors is projected to improve by 10 per cent in 2003, rising to 153,000 oz. The overhang of surplus component inventories, which had affected demand for ruthenium pastes in 2002, has been eliminated and both corporate and consumer demand for electronic products have shown signs of improvement.

At 102,000 oz, electrochemical demand for ruthenium is not expected to change significantly in 2003. Capacity utilisation in the chloralkali industry, in which both ruthenium and iridium are used to coat electrodes, edged up during the first half of the year but this had no impact on electrode recoating programmes.

Demand for ruthenium-titanium alloys used in the manufacture of corrosion-resistant pipes has continued to be stable in 2003. Consumption of ruthenium in other industrial alloys and jewellery alloys is also expected to be in line with the previous year.

The use of iridium in fabricating crucibles for the electronics industry is forecast to improve in 2003 as demand for high purity crystals rises and overcapacity in the sector declines. This will contribute to an overall increase in electronics demand for iridium of 5,000 oz to a total of 26,000 oz.

As with ruthenium, demand for iridium from chloralkali manufacturers will be stable. The automotive industry is expected to consume less iridium overall in 2003 than the previous year – use of the metal in autocatalysts was phased out by the end of 2002. This fall in demand, however, will be partially offset by growing use of iridium in high performance spark plugs.

The spread of the Cativa® acetic acid technology will give a substantial boost to chemical catalyst demand for iridium in 2003. Consumption in most other applications, such as cathodic protection and jewellery alloys, is forecast to be flat.

Ruthenium Demand by Application
'000 oz

	2002	2003
Chemical	101	139
Electrochemical	100	102
Electronics	140	153
Other	63	67
Total Demand	**404**	**461**

JM

Supplies

Rhodium

Total rhodium supplies are expected to rise by just under 7 per cent in 2003 to 655,000 oz. Growth in supplies from South Africa will lead the increase as output of platinum rises and UG2 ore, which is enriched with rhodium compared to the Merensky Reef, accounts for an increased proportion of mine production. Russian sales of rhodium in 2003 are forecast to reach 100,000 oz – slightly higher than the previous year. Production in North America will slip lower due to reduced output from Inco's strike-hit operations at Sudbury but this will be outweighed by higher output from the expanding pgm mines in Zimbabwe.

Ruthenium & Iridium

Ruthenium demand is forecast to rebound by 14 per cent in 2003 but the price of the metal fell to settle at $33 during the first nine months of the year. The price of iridium also dropped, bottoming out at $90, even though demand improved from the very weak conditions of 2002. This reflects the fact that, despite the upturn in industrial use of both metals, there is no lack of physical availability. As with rhodium, South African output of ruthenium and iridium is rising as more UG2 ore is mined. UG2 generally has a higher minor pgm content than the Merensky Reef, particularly on the Eastern Bushveld, where several major new mines are being developed.

Iridium Demand by Application
'000 oz

	2002	2003
Chemical	10	20
Electrochemical	23	23
Electronics	21	26
Other	28	27
Total Demand	**82**	**96**

JM

Prices and Futures Markets

Platinum

A combination of the poor equity markets in 2002, the prevailing low interest rate environment in the USA and Japan, and US dollar weakness, has resulted in hedge funds and smaller investors increasing their exposure to precious metals in 2003. This had a marked influence on the price of platinum during the first nine months of the year.

The platinum price began 2003 strongly, climbing from $600 at the start of January to breach $700 in early February, and again in March. The rally was largely investor-driven, with activity on TOCOM leading the market. A burst of futures long liquidation, coupled with a drop in physical purchasing by the Chinese jewellery sector, saw the platinum price fall back towards $600 by the end of April. From then on, renewed speculative buying of platinum derivatives fuelled another rally that touched $714 in September. The net speculative long position on NYMEX increased from around 95,000 oz at the end of April to almost 350,000 oz in early September.

Although purchases of platinum by Chinese jewellery manufacturers softened during the first nine months of the year, auto industry demand remained strong. With supplies from South Africa lower than expected, the market remained in deficit, helping to support higher prices. Lease rates, however, softened from around 20 per cent in early March to 5 per cent by mid-September as spot metal bought by funds and by dealers to hedge option positions was lent to the market.

The rally in the platinum price that had developed steadily throughout the second half of 2002 accelerated in **January** 2003. The price of the metal climbed rapidly from an opening fixing of $600 to reach $671 on the 30th. Investor buying of platinum futures was primarily responsible, with supply concerns (based on the smelter explosion at Lonmin and the possibility of a strike at Norilsk) and a swift rise in the price of gold boosting sentiment. With physical availability also tight, strong borrowing and subsequent dealer short-covering pushed one-month lease rates above 18 per cent by the 30th, helping to drive up the spot price.

February was marked by considerable volatility in short-term lease rates and the platinum spot price. Further investor buying in Asia and dealer short-covering propelled spot quotes in Tokyo above $710 on the 4th, while the morning fixing in London was settled at $703, the highest since 1980. Long liquidation as investors took profits then caused the price to slump to $676 on the 6th. A jump in borrowing produced a brief recovery to $692 on the 12th but as greater volumes of physical metal were offered and funds closed out long positions on NYMEX the price subsided to $664 on the 21st. Platinum ended the month with light volumes being traded either side of $680.

Early **March** saw renewed buying of platinum futures on TOCOM as the yen strengthened against the dollar and the gold price moved above $350. With short-covering evident, platinum climbed to a new fixing high for the year of $705 on the morning of the 11th. In contrast to the futures activity, purchases of platinum by industrial users and the Chinese jewellery sector fell away as the price rose above $700. From the 18th onwards investors began rapidly liquidating long futures positions across a range of hard commodities, including platinum, and the price turned sharply downwards. Few buyers of physical metal were willing to bid as the market fell, and as short-term lease rates slid to around 10 per cent the platinum price slumped to fix at $625 on the 28th.

After rebounding to $645 over the final three days of March, a marked strengthening of the dollar versus the yen, plus a fall in the price of gold, triggered further selling of platinum by Japanese investors on TOCOM in **April**. By the morning of the 8th, platinum had dropped to a fixing of $611 in London. At this level bids for physical metal picked up and the price briefly recovered to $640 before increased offers of platinum on the spot market then weighed on the price. With the potential impact of the SARS virus on Chinese jewellery demand also starting to affect market sentiment, platinum fell to end the month at $603.

May saw the platinum market turn upwards again in a remarkably rapid rally. The price gained $82 on the London fixings (over 13 per cent) in just 17 days of trading, reaching $685 on the 27th. Funds came back into the market strongly, the net speculative long position on NYMEX rising from approximately 95,000 oz at the start of the month to almost 245,000 oz by the 27th. The increasing weakness of the dollar against the euro and the yen, also encouraged greater purchasing of physical platinum by end users. At the same time, offers of spot metal decreased and short-term lease rates climbed back up towards 20 per cent.

Over the final few days of the month, however,

Average PGM Prices in $ per oz

	Jan-Sep 2002	Jan-Sep 2003	Change
Platinum	523.55	667.42	27%
Palladium	355.08	201.17	– 43%
Rhodium	888.28	539.90	– 39%
Iridium	329.64	94.74	– 71%
Ruthenium	70.48	34.44	– 51%

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

investor profit-taking coupled with an improvement in physical availability of metal resulted in the price weakening to $642.

In **June**, the platinum price began a sustained, if slightly erratic, rally that continued through to the middle of September. The speculative buying of futures on NYMEX and TOCOM again provided much of the impetus, but underlying physical demand provided a solid foundation. By the 4th of June the platinum price had bounced to $669, led by strong buying by Japanese investors. Greater lending and larger offers of physical metal then pushed short-term lease rates back under 10 per cent and the spot price dipped briefly below $650. However, as speculative buying resumed the price firmed to end June at $667.

During **July**, lease rates softened further while the spot price continued to rise – a reflection of the fact that fund buying, rather than physical demand, was driving the platinum market. The price climbed from an opening fixing of $671 to hit $690 on the 15th, and after a brief pause, surged to reach $700 on the morning of the 29th. Demand for platinum from Chinese jewellery fabricators, however, waned as the price rose and platinum fell back to fix at $684 on the 31st as some investors took profits.

Platinum was by no means unique in attracting strong flows of speculative money throughout July and into August – aluminium, copper, nickel, zinc and silver also rallied as increasing confidence in a sustained global economic recovery led funds to increase their holdings of most hard commodities.

The platinum rally resumed from the 5th of **August** onwards as funds continued to extend their long holdings on both NYMEX and TOCOM. The price breached $700 again on the 20th with further buying and short-covering in Tokyo, and the morning fixing was settled at $703.

On the physical side, trading of platinum began on the Shanghai Gold Exchange on the 13th, with just under 12,000 oz of metal changing hands. Towards the end of the month, the platinum price gained further momentum from the rising price of gold, moving from $691 to $709 on the 28th and ending the month at $707. The steep moves in the price of both metals were linked to the expiry of options, as well as to further investor buying of futures.

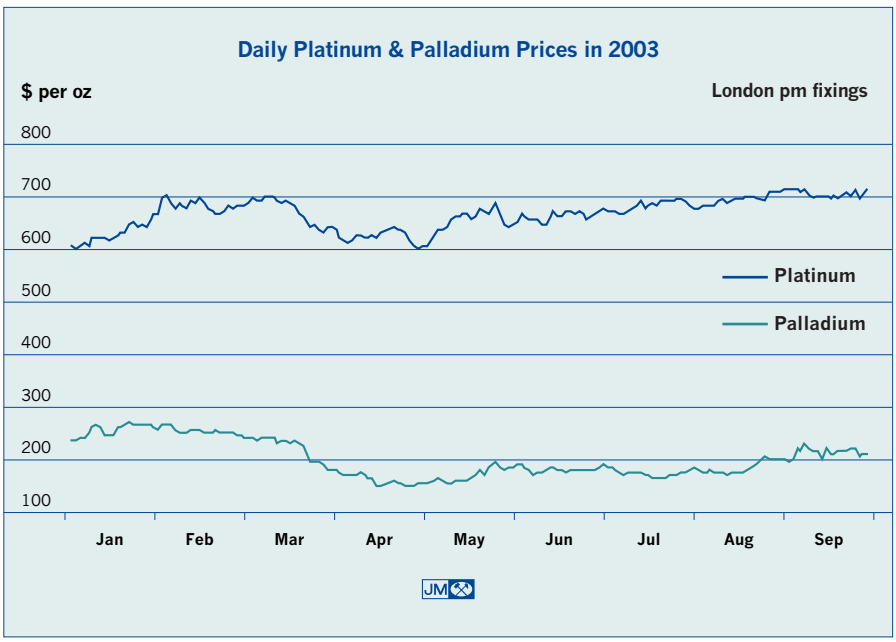
The platinum price remained firm throughout much of **September**. A new high for the year of $714 was set at the morning fixing in London on the 2nd, the net speculative position on NYMEX having grown to nearly 350,000 oz. Chinese purchasing of physical metal increased noticeably in advance of the key October holiday season, with the Shanghai Gold Exchange recording rising volumes of trade. Although a degree of long liquidation was seen on TOCOM and NYMEX from the 15th onwards, the price remained well supported around $700, ending September at $710.

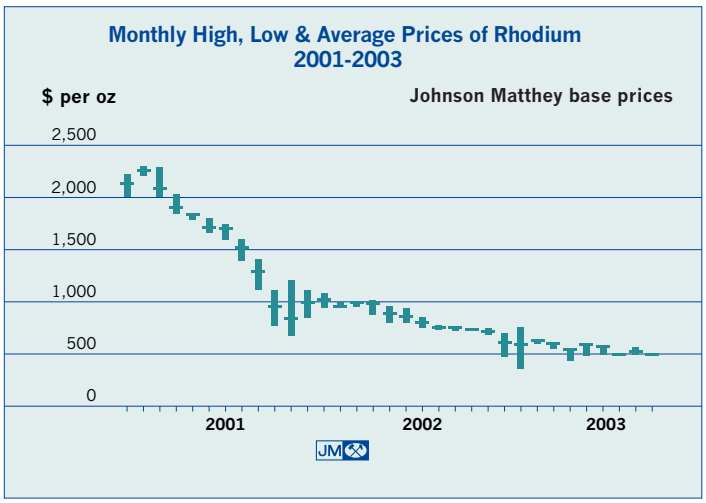
Palladium

Continued weakness in the electronics industry, coupled with relatively low levels of purchasing by the auto industry, undermined the palladium price during the first half of 2003. Against this background of soft demand, any upturn in the volume of metal offered on the fixings tended to push the price lower.

After opening the year at $234, the price dropped by $80 or 34 per cent by the end of April. A modest increase in fund buying of palladium on NYMEX then triggered a small recovery and the price traded between $170 and $180 throughout much of May, June and July.

Speculative buying increased rapidly from early August on both NYMEX and TOCOM, and this was primarily responsible for palladium rallying to a peak of $232 in early September. However, with Russian metal in particular being sold strongly into the rally the price eased off to end the month at $209.





Substantial offers of spot metal and selling of futures weakened the palladium market towards the end of 2002, but as physical availability tightened and short positions were closed out in early 2003 the price staged a recovery. From an opening fixing of $234 on the 2nd of **January** the price climbed to $267 on the 10th. This improvement attracted more metal back to the spot market and on the 14th palladium dropped back to $242. The rise in the platinum price then provided a moderate boost to palladium as investors opened new long positions on TOCOM and NYMEX. The palladium rally, however, stalled at $271 on the 22nd and the metal ended the month at $256.

Trade in palladium remained thin during **February** and with physical demand weak, relatively small volumes of metal offered on the fixings were sufficient to undermine the price further. After initially edging up to $266 on the 4th, the price stuttered downwards over the course of the month to end at $244 on the 28th.

The palladium market was very subdued for the first three weeks of **March**, the London fixings fluctuating between $230 and $242 through to the 20th. On the 21st, however, the price softened further and then entered a precipitous decline. Initial offers of metal on the afternoon fixing of the 24th met with no buying interest and the price slid to $216 before matching bids were found. This led to stop-loss selling by dealers and the fall continued as moderate volumes of palladium struggled to find buyers. The price dropped below $200 on the 25th and March closed with palladium under pressure at $180.

The slide persisted in **April** as the fundamentals of weak industrial demand and oversupply continued to weigh on the market. The price had dropped to $170 by the 9th, slid to $161 on the 14th, and then slumped to $144 on the morning of the 17th – a six-year low. However, the fall under $150 and a concomitant increase in the ratio between the platinum and palladium prices to over 4:1, encouraged an upturn in speculative buying on NYMEX. This was sufficient to halt the slide and palladium ended the month at $154.

The palladium market traded uneventfully during the first half of **May**, consolidating between $152 and $164 from the opening fix through to the 19th. A rally began to develop from the 20th onwards as improved bids for spot metal led to a morning fixing of $168. Fund activity on NYMEX also increased, and with platinum also rising strongly, palladium moved up to $177 on the 21st. Comments by General Motors that it was examining the potential for increasing the use of palladium in its autocatalysts in place of platinum then added momentum to the investor buying on NYMEX. As dealers started covering short positions and Japanese investors began opening long positions on TOCOM the rally gathered pace, reaching $185 on the 23rd and hitting $206 on the morning of the 27th. The rise was not, however, supported by any lasting improvement in physical demand and as increased offers of metal again outweighed buying interest the price subsided to $183 by the 30th.

Palladium initially followed platinum upwards in **June**, rising from an opening fix of $181 on the 2nd to $190 on the 3rd, with higher than average volumes trading through the London fixings. However, once the level of bids was scaled back the price began to fall, dropping to $169 on the 9th. Further, moderate fund buying of palladium futures on NYMEX then provided support for a brief run up to $186 on the 16th, but the price soon slipped back to trade steadily between $170 and $180 for the remainder of the month.

Another short burst of futures buying on NYMEX squeezed the palladium price up to $188 on the 2nd of **July**, but the fund interest then tapered off. With physical demand slack, the price subsequently faded to $160 by the 23rd in very thin trade. That triggered an improvement in physical buying interest and with the spread between platinum and palladium widening to $530, speculative buying of the latter also picked up again. As a result, the palladium spot price moved back up to its previous $170 to $180 trading range.

Steady buying by hedge funds on NYMEX was absorbed with little impact on the price from the 1st of **August** through to the 20th; palladium largely

maintained its $170 to $180 fixing range as sales of Russian metal rose to meet the speculative demand. From then on, however, managed futures funds and smaller investors joined in, rapidly increasing their long positions. Open interest on TOCOM also began to rise, whilst hedging of substantial options positions added to the price pressure. The speculative buying appeared to be based on a number of premises: that a palladium to platinum price discount of over $500 was unsustainable; that demand for the metal would increase as auto companies switched to greater use of palladium-based catalysts; and that purchasing would be further boosted as excess metal inventories at certain auto manufacturers became depleted. As a result, palladium climbed to fix at $205 on the 26th, and despite good volumes of physical metal being offered, it ended the month firmly at $201.50.

There was no let up in the speculative buying of palladium during **September**, the rally reaching a peak on the 9th when physical buying in London and fund buying on NYMEX combined to produce an afternoon fixing of $232. The price then eased as the fund buying backed off, slipping to $214 on the 12th. With TOCOM closed on the 15th and few fresh bids from investors, offers of metal on the fixings met with indifference and palladium dropped to $197 in the afternoon as dealers executed stop-loss sell orders. The price rapidly recovered, however, as the futures buying resumed and palladium held comfortably above $200 for the remainder of the month. The net speculative long position on NYMEX had risen to almost 400,000 oz by the 26th, and palladium ended September at $209.

Other PGM

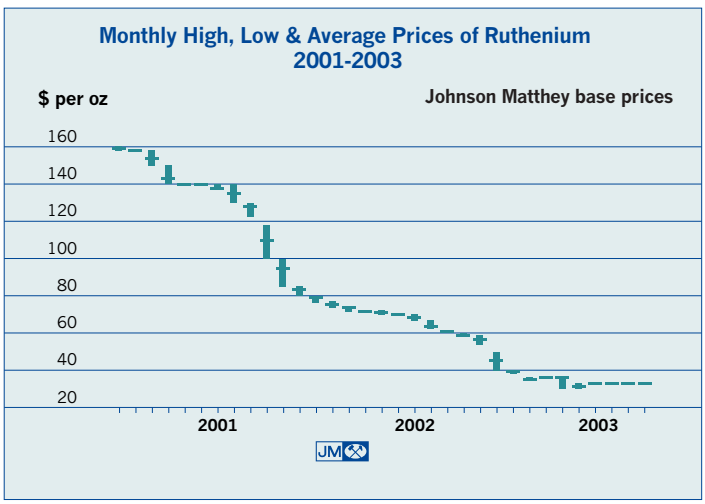
The price of rhodium was rather erratic during the first five months of 2003, fluctuating between $440 and $650 as a balance between supply and demand proved elusive. From June through to the end of September, however, the market was more stable and rhodium traded at or close to $500 for much of the period. After falling substantially in 2002, ruthenium and iridium prices continued to soften into 2003 as demand remained well below supply. Both metals, however, had established a floor by mid-year, ruthenium settling at $33 and iridium at $90.

The price of rhodium staged a recovery in early 2003, having fallen sharply during December 2002 due to increased year-end sales by producers and dealers and little buying interest. With less metal on offer in January, particularly from Russia, and purchasers returning to the market, the Johnson Matthey base price climbed rapidly from $485 to $650. However, after stabilising at $620 for most of February, the price began to slide once more as greater volumes of metal were drawn to the market from both primary sources and secondary refiners. With demand from the auto industry flat at best, the rhodium price faded to $440 in late April – its lowest point since February 1998.

The dip below $500 saw buyers return once more and rhodium briefly rebounded to $590 in May. The improvement, however, was short-lived and by early June the market had established equilibrium around $500. There was little change during July, and after a brief rise to $560 in thin summer trade in August, the price settled back at $500 through to the end of September.

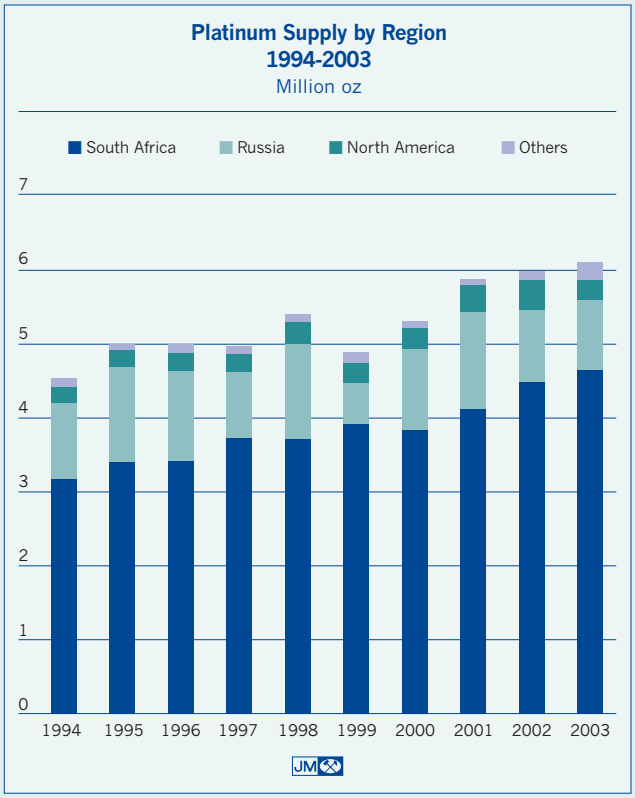
During the first half of 2003 the price of ruthenium completed a three-year decline from its peak of $170 in 2000. The metal opened January at $40 and had softened to $36 by mid-February as supplies easily accommodated improved demand from the electronics and chemicals markets. After slipping further to $30 towards the end of April, the JM base price edged back up to $33 in May and then remained unchanged through to the end of September.

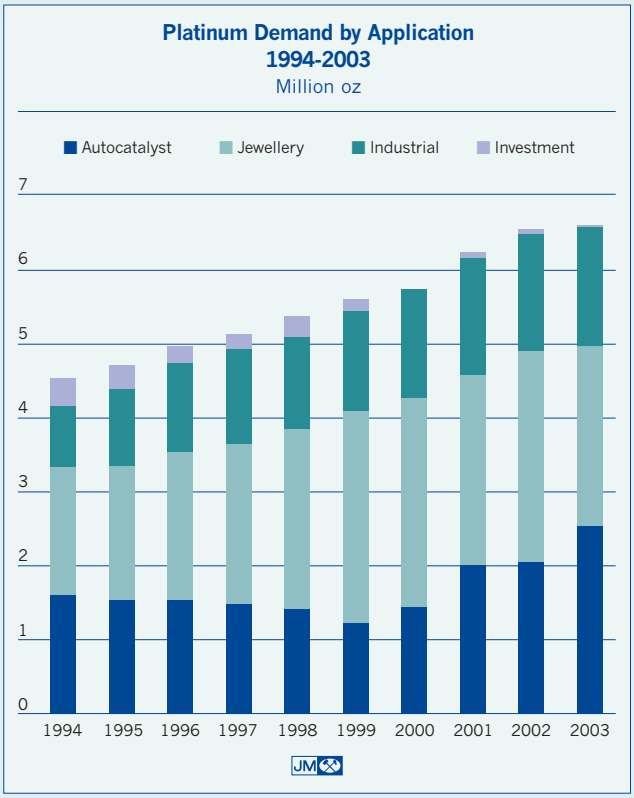
The price of iridium also bottomed out during the first half of 2003, after falling steeply throughout 2002 due to substantial overcapacity in the key electronic crystal manufacturing sector. The JM base price dropped from $125 to $100 during January, paused at this level in February and March, before coming to rest at $90 in April.



Platinum Supply and Demand

'000 oz	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Supply										
South Africa	3,160	3,370	3,390	3,700	3,680	3,900	3,800	4,100	4,450	**4,650**
Russia	1,010	1,280	1,220	900	1,300	540	1,100	1,300	980	**950**
North America	220	240	240	240	285	270	285	360	390	**285**
Others	140	100	130	120	135	160	105	100	150	**225**
Total Supply	**4,530**	**4,990**	**4,980**	**4,960**	**5,400**	**4,870**	**5,290**	**5,860**	**5,970**	**6,110**
Demand by Application										
Autocatalyst: gross	1,870	1,850	1,880	1,830	1,800	1,610	1,890	2,520	2,640	**3,180**
recovery	(290)	(320)	(350)	(370)	(405)	(420)	(470)	(530)	(570)	**(650)**
Chemical	195	225	230	235	280	320	295	290	330	**325**
Electrical	190	250	275	305	300	370	455	385	380	**395**
Glass	170	245	255	265	220	200	255	290	255	**245**
Investment: small	155	75	110	180	210	90	40	50	45	**30**
large	240	270	130	60	105	90	(100)	40	35	**(20)**
Jewellery	1,760	1,880	1,990	2,160	2,430	2,880	2,830	2,590	2,820	**2,450**
Petroleum	95	135	185	170	125	115	110	130	130	**130**
Other	195	230	255	295	305	335	375	465	495	**505**
Total Demand	**4,580**	**4,840**	**4,960**	**5,130**	**5,370**	**5,590**	**5,680**	**6,230**	**6,560**	**6,590**
Movements in Stocks	**(50)**	**150**	**20**	**(170)**	**30**	**(720)**	**(390)**	**(370)**	**(590)**	**(480)**



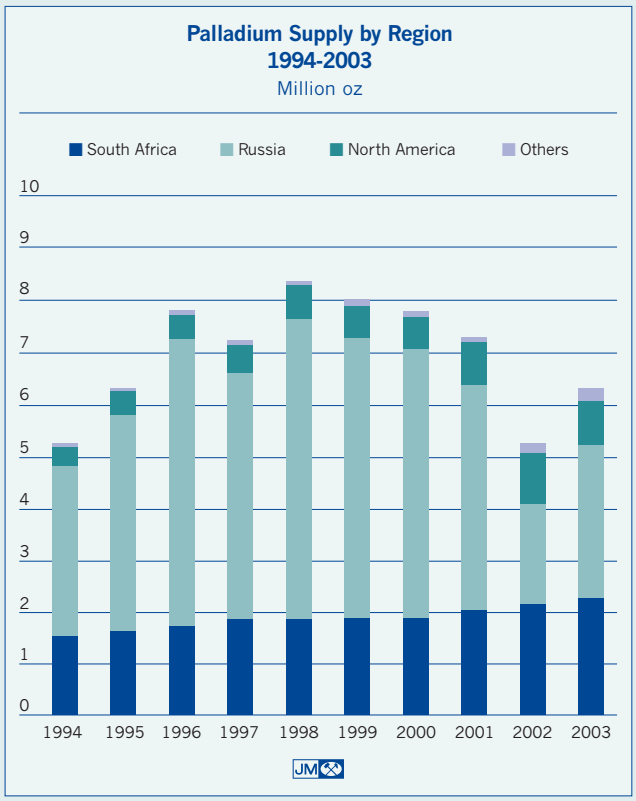


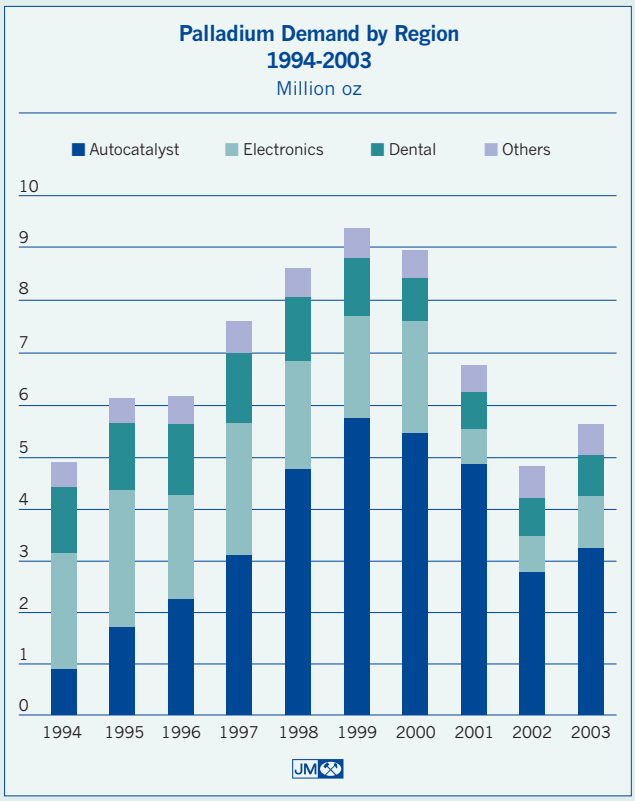
Platinum Demand by Application: Regions

'000 oz	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe										
Autocatalyst: gross	605	560	515	510	545	560	680	1,060	1,260	**1,370**
recovery	(10)	(15)	(20)	(25)	(30)	(30)	(40)	(70)	(90)	**(110)**
Chemical	50	55	60	70	60	80	100	105	120	**115**
Electrical	25	25	25	45	45	70	80	65	65	**70**
Glass	30	35	40	20	25	20	20	10	10	**10**
Investment: small	45	10	5	5	5	5	0	0	0	**0**
Jewellery	100	120	125	150	160	185	190	170	160	**165**
Petroleum	25	15	15	15	15	15	15	15	15	**15**
Other	65	75	75	85	85	90	105	155	170	**180**
Total	**935**	**880**	**840**	**875**	**910**	**995**	**1,150**	**1,510**	**1,710**	**1,815**
Japan										
Autocatalyst: gross	290	270	245	255	240	250	290	340	430	**490**
recovery	(45)	(40)	(50)	(50)	(55)	(60)	(60)	(55)	(60)	**(60)**
Chemical	15	20	20	20	20	20	20	25	30	**30**
Electrical	45	45	45	65	55	75	90	80	80	**80**
Glass	80	105	80	85	80	65	65	85	80	**75**
Investment: small	40	35	25	25	25	20	5	5	5	**5**
large	240	270	130	60	105	90	(100)	40	35	**(20)**
Jewellery	1,450	1,480	1,480	1,390	1,290	1,320	1,060	750	780	**665**
Petroleum	5	5	5	5	5	5	5	5	5	**5**
Other	25	25	25	30	30	35	35	35	40	**40**
Total	**2,145**	**2,215**	**2,005**	**1,885**	**1,795**	**1,820**	**1,410**	**1,310**	**1,425**	**1,310**
North America										
Autocatalyst: gross	790	820	850	800	775	535	620	795	570	**880**
recovery	(230)	(260)	(275)	(290)	(310)	(315)	(350)	(370)	(380)	**(430)**
Chemical	65	70	80	80	80	95	100	100	100	**95**
Electrical	75	115	130	100	105	120	145	120	115	**125**
Glass	20	25	30	45	20	25	50	35	30	**40**
Investment: small	65	25	75	145	175	60	35	45	40	**25**
Jewellery	55	65	90	160	270	330	380	280	310	**325**
Petroleum	5	40	60	50	40	40	35	40	45	**45**
Other	95	115	140	160	170	190	210	250	260	**255**
Total	**940**	**1,015**	**1,180**	**1,250**	**1,325**	**1,080**	**1,225**	**1,295**	**1,090**	**1,360**
Rest of the World										
Autocatalyst: gross	185	200	270	265	240	265	300	325	380	**440**
recovery	(5)	(5)	(5)	(5)	(10)	(15)	(20)	(35)	(40)	**(50)**
Chemical	65	80	70	65	120	125	75	60	80	**85**
Electrical	45	65	75	95	95	105	140	120	120	**120**
Glass	40	80	105	115	95	90	120	160	135	**120**
Investment: small	5	5	5	5	5	5	0	0	0	**0**
Jewellery	155	215	295	460	710	1,045	1,200	1,390	1,570	**1,295**
Petroleum	60	75	105	100	65	55	55	70	65	**65**
Other	10	15	15	20	20	20	25	25	25	**30**
Total	**560**	**730**	**935**	**1,120**	**1,340**	**1,695**	**1,895**	**2,115**	**2,335**	**2,105**

Palladium Supply and Demand

'000 oz	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Supply										
South Africa	1,500	1,600	1,690	1,810	1,820	1,870	1,860	2,010	2,160	**2,280**
Russia	3,300	4,200	5,600	4,800	5,800	5,400	5,200	4,340	1,930	**2,950**
North America	410	470	455	545	660	630	635	850	990	**850**
Others	70	70	95	95	120	160	105	120	170	**240**
Total Supply	**5,280**	**6,340**	**7,840**	**7,250**	**8,400**	**8,060**	**7,800**	**7,320**	**5,250**	**6,320**
Demand by Application										
Autocatalyst: gross	975	1,800	2,360	3,200	4,890	5,880	5,640	5,090	3,090	**3,670**
recovery	(105)	(110)	(145)	(160)	(175)	(195)	(230)	(280)	(370)	**(410)**
Chemical	185	210	240	240	230	240	255	250	255	**250**
Dental	1,265	1,290	1,320	1,350	1,230	1,110	820	725	770	**815**
Electronics	2,230	2,620	2,020	2,550	2,075	1,990	2,160	670	750	**985**
Jewellery	205	200	215	260	235	235	255	230	260	**245**
Other	115	110	140	140	115	110	60	65	95	**95**
Total Demand	**4,870**	**6,120**	**6,150**	**7,580**	**8,600**	**9,370**	**8,960**	**6,750**	**4,850**	**5,650**
Movements in Stocks	**410**	**220**	**1,690**	**(330)**	**(200)**	**(1,310)**	**(1,160)**	**570**	**400**	**670**





Palladium Demand by Application: Regions

'000 oz	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Europe										
Autocatalyst: gross	260	650	860	1,100	1,370	1,530	1,900	1,730	1,410	**1,310**
recovery	0	0	(5)	(5)	(5)	(10)	(15)	(30)	(45)	**(70)**
Chemical	60	65	65	70	65	65	95	65	70	**70**
Dental	255	250	255	260	210	180	100	50	45	**45**
Electronics	255	325	300	340	270	255	265	35	90	**125**
Jewellery	30	30	30	50	50	50	45	35	35	**35**
Other	25	20	20	25	25	25	20	20	20	**20**
Total	**885**	**1,340**	**1,525**	**1,840**	**1,985**	**2,095**	**2,410**	**1,905**	**1,625**	**1,535**
Japan										
Autocatalyst: gross	125	145	180	245	480	600	510	505	520	**540**
recovery	(30)	(25)	(30)	(45)	(50)	(55)	(50)	(40)	(40)	**(40)**
Chemical	20	20	20	20	20	20	20	20	20	**20**
Dental	550	580	600	620	590	545	470	475	505	**530**
Electronics	1,400	1,600	990	1,390	1,060	980	990	260	150	**230**
Jewellery	120	115	115	110	105	105	150	140	165	**160**
Other	15	10	10	10	10	10	15	10	10	**10**
Total	**2,200**	**2,445**	**1,885**	**2,350**	**2,215**	**2,205**	**2,105**	**1,370**	**1,330**	**1,450**
North America										
Autocatalyst: gross	525	950	1,230	1,680	2,820	3,490	2,805	2,375	640	**1,310**
recovery	(75)	(85)	(110)	(105)	(115)	(125)	(155)	(200)	(260)	**(270)**
Chemical	60	70	70	70	70	75	65	75	75	**70**
Dental	410	410	410	415	390	350	230	190	210	**230**
Electronics	450	545	490	550	460	405	485	250	225	**240**
Jewellery	5	5	5	10	10	10	10	0	0	**0**
Other	55	65	90	55	55	50	5	15	45	**45**
Total	**1,430**	**1,960**	**2,185**	**2,675**	**3,690**	**4,255**	**3,445**	**2,705**	**935**	**1,625**
Rest of the World										
Autocatalyst: gross	65	55	90	175	220	260	425	480	520	**510**
recovery	0	0	0	(5)	(5)	(5)	(10)	(10)	(25)	**(30)**
Chemical	45	55	85	80	75	80	75	90	90	**90**
Dental	50	50	55	55	40	35	20	10	10	**10**
Electronics	125	150	240	270	285	350	420	125	285	**390**
Jewellery	50	50	65	90	70	70	50	55	60	**50**
Other	20	15	20	50	25	25	20	20	20	**20**
Total	**355**	**375**	**555**	**715**	**710**	**815**	**1,000**	**770**	**960**	**1,040**

Rhodium Supply and Demand

'000 oz	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Supply										
South Africa	330	342	359	377	400	410	457	452	490	**520**
Russia	80	80	110	240	110	65	290	125	90	**100**
North America	15	13	5	16	16	18	17	23	25	**21**
Others	1	1	2	3	4	8	3	4	9	**14**
Total Supply	**426**	**436**	**476**	**636**	**530**	**501**	**767**	**604**	**614**	**655**
Demand by Application										
Autocatalyst: gross	379	464	424	418	483	509	793	566	609	**673**
recovery	(34)	(37)	(45)	(49)	(57)	(65)	(79)	(88)	(99)	**(120)**
Chemical	10	13	21	36	31	34	39	44	40	**36**
Electrical	8	8	9	9	6	6	7	6	6	**6**
Glass	14	17	53	43	34	35	42	41	37	**36**
Other	11	9	9	10	10	9	10	10	11	**10**
Total Demand	**388**	**474**	**471**	**467**	**507**	**528**	**812**	**579**	**604**	**641**
Movements in Stocks	**38**	**(38)**	**5**	**169**	**23**	**(27)**	**(45)**	**25**	**10**	**14**

Notes to tables

Supply figures are estimates of sales by the mines of primary pgm.

With the exception of the autocatalyst sector, **demand** estimates are net figures, demand in each sector being total purchases by consumers less any sales back to the market. Thus, annual totals represent the amount of primary metal that is acquired by consumers in a particular year. We continue to exclude the CIS from our demand estimates.

Movements in stocks in a 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 indicates an increase in stocks; a negative figure indicates a rundown in stocks.

Gross autocatalyst demand is purchases of pgm by the auto industry for manufacture of catalytic converters. **Autocatalyst recovery** is pgm recovered from scrapped catalytic converters and is allocated to the region in which the converter was scrapped.

Investment: small refers to the long-term holding of metal in the form of coins, and bars weighing 10 oz or less. **Investment: large** is in the form of 500 g and 1 kg bars in Japan and includes platinum held on account for subscribers to accumulation plans.

Glossary

g	grams
kg	kilograms
tonne	1,000 kg
tons	short tons (2,000 pounds or 907 kg)
oz	ounces troy
pgm	platinum group metals
ppt	parts per thousand
prices	all prices quoted are per oz unless otherwise stated
R	South African rand
$	US dollars
¥	Japanese yen
Almaz	Almazjuvelirexport, the pgm marketing agency of the Russian Federation
CO	carbon monoxide
DPF	diesel particulate filter
GDP	gross domestic product
HC	hydrocarbons
HIC	hybrid integrated circuit
LCD	liquid crystal display
LEV	Low Emissions Vehicle
Merensky, UG2, Platreef	platiniferous orebodies in South Africa
MLCC	multi-layer ceramic capacitor
NOx	oxides of nitrogen
NYMEX	New York Mercantile Exchange
PEM	proton exchange membrane
PM	particulate matter
TOCOM	Tokyo Commodity Exchange
ULEV	Ultra Low Emissions Vehicle
ZEV	Zero Emissions Vehicle

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