PLATINUM 2005

20th anniversary

Johnson Matthey

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The image below is a coloured scanning electron micrograph of metallic palladium crystals (magnification approximately x1,500).

PLATINUM 2005

by Tom Kendall

JM
Johnson Matthey

SUMMARY AND OUTLOOK

PLATINUM

In 2004, demand for platinum edged up by less than 1 per cent for the second year in succession, increasing by just 50,000 oz to 6.58 million oz. Although autocatalyst purchases of platinum again climbed strongly, and greater consumption was seen in several industrial applications, jewellery demand for platinum fell in reaction to higher metal prices. Supplies expanded more rapidly than demand, rising by 300,000 oz to 6.50 million oz and narrowing the market deficit to 80,000 oz.

Purchases of platinum for use in **autocatalysts** jumped by 240,000 oz to a new high of 3.51 million oz in 2004. Rising European demand was powered by higher diesel car sales and tightening diesel emissions limits. In Japan, the heavy duty diesel sector led growth in platinum demand as truck manufacturers introduced models fitted with diesel oxidation catalysts to comply with new emissions standards. North American auto makers, however, purchased less platinum in 2004 than the year before as they continued to move to palladium in gasoline autocatalyst systems.

Platinum Supply and Demand
'000 oz

	2003	2004
Supply		
South Africa	4,630	5,030
Russia	1,050	850
North America	295	385
Others	225	235
Total Supply	**6,200**	**6,500**
Demand		
Autocatalyst: gross	3,270	3,510
recovery	(645)	(700)
Jewellery	2,510	2,200
Industrial	1,380	1,530
Investment	15	40
Total Demand	**6,530**	**6,580**
Movements in Stocks	**(330)**	**(80)**

Purchases of platinum for **jewellery** manufacture dropped by 12 per cent last year, falling by 310,000 oz to 2.20 million oz. A 19 per cent reduction in demand for metal from Chinese jewellery manufacturers accounted for much of the decline, and was attributable to both the volatility and the strength of the platinum price. In Japan, sales of platinum jewellery were adversely affected by elevated metal prices and recycling of old jewellery stock throughout the trade persisted at high levels. North American retail sales of platinum jewellery also slipped lower, but in Europe the expansion of the UK market continued and demand for Swiss platinum watches was good.

Industrial demand for platinum climbed by 11 per cent to 1.53 million oz in 2004. Substantial investment in the construction of new glass production capacity in Asia led to a marked increase in demand for platinum fabrications. In the electrical sector, strong growth in sales of consumer electronics boosted shipments of hard disks, whilst consumption of platinum in the manufacture of catalysts for the bulk chemicals and petroleum refining industries also increased.

Net demand for physical platinum **investment** products improved from just 15,000 oz in 2003 to 40,000 oz last year. Although significant volumes of large bars were sold back to dealers in Japan during the first quarter of 2004, purchases throughout the remainder of the year outweighed further disinvestment.

Supplies of platinum increased by 300,000 oz to 6.5 million oz in 2004. South African output exceeded 5 million oz for the first time, despite operational and industrial relations difficulties at several mines. Platinum production in North America also recovered after a relatively poor 2003, while output in Zimbabwe was moderately higher. However, after significant sales from stocks the previous year, shipments of platinum from Russia fell back to closely reflect the level of mine production.

The **price** of platinum surged from $815 to $937 during the first four months of 2004. Although the market for physical metal was fairly tight, with short term lease rates of around 8 per cent at the start of the year, most of the impetus for the rally came from fund buying of futures on the NYMEX and TOCOM exchanges. This mirrored increased fund investment across the commodities market as a whole as investors sought to profit from the weakening of the US dollar. However, many buyers of physical metal, notably Chinese jewellery manufacturers, scaled back orders for platinum as the price climbed.

When funds liquidated long futures positions in late April the price fell back rapidly and subsequently dipped below $800 on a number of occasions between May and July. Although renewed fund buying then came into the market, it was not sufficient to drive the price back over $900 and from August onwards platinum largely traded between $820 and $880. The average platinum price over the year as a whole increased to $845.75, a rise of 22 per cent compared with the previous year.

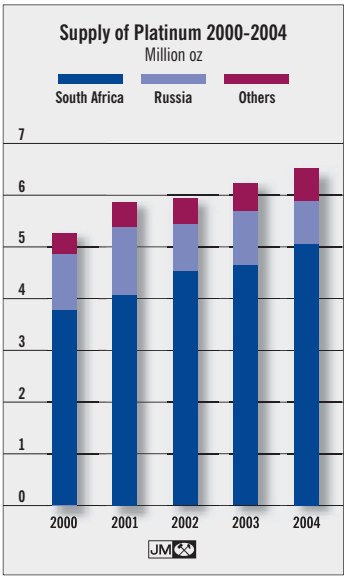
- **Demand** for platinum increased marginally in 2004 to 6.58 million oz.
- Purchases of platinum for use in **autocatalysts** climbed to a record high of 3.51 million oz, primarily as a result of higher demand from the light duty diesel sector in Europe.
- **Jewellery** demand for platinum slid to 2.20 million oz in 2004 as the high and volatile price of the metal adversely affected Chinese purchases.
- Consumption of platinum in **industrial** applications grew substantially, rising to 1.53 million oz as use of the metal in the glass industry, hard disks and chemical catalysts increased.
- **Supplies** of platinum rose by 5 per cent to 6.50 million oz, as the expansion of production in South Africa accelerated and North American output improved.
- With the platinum market still in deficit, fund investment in the metal pushed the **price** to a peak of $937 in April. The price subsequently fell back but remained well supported by both speculative and physical demand.

Use of platinum in most industrial applications, including computer hard disks, increased in 2004.

Supply

Supplies of platinum from **South Africa** climbed by 400,000 oz to 5.03 million oz in 2004, an annual increase of 9 per cent. Output of refined platinum at Anglo Platinum reached the company's target of 2.45 million oz, up from 2.31 million oz the year before. Substantial new production came from the company's Rustenburg UG2 project and tailings retreatment plant on the western limb of the Bushveld Complex, as well as from the Modikwa joint venture mine on the eastern limb. However, platinum output at a number of Anglo Platinum's established mines, including Amandelbult, declined and the company suffered from industrial action at several operations during October.

The marked appreciation of the South African rand in 2004 caused problems for all of the country's pgm producers, particularly with regard to planning and costing new projects. One of the consequences of the stronger rand was Anglo Platinum's decision to scale back its production target for 2006 to 2.7-2.8 million oz of refined platinum.



Production of platinum from Impala's core lease area on the western Bushveld increased by 5 per cent to 1.09 million oz last year. The effects of a strike in October were outweighed by higher mining and milling rates throughout the year as a whole. However, at the developing Marula mine on the eastern Bushveld, geological difficulties meant that production fell behind schedule.

Sales of platinum by Lonmin grew to 943,000 oz in the year to September 2004. Although the tonnage of ore mined from underground operations declined, this was more than offset by greater production from a number of open pits.

Platinum output at Aquarius Platinum's Kroondal operation jumped by 17 per cent last year to 155,000 oz. Output at the company's developing Marikana mine also increased but by less than planned due to a combination of persistent heavy rain early in the year and poor ore quality in parts of the open pit.

For Northam Platinum, 2004 was marked by a serious fire at its mine; production was subsequently halted for three weeks and was adversely affected for several more. The effect of the fire on platinum output, however, was partially offset by a reduction of metal in the refining pipeline. The ramp up of production at Southern Platinum's Messina mine and at ARM Platinum's Modikwa joint venture with Anglo Platinum also continued, but the rate of development at both operations fell behind schedule.

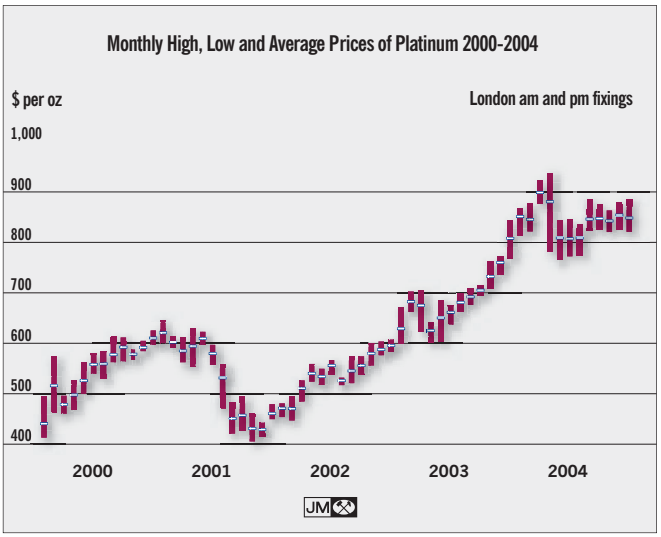
Shipments of platinum from **Russia** are estimated to have totalled 850,000 oz in 2004, close to the level of production from Norilsk Nickel and the alluvial mines in the Far East of the country. There was little evidence of sales of platinum from state stocks during the year. The Russian parliament passed a law in February 2004 declassifying information on companies' geological reserves, production, stocks and sales of pgm but it was not until March 2005 that President Putin signed a decree permitting the release of this data. Information on stocks of metal held by the Russian Treasury (Gokhran) or the Central Bank will, for the time being at least, remain confidential.

After a substantial drop in 2003, due largely to strike action at Inco, supplies of platinum from **North America** bounced back to 385,000 oz in 2004, up by a third on the year before. Supplies of platinum from **Zimbabwe** increased more slowly, rising by 5 per cent to 145,000 oz as a result of improved production at both the Mimosa and Ngezi mines.

Demand

Total purchases of platinum by the **autocatalyst** sector climbed by 7 per cent to 3.51 million oz in 2004. European autocatalyst demand for platinum again grew strongly, rising by 205,000 oz to reach a new high of 1.66 million oz. Much of the increase was due to further growth in sales of diesel cars, which accounted for more than 48 per cent of all new cars sold in the region during the year. At the same time, tightening emissions standards resulted in higher average diesel catalyst loadings, as well as the introduction of platinum-catalysed diesel particulate filters (DPF) as original equipment on some light vehicle models.

Purchases of platinum by Japanese vehicle manufacturers jumped by 90,000 oz to 590,000 oz in



2004. A significant proportion of the additional demand came from truck manufacturers, as the imminent introduction of tighter emissions regulations necessitated the introduction of oxidation catalysts (plus, in some cases, diesel particulate filters) on new heavy duty diesel vehicles. There also appeared to be a degree of pgm stock building by the Japanese auto industry last year, which contributed to the rise in purchases of platinum.

Elsewhere in Asia, growth in light vehicle production coupled with tightening emissions standards resulted in increased autocatalyst demand for platinum, notably in China where consumption climbed by 20 per cent to 75,000 oz. Although the introduction of restrictions on consumer credit in China slowed the rate of growth of car sales, the market remained relatively buoyant. At the same time, more stringent light vehicle emissions standards were introduced nationwide.

In contrast to all other major vehicle manufacturing regions, the North American auto industry purchased less platinum in 2004 than the year before. The major auto makers in the region continued to reduce their use of the metal, preferring to adopt palladium-based autocatalyst systems on new models, and so demand for platinum fell by almost 10 per cent to 800,000 oz.

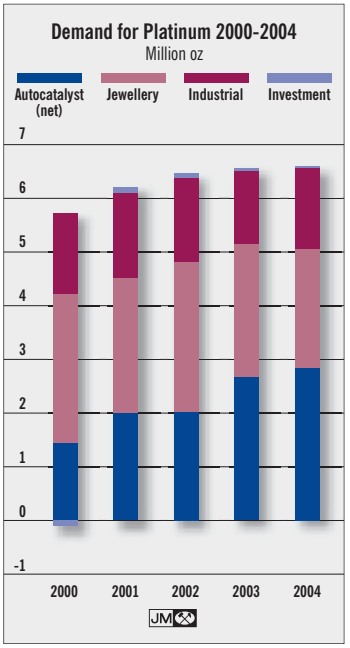
In 2004, demand for platinum from the Chinese and Japanese **jewellery** industries dropped substantially for the second year in succession. This outweighed improved demand in Europe and the Rest of the World, resulting in a 12 per cent fall in total jewellery purchases of platinum to 2.20 million oz.

Purchases by Chinese jewellery manufacturers fell by 240,000 oz in 2004 to 1.01 million oz. The performance of the platinum price, particularly during the first four months of the year, had a pronounced effect on Chinese demand. The rise in the metal price increased the cost of financing inventories of platinum products throughout the industry, whilst the volatility of the price raised the financial risks of holding metal. The result was a noticeable upturn in the volume of old jewellery stock returned to manufacturers by wholesalers and retailers.

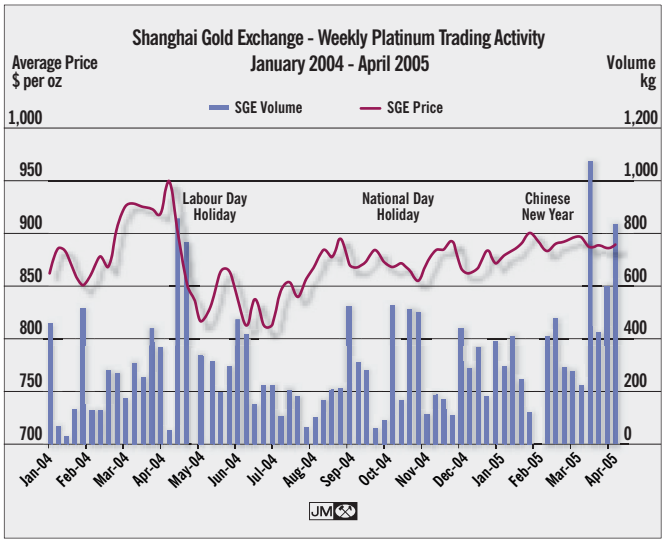
At the same time, manufacturer profit margins were squeezed by large retail chains and department stores, who were keen to hold retail prices of platinum jewellery down for as long as possible whilst at the same time protecting their own margins. Consequently, many manufacturers diverted resources from the production of platinum jewellery to higher margin white gold and palladium.

Although lagging behind changes in the metal price, retail prices of platinum jewellery were raised on several occasions throughout the year. As a result, platinum lost some market share to less expensive white gold and, especially in smaller provincial cities, to palladium jewellery.

Nevertheless, Chinese jewellery demand for platinum held above 1 million oz for the fifth year in a row. Sales of platinum in the most affluent urban areas (notably Beijing and Shanghai) remained fairly robust, despite higher prices, and the markets for bridal and diamond set platinum jewellery continued to develop. From the manufacturers' perspective, margins on platinum improved during the second half of the year as the metal traded between $830 and $860 for prolonged periods.



Japanese jewellery demand for platinum contracted by 70,000 oz to 560,000 oz in 2004, a fall of 12 per cent. Higher metal prices translated into higher product prices, which resulted in a drop in retail sales of platinum jewellery. Sales at the upper end of the



The weekly volumes of platinum traded on the Shanghai Gold Exchange varied considerably in 2004, largely in relation to the metal's price.

market held up reasonably well, but Japanese manufacturers faced greater competition from imported designer-brand jewellery. The rising price of platinum also boosted the recycling of old platinum jewellery stock throughout the Japanese trade.

Retail sales of platinum jewellery in North America also fell in reaction to higher metal prices in 2004, and platinum demand slipped by 20,000 oz to 290,000 oz. However, this was partly offset by greater purchases of metal by European jewellery manufacturers. Sales of platinum jewellery in the UK continued on an upward trend, whilst orders for luxury Swiss watches were firm.

After a relatively weak 2003, **industrial** demand for platinum rebounded by 150,000 oz to 1.53 million oz last year. More than half of this growth was due to a surge in demand from the glass industry, which climbed by 80,000 oz to 290,000 oz. This, in turn, was a result of the construction of numerous new furnaces for the production of liquid crystal display (LCD) glass in Asia. Expansion of fibre glass and conventional television glass plants in China also contributed to higher platinum demand.

The consumption of platinum in electrical applications also grew firmly in 2004, reaching 295,000 oz. Increased production of hard disks for computers, MP3 music players and other consumer goods accounted for the lion's share of the growth, although use of platinum wire in high temperature thermocouples also expanded.

Demand for platinum in chemical applications climbed to 330,000 oz last year as higher production of silicones in Europe and the construction of new paraxylene manufacturing facilities in Asia led to improved orders for platinum-based catalysts. This more than offset a moderate reduction in demand from the nitric acid industry. Purchases of metal for use in petroleum reforming and isomerisation catalysts also rose, advancing to 145,000 oz on the back of the construction of new refining capacity in Asia, Africa and the Middle East.

Total demand for platinum in other applications was stable in 2004 at 470,000 oz. Consumption of the metal in gas sensors, spark plugs, the biomedical sector and turbine blades increased steadily but the use of platinum in stationary emissions control catalysts fell.

Outlook

Supplies of platinum are set to increase further in 2005, although not as rapidly as last year as the rate of growth in South African production slows. The outlook for demand is similar: autocatalyst purchases of platinum are expected to rise once again this year, but the increase will be less pronounced than in 2004. Jewellery demand may also improve, although this will depend heavily on the level of Chinese purchases.

The price of platinum has been less volatile to date in 2005 compared with the same period of 2004. Whilst this has allowed a degree of equilibrium to be restored between Chinese retail prices of platinum jewellery and the metal price, financing costs remain a deterrent to holding inventories, and both retailers and manufacturers can still earn more money on white gold and palladium. Nevertheless, the bridal and diamond-set sectors of the platinum market offer potential for growth, as well as higher margins than for plain platinum jewellery.

Japanese sales of platinum jewellery are likely to weaken again this year as white gold takes further market share, leading to a further fall in platinum purchases. Little change is forecast for European and North American jewellery demand for platinum in 2005. In both regions retail sales of platinum jewellery will continue to be pressured by lower priced white gold, although international brand name products should continue to sell well.

Autocatalyst demand for platinum is forecast to climb further in 2005, with growth again driven

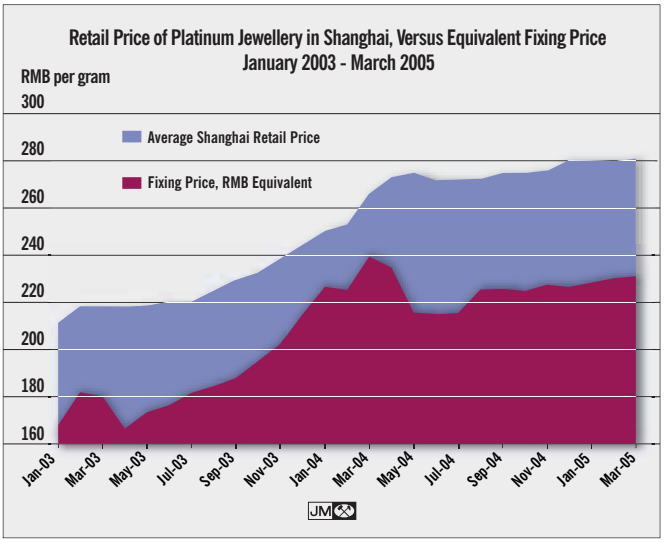
primarily by the light duty diesel sector in Europe. Another increase in production and sales of diesel cars in the region appears certain, whilst the launch of additional Euro IV compliant models will see average diesel catalyst loading levels shift upwards. The fitment of catalysed particulate filters this year, both as original equipment and as optional extras, is also expected to rise as the focus on particulates as a cause of health problems intensifies.

Demand for platinum from the Asian autocatalyst sector (excluding Japan) is also forecast to grow in 2005. Additional increases in light vehicle production and sales are projected for China and India and the tightening of emissions limits across the region will continue. In South Korea, platinum demand will also get a boost from the lifting of restrictions on the sale of light duty diesel vehicles.

In Japan, demand for platinum from the heavy duty diesel sector should continue to be firm as the number of truck models that comply with tougher emissions legislation grows. North American autocatalyst demand for platinum, however, is expected to continue on a downward trend as the substitution of platinum by palladium in gasoline catalyst systems continues.

Consumption of platinum in industrial applications is expected to grow again this year. The expansion of the LCD glass manufacturing industry in Asia is continuing at a rapid pace, and demand from the hard disk sector is also forecast to remain robust. Orders for platinum-based catalysts from the chemicals industry are expected to increase further in 2005 as new manufacturing capacity is commissioned in Asia.

Margins on the manufacture of platinum jewellery have been largely stable in China since the middle of 2004, but metal funding costs remain high.



Sales of Swiss platinum watches, such as the Opus V shown left, are set to remain firm in 2005, but jewellery demand for platinum in Europe as a whole is likely to be flat.

Supplies of platinum are forecast to expand once again this year, but not by as much as previously anticipated. The rate of growth in South African output will slow, largely as a result of Anglo Platinum scaling back its production target for the year to 2.6 million oz. At the same time, North American platinum production is likely to slip behind last year's total, with Inco not scheduled to produce as much by-product pgm from its base metal mines in Canada. Shipments of platinum from Russia are forecast to be largely stable, continuing at or close to the level of mine production.

In conclusion, if Chinese purchases of platinum for jewellery in 2005 are similar to last year's level of demand, we would expect the overall platinum market to be more or less in balance. This suggests that the price will continue to trade around levels seen in the first quarter of the year. However, as in 2004, the actions of hedge funds and other investors may well have a greater impact than the fundamentals of supply and demand, and could again result in wide fluctuations in the price. The level of fund activity in platinum (as for other dollar-denominated commodities) will in turn continue to be closely linked to the strength or weakness of the US dollar, and particularly to the $:rand exchange rate. With this in mind, we have set our forecast price range for platinum for the next six months at $830 to $930.

PALLADIUM

Demand for palladium climbed steeply in 2004, rising by 22 per cent to 6.6 million oz. The rapid development of palladium jewellery manufacturing in China had a pronounced impact on demand, and use of the metal in all of its other main applications (autocatalysts, electronics and dental alloys) increased.

The growth in demand, however, was almost exactly matched by a substantial rise in supplies of palladium. Mine production in South Africa and North America expanded, and a considerable volume of Russian metal was sold from stocks. As a result, total supplies jumped to 7.62 million oz and a market surplus of over 1 million oz was recorded for the second year in a row. Consequently, with the exception of a fund-driven rally in March and April, the price was soft and palladium ended December at $184, $10 below the year's opening fixing.

- **Demand** for palladium jumped by 22 per cent to 6.6 million oz in 2004.
- **Autocatalyst** purchases of palladium climbed by 10 per cent to 3.81 million oz. US automakers bought more metal, having run down stocks the previous year, and the substitution of platinum in gasoline autocatalysts continued.
- Demand for palladium in **electronics** increased to 955,000 oz, influenced by strong sales of electronic goods and the low palladium price.
- Use of palladium in **jewellery** soared to 920,000 oz in 2004 as large scale production of palladium jewellery began in China.
- **Supplies** of palladium surged to 7.62 million oz, an annual rise of 18 per cent, as substantial sales of Russian metal were made from stocks. Mine production in South Africa and North America also increased significantly.
- Supplies exceeded demand by more than 1 million oz for the second year in succession. Consequently, the palladium **price** was weak for much of the year, despite substantial fund investment, ending 2004 at $184.

Autocatalyst demand for palladium climbed by 360,000 oz to 3.81 million oz in 2004, a rise of 10 per cent. There was a substantial increase in purchases of metal in North America as, unlike the previous year, US car companies did not consume significant quantities of palladium from inventories. Japanese auto manufacturers made greater use of palladium-based catalyst systems on gasoline light vehicle models, whilst demand elsewhere in Asia expanded in line with higher light vehicle output and tighter emissions standards. In Europe, however, autocatalyst demand for palladium continued to follow gasoline car production downwards, falling by 5 per cent.

Demand for palladium in **electronic** applications grew to 955,000 oz in 2004, an annual rise of 55,000 oz. Use of the metal expanded in all sectors of the market, driven by strong growth in production of electronic consumer goods and the increasing use of electronic systems in automobiles. The relatively low price of palladium also gave it an advantage in plating applications where it competes with gold.

Palladium Supply and Demand
'000 oz

	2003	2004
Supply		
South Africa	2,320	2,500
Russia	2,950	3,800
North America	935	1,055
Others	245	265
Total Supply	**6,450**	**7,620**
Demand		
Autocatalyst: gross	3,450	3,810
recovery	(410)	(530)
Dental	825	850
Electronics	900	955
Jewellery	250	920
Other	405	595
Total Demand	**5,420**	**6,600**
Movements in Stocks	**1,030**	**1,020**

JM

In 2003, approximately 250,000 oz of palladium was consumed in the production of white gold and platinum jewellery alloys, primarily in Europe and Japan. In 2004, **jewellery** demand for the metal soared to 920,000 oz as a result of the remarkably rapid development of palladium jewellery manufacturing in China. Jewellery consequently overtook the dental sector as the third largest market for palladium.

Purchases of palladium for use in **dental** alloys totalled 850,000 oz in 2004, an improvement of 3 per cent on the year before, as the low and relatively stable palladium price fed through to greater demand for palladium alloys.

Demand for palladium in **other** applications jumped to 595,000 oz in 2004, climbing from 405,000 oz the previous year. This was primarily a result of a surge in sales of palladium bullion bars and coins to North American investors. Demand for palladium-based catalysts from the chemicals industry also improved.

Supplies of palladium leapt by 1.17 million oz to 7.62 million oz in 2004, well above the level of mine production. Much of the additional metal was Russian material that entered the market late in the year, after having been imported into Switzerland, and was most probably sold on behalf of either the Russian Treasury (Gokhran) or the Central Bank. Additional Russian palladium was sold by Stillwater Mining, which began regular deliveries to customers

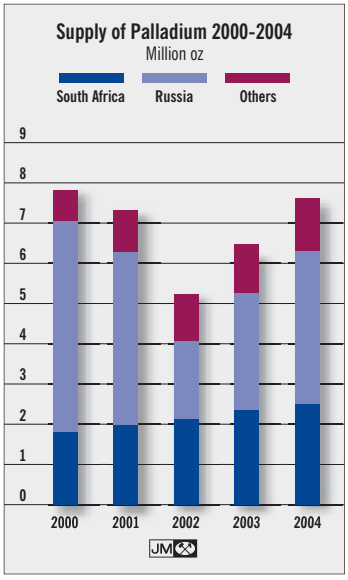
from the inventory that it received when Norilsk Nickel acquired a majority shareholding in 2003.

A potent combination of fund buying, expanding demand for metal from Chinese jewellery manufacturers, and an announcement regarding the potential use of palladium in diesel autocatalysts propelled the **price** of palladium from $192 on the 2nd of January to a peak fixing of $333 on the 13th of April. At that point the net long position held by funds on NYMEX was equivalent to almost 987,000 oz, up from just over 532,000 oz at the start of the year. However, with plenty of metal available to cover both speculative and end user demand, the price collapsed when funds started taking profits, falling to less than $240 before the end of the month.

After a brief rebound in May, the price slipped back and traded steadily between $200 and $240 from early June through to November, despite renewed fund buying. Towards the end of the year, the volumes of physical metal offered increased considerably. This, combined with year-end profit taking by funds, resulted in the palladium price sliding below $200 and ending 2004 weakly at $184.

Supply

Russian supplies of palladium jumped to 3.80 million oz in 2004, up from 2.95 million oz the year before, as mine production was supplemented with the sale of substantial volumes of metal from stocks.



Sales of Russian palladium accelerated in the final two months of 2004, coinciding with the transfer of over 1 million oz of Russian metal into Switzerland in November and a further 657,000 oz in December. The sudden surge of Russian metal flowing into Zurich was probably related to the fact that Gokhran and the Russian Central Bank did not receive palladium export quotas for 2004 until late in the third quarter of the year. A significant proportion of this palladium is believed to have then been sold into the market.

Norilsk Nickel's production of palladium was relatively stable, the company producing in the region of 2.7 million oz from its nickel-pgm mines in northern Siberia and the Kola Peninsula. Norilsk stated that it would sell its full output during the year and is believed to have done so, delivering the majority of its production under contracts with end users.

Our total Russian supply figure for 2004 also includes 375,000 oz of metal that Stillwater Mining sold to end users during the year from the inventory of 877,169 oz of palladium that it gained when Norilsk took a majority shareholding in the company.

South African output of palladium increased by 8 per cent to 2.50 million oz in 2004, in line with higher platinum production from most of the major pgm companies. **North American** shipments also rose substantially, climbing by 13 per cent to 1.055 million oz. Inco's production more than doubled as the company processed pipeline stocks that had accumulated during the previous year's three month strike. North American Palladium also reported higher output as it mined higher-grade zones of ore and increased mill throughput. These increases far outweighed slightly weaker production at Stillwater Mining.

Demand

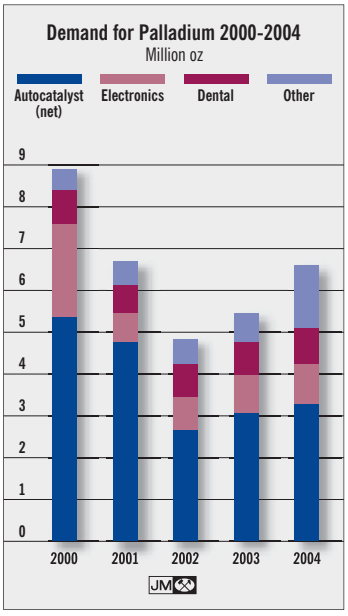
Demand for palladium from the **autocatalyst** sector grew by more than 10 per cent to 3.81 million oz in 2004. The largest increase in purchases came from the North American auto industry, up almost 20 per cent to 1.445 million oz. In contrast to 2003, when substantial volumes of palladium were drawn down from inventories, there was little evidence of further consumption of metal from stocks in 2004.

The actual use of metal on catalysts, however, continued to fall as a result of programmes to thrift pgm loading levels by US auto makers. In North America, the average palladium loading on a light duty vehicle catalyst system halved from around 6 grams per vehicle in 2000 to just over 3 grams in 2004 (this average covering a very broad range of loading levels on individual vehicle models). The negative effects of thrifting continued to outweigh the positive impact on metal demand of further switching from platinum-based catalysts to those using palladium.

Japanese purchases of palladium for use in

autocatalysts rose substantially in 2004, reaching 675,000 oz. Much of this growth was attributable to increased use of palladium-based autocatalysts on new vehicle models in response to the widening and persistent difference between the prices of platinum and palladium. At the same time, the ongoing tightening of emissions regulations in Japan led to a rise in average pgm loading levels.

Autocatalyst demand for palladium in China and elsewhere in Asia also expanded in 2004, in line with higher light vehicle production and tighter emissions standards. In Europe, however, demand fell for the fourth year in succession as sales of gasoline-powered cars continued to trend downwards.



Demand for palladium from the **electronics** industry grew by 6 per cent to 955,000 oz last year. Rapid growth in sales of consumer goods and increased use of electronics in the auto industry led strong demand for components using palladium. The weak price of the metal was also a significant factor in generating greater demand from the plating sector. On the down side, continued thrifting, miniaturisation and substitution of palladium by nickel suppressed growth in consumption in multi-layer ceramic capacitors.

The use of palladium in **jewellery** soared to 920,000 oz in 2004, up from 250,000 oz the year before, driven almost entirely by the introduction of palladium products in China.

Early in the year, disillusioned with the poor profitability of platinum jewellery, a number of leading Chinese manufacturers began producing pieces in palladium, on which they could make substantially higher margins. As a growing number of wholesalers and retailers in smaller provincial cities established stocks of product, and as more manufacturers began producing palladium jewellery, demand for the metal jumped. Imports of palladium into Hong Kong during March and April alone totalled 314,000 oz, compared with just 64,000 oz in the same two months the previous year. Although the rate of purchasing subsequently eased back from those exceptional levels, it remained firm throughout 2004, Chinese jewellery demand for palladium totalling 700,000 oz for the year as a whole.

Chinese retail outlets promoted palladium jewellery on its low price, its purity, and the metal's close association with platinum. This mix of attributes proved to be appealing to consumers aspiring to pure white precious metal jewellery but who could not afford platinum. The low up-front costs of establishing inventory and the attractive potential profit margins meant that palladium jewellery was given significant display space by those retailers choosing to stock it, taking market share not only from plain platinum jewellery and white gold, but also from traditional yellow gold products.

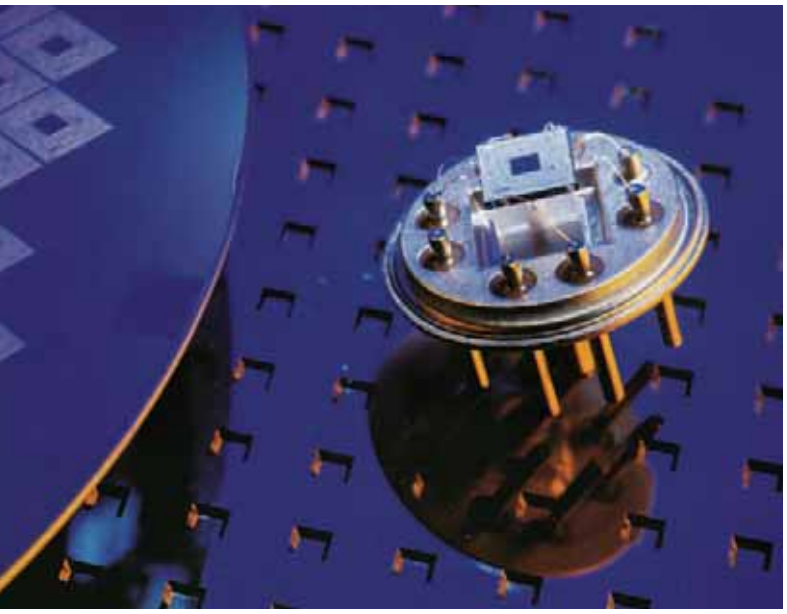
In the most affluent urban centres, however, and particularly in Beijing and Shanghai, few stores were willing to stock palladium jewellery. In these areas platinum has established a strong position in the market, supported by co-ordinated promotion and marketing, and retailers have been wary about detracting from this by introducing palladium.

The low and relatively stable price of palladium, particularly from May onwards, led to an improvement in consumption of palladium in **dental** alloys last year. Demand rose by 3 per cent to 850,000 oz as use of palladium alloys made modest gains in Europe, Japan and North America.

Purchases of palladium for **industrial** and **other** applications increased by 47 per cent in 2004, reaching 595,000 oz. Sales of palladium coins and small bars in North America surged to an estimated 200,000 oz, a result of both effective marketing and the perception amongst individual investors that the metal had the potential to appreciate substantially in price. Greater use of palladium-based catalysts pushed demand from the chemicals industry up by 15 per cent to 305,000 oz.

Outlook

Autocatalyst demand for palladium is forecast to be stable in 2005. With no distortion expected from year-to-year changes in inventory use, North American purchases will reflect consumption of metal on catalysts this year, which we expect to increase as switching from platinum continues and the impact of thrifting moderates. Demand in China and the Rest of



Use of palladium in hybrid integrated circuits and other electronic components should continue to grow in 2005.

the World region should also grow, again driven by higher light vehicle production and tightening emissions regulations.

However, these increases in autocatalyst purchases are forecast to be countered by another fall in European demand, as gasoline light vehicles lose further market share to diesels. The development of diesel autocatalysts in which palladium substitutes for a proportion of the platinum currently used is continuing, but will not have a discernible effect on demand for either metal this year.

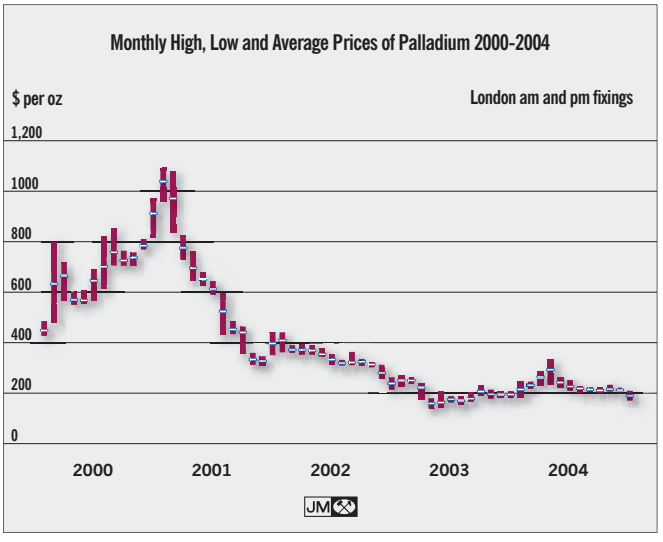
Palladium has established a clear presence in the Chinese jewellery market, and there is certainly potential for retail sales to increase in 2005. However, it is uncertain whether higher retail sales will translate directly into year-on-year growth in metal purchases, given that a significant amount of the palladium bought in 2004 supported an initial stock build across the jewellery trade.

Demand for palladium from the electronics sector is forecast to grow further this year, so long as the global economy continues to expand at its present rate. Use of palladium in dental alloys is also expected to show another modest improvement. We would be surprised, however, if demand for physical investment products were to match the high rate of sales seen in 2004.

On the supply side, South African production of palladium should increase once again as platinum output continues to rise. North American sales are expected to fall short of last year's high level, whilst Russian shipments of palladium remain unpredictable. In March 2005, President Putin signed a decree that will permit Norilsk Nickel to release data on its geological reserves, production, stocks and sales of pgm, and the company may publish its first set of figures later this year. However, information regarding metal held by the Russian state, whether by Gokhran or the Central Bank, will remain confidential. What is certain is that between them, these two organisations still own a very substantial volume of palladium, and further sales from these stocks could occur during 2005.

In 2004, palladium demand increased for the third year in succession, with substantial new sales to the Chinese jewellery industry, increased investor buying of physical products in the USA, higher purchases of metal for autocatalysts, and improved electronics and dental demand. There was also very substantial investment in palladium derivatives by funds throughout much of the year. At the same time, however, supplies of palladium also increased due to rising mine production, the release of metal from stocks, and greater recovery of palladium from scrapped autocatalysts. Consequently, availability of palladium was high, and is likely to remain so during 2005.

The palladium market, therefore, is projected to continue in surplus. In light of this, the prospect of a sustained rally in the palladium price appears remote, unless there is further substantial speculative buying. We therefore forecast that palladium will trade between $160 and $230 over the next six months.



SUPPLIES, MINING & EXPLORATION

SOUTH AFRICA

Supplies of platinum from South Africa expanded by 9 per cent to 5.03 million oz in 2004, an increase of 400,000 oz over the previous year. A substantial proportion of this growth came from Anglo Platinum, which met its target for platinum production of 2.45 million oz despite a 13-day strike. Impala Platinum also overcame the impact of industrial action, increasing output from its lease area and benefiting from the start-up of the Marula mine. Sales by other producers also climbed, with the exception of Northam, which lost 6 weeks of production following a serious fire. Shipments of palladium grew in line with those of platinum, rising 8 per cent to 2.50 million oz, while those of rhodium were also up 8 per cent at 587,000 oz.

Anglo Platinum

Additional production from its newer operations helped lift platinum output from Anglo Platinum to 2.45 million oz in 2004, up from 2.31 million oz the previous year. The new western limb tailings retreatment plant, the Rustenburg UG2 project, and the Modikwa joint venture together added over 150,000 oz of refined platinum last year; the company also received a one-off benefit of 91,000 oz from the clean-up of residues at the Waterval Smelter following the commissioning of the ACP converter plant. However, production at some of the established mines declined, partly due to a 13-day strike in October.

PGM Supplies: South Africa
'000 oz

	2003	2004
Platinum	4,630	5,030
Palladium	2,320	2,500
Rhodium	544	587

JM

At Rustenburg Section, production from the Merensky Reef continued to fall; the milling rate in 2004 was 5.76 million tonnes of ore, a decline of 11.5 per cent compared with the previous year. However, equivalent refined platinum output fell by only 4.5 per cent to 545,000 oz, reflecting an increase in grades. Over the last two years the quantity of Merensky Reef mined and processed at Rustenburg has decreased by over 1.1 million tonnes, reflecting the depletion of ore reserves accessible from existing shaft systems. The company is currently reviewing a number of options to enable it to maximise future production from the Merensky Reef.

Declining Merensky production at Rustenburg has been greatly offset by the increase in output from the Rustenburg UG2 project, which is currently in its ramp-up phase. In 2004, this operation processed 6.51 million tonnes of ore, yielding 319,000 oz of platinum. A phase II expansion is planned; originally, this would have added 400,000 tonnes per month (tpm) of milling capacity but has been scaled back to 255,000 tpm.

The Amandelbult mine produced 592,000 oz of platinum last year, a decline of 8 per cent compared with 2003. Production was affected by difficult geological conditions at Number 2 shaft, while opencast output decreased in line with the depletion of near-surface reserves; in addition, some 23,000 oz of platinum were lost as a result of the strike. At Union Section, lower production from opencast workings was largely offset by the processing of old tailings and additional output from new UG2 declines.

Other operations reported increases in refined production. The biggest single contributor to last year's expansion in platinum output was the new western Bushveld tailings reprocessing operation, which milled 4.35 million tonnes yielding over 66,000 oz of platinum. Elsewhere, output at PPRust was up 4 per cent at 200,000 oz, while Lebowa saw a 13 per cent rise to 119,000 oz (of which some 4,000 oz came from trial mining at the nearby Twickenham project). There were also small gains at BRPM, as open pit tonnage was replaced by increased production from underground, and a boost in output at the Modikwa joint venture with ARM.

Drilling underground at Norilsk Nickel's Oktyabrsky mine on the Taimyr Peninsula, Siberia, source of more than half of the company's annual pgm production.

Impala Platinum

In 2004, refined production of platinum from the Impala lease area totalled 1.09 million oz, an increase of 5 per cent. Although the company lost 10 days of production and an estimated 44,000 oz of platinum due to a wage strike in October 2004, this was more than offset by higher rates of ore extraction and processing during the rest of the year. A total of 15.5 million tonnes of ore were processed in 2004, up 2.5 per cent, while a new tailings scavenging plant contributed to higher recoveries.

Impala's intention is to maintain platinum

production from its core lease area at a minimum of 1 million oz in future. To achieve this, it will need to construct two new shafts, in addition to its current programme of developing declines from existing mining infrastructure. In September 2004, the board of directors approved capital spending of R6.6 billion on the construction of the new shafts, which are expected to enter production in 2009 and 2012.

Impala's Marula mine on the eastern Bushveld had a difficult first year of operation. Production of 1.03 million tonnes of ore milled, yielding around 30,000 oz of platinum in concentrate, was below plan. In addition, it became apparent that the chosen mining method (mechanised bord and pillar) was not appropriate for the ore body, which dips relatively steeply in the shallower parts of the Marula lease, and also has an unexpectedly high incidence of 'rolling reef' (areas in which the reef undulates). As a result, Impala has decided to spend an additional R830 million on converting the operation to conventional labour-intensive mining methods over a period of about five years. The mine's output at full capacity is now expected to be in the region of 135,000 oz platinum per annum.

Impala Platinum also has a 45 per cent stake in the Two Rivers joint venture with ARM Platinum *(see separate section)* as well as an 84.5 per cent interest in Zimplats and a 50 per cent stake in Mimosa in Zimbabwe.

Production at Anglo Platinum's new smelter at Polokwane continued to build during 2004.

Lonmin

Sales of platinum by Lonmin totalled 943,000 oz in its financial year to September 2004, an increase of 4.5 per cent. Palladium shipments were almost unchanged at 406,000 oz, while rhodium supplies fell slightly to 127,000 oz.

The tonnage of underground ore mined by Lonmin declined in 2004 but this was more than offset by a sharp increase in the quantity of ore sourced from open pits. Refined production of platinum totalled 918,000 oz, of which 5,000 oz came from the processing of old residue ponds. The treatment of these residues, which has added over 30,000 oz to refined platinum production over the last two years, has now been completed.

Production at Lonmin's Number 1 smelter recommenced in early 2004, following an explosion in December 2002. However, in November 2004 a second serious incident took place when cooling water leaked into the furnace, causing a steam explosion. Although the smelter was out of action for approximately two months, Lonmin was able to treat much of its concentrate output via its old Pyromet furnaces, while sending the remaining material to Impala for toll-refining. The outage consequently had little impact on refined pgm production, and the smelter was recommissioned in January 2005.

In March 2005 Lonmin made a recommended cash offer for Southern Platinum, which has a 91.5 per cent stake in Messina Platinum. Lonmin also reached an agreement with Impala to buy out the latter's concentrate purchase agreement with Messina for $15 million plus the delivery of a fixed quantity of pgm concentrate until mid-2006.

Lonmin's intention is to raise production at Messina's Voerspoed section to 75,000 oz of platinum by 2007. It will also review a feasibility study already conducted by Southern Platinum into a new mine on the Doornvlei and Dwaalkop sections, producing up to 150,000 oz platinum annually.

Northam Platinum

On the 20th of September 2004, nine employees lost their lives in a fire at Northam Platinum. As a result, the mine was closed for three weeks and production was

affected for several more. In total, approximately six weeks of output were lost.

As a result of the fire, mill throughput in 2004 fell by 12.5 per cent to 2.01 million tonnes, while production of platinum in concentrate was down by a similar percentage to 191,000 oz. However, a release of metal from the refining pipeline enabled the company to achieve platinum sales of 198,000 oz, a decline of only 7.5 per cent. Shipments of palladium and rhodium were 93,000 oz and 23,000 oz respectively.

There is currently little prospect of any significant expansion in output at the Northam mine, where sustainable platinum output is thought to be around 200,000 oz per annum. However, the company is expected to acquire Mvelaphanda's 50 per cent share in the Booysendal joint venture with Anglo Platinum. Under this agreement, Mvelaphanda will increase its shareholding in Northam Platinum to 34 per cent. The principal conditions required for this transaction to proceed, including the granting of prospecting licences, have now been fulfilled.

Aquarius Platinum

In 2004, there was in increase in pgm output from both of Aquarius Platinum's operations in South Africa. At Kroondal, mill throughput rose by 12 per cent to 3.34 million tonnes of ore yielding 155,000 oz of platinum in concentrate, an increase of 17 per cent on the previous year. Palladium output increased by 22 per cent to 75,000 oz, while rhodium production totalled 28,000 oz. Under the Pool and Share Agreement (PSA) with Anglo Platinum, which came into operation in November 2003, the value of pgm production was split equally between the partners. However, in 2004 all pgm concentrate produced at Kroondal was refined by Impala under a pre-existing concentrate purchase agreement.

Under the PSA, capacity at Kroondal is set to double; a new 250,000 tpm concentrator has been constructed and when operating at full capacity this will raise the mine's annual refined platinum output to 280,000 oz per annum. Expansion of the underground mine is underway, involving the construction of a third decline shaft and the extension of underground workings at the existing Central and East shafts.

A new 250,000 tpm concentrator was constructed at Aquarius Platinum's Kroondal operation last year as part of the company's Pool and Share Agreement with Anglo Platinum.

Commissioning of the concentrator was completed in late March 2005, and throughput is expected to build up to planned levels by June. All concentrate production from the new plant will be purchased and refined by Anglo Platinum.

The Marikana mine had a more difficult year. Although production of platinum in concentrate increased by 9 per cent to 55,000 oz in 2004, the mine's performance fell short of expectations. Early in the year, operations were affected by heavy rainfall, which resulted in the loss of 23 days of production. In certain areas of the pit sulphide ore was found to be either exceptionally difficult to process or it was more oxidised than anticipated. As a result, recoveries were disappointing, falling below 50 per cent for much of the year, although some improvement was seen during the final quarter.

In response to these difficulties, Aquarius revised the mine plan in order to accelerate the development of production from deeper, competent ore. Trial underground mining from a decline through the pit high wall was due to start in the first quarter of 2005, and if successful, underground production may be increased to 50,000 tonnes per month.

Aquarius' BEE transaction was completed in October 2004, following the approval of the deal by the company's shareholders and the finalisation of funding arrangements by its BEE partner, the Savannah Consortium. The latter injected R860 million

into Aquarius in return for a 29.5 per cent equity stake in the company's South African subsidiary, Aquarius Platinum South Africa (Pty) Limited. Following the receipt of this funding, Aquarius commenced development of its third South African platinum mine, at Everest South. This operation is due to enter production in 2006, producing an average 225,000 oz pgm per annum over the life of the mine.

In addition to its South African interests, Aquarius holds a 50 per cent stake in ZCE Platinum, which operates the Mimosa mine in Zimbabwe *(see Zimbabwe section)*.

ARM Platinum

ARM Platinum has interests in two pgm-producing mines in South Africa: the Modikwa joint venture with Anglo Platinum, and the Nkomati base metals mine that produces pgm as by-products. In 2004, output at Modikwa increased by 25 per cent to 114,000 oz of platinum, although production remained below planned levels due to poor geological conditions and difficulties in employee relations.

ARM Platinum's Nkomati nickel mine currently exploits a high-grade, massive sulphide orebody from which it produces about 5,000 tonnes of nickel and 30,000 oz of pgm annually. In February 2005 it was announced that the Australian company LionOre Mining International was to take a 50 per cent stake in the operation. The joint venture partners are investigating a major expansion that would exploit a larger, low-grade disseminated ore body. If this were to proceed it could lift annual production to around 16,500 tonnes of nickel and 100,000 oz pgm.

ARM Platinum also holds a 55 per cent interest in the Two Rivers joint venture with Impala Platinum. The boards of both companies have approved the project, and development will proceed upon completion of financing arrangements. At full production the mine is expected to produce 110,000 oz of platinum per year.

Southern Platinum

Output from Southern Platinum's Messina mine rose sharply last year, with pgm production jumping by 52 per cent to 86,000 oz (of which platinum accounted for an estimated 40,000 oz). Although the expansion of production at the mine fell behind schedule, there was a strong increase in mill throughput, up 57 per cent to 766,000 tonnes of ore. The average grade declined to 3.97 grams per tonne but concentrator recoveries improved and, at over 88 per cent, were among the best in the industry.

There were significant changes to the ownership of Messina in 2004. In June, the mine's owner SouthernEra acquired an additional 18.4 per cent of the shares in Messina, raising its total holding to 91.5 per cent. Subsequently, in September 2004, SouthernEra reorganised its businesses, with a new company, Southern Platinum Corporation, acquiring the former's pgm and gold assets. In March 2005, it was announced that Lonmin had made an agreed cash offer for Southern Platinum; this transaction is expected to be concluded in the second half of 2005.

RUSSIA

Sales of Russian palladium accelerated in the final two months of 2004 and are estimated to have reached 3.8 million oz for the year. This total includes 375,000 oz of metal that was sold from stocks held by Stillwater Mining in the USA. Shipments of platinum and rhodium from Russia are estimated to have been 850,000 oz and 105,000 oz respectively.

Norilsk Nickel stated that it intended to sell its full production of palladium during 2004 and it seems likely that this was achieved, although the company has to date remained unable to release any specific data as secrecy regulations governing pgm remain in force. Although the Russian parliament passed a law in February 2004 declassifying such information, it was not until March 2005 that President Putin signed a decree permitting the release of the data. Norilsk is expected to be able to publish data on geological reserves, production, stocks and sales of pgm later this year, but information on stocks of pgm held in the State Treasury (Gokhran) and the Central Bank will remain secret for at least the immediate future.

PGM Supplies: Russia
'000 oz

	2003	2004
Platinum	1,050	850
Palladium	2,950	3,800
Rhodium	140	105

An ore transfer station at Norilsk's Oktyabrsky mine. Production of ore from the company's operations on the Taimyr Peninsula has stabilised at around 13 million tonnes per year.

There are also signs that the system of export quotas and licences for pgm may be brought to an end. Norilsk already has long-term quotas and export licences and was able to export steadily throughout last year. In contrast, it is believed that export licences for state metal were only granted as late as September and this is probably the reason why Russian exports of palladium and rhodium soared in November and December 2004. Although there were strong indications of Russian palladium sales at that time, Swiss trade statistics suggest that some of the metal remained in Zurich, perhaps for sale in 2005. Interestingly, no such rise in platinum shipments was evident, perhaps reflecting a lack of stocks for export.

Data published by Norilsk Nickel in June 2004 show that ore production at its mines in the Taimyr Peninsula has stabilised at just over 13 million tonnes per year. The proportion of cuprous ore produced in the Talnakh sector is increasing slightly at the expense of rich ore as the mines there expand, whereas the quantities of disseminated ore that are produced largely at the old Norilsk-1 operations are gradually declining. As a result of these changes, output of pgm from the Taimyr mines is probably increasing marginally. Production of platinum from the alluvial mines of the Far East of Russia, primarily Kondyor (Khabarovsk) and Koryak (Kamchatka), is thought to have declined slightly in 2004.

In 2003 Norilsk Nickel transferred 877,169 oz of palladium to Stillwater Mining in part payment for a majority shareholding in the company. Although the metal was exported from Russia, none of it was sold during the year and so was not included in our 2003 supply data. Stillwater entered into sales agreements during the first quarter of 2004 to sell the palladium received from Norilsk, and shipped a total of 375,000 oz in the year. This has been incorporated into our 2004 Russian supply total of 3.8 million oz. The remainder of the inventory is scheduled to be sold during 2005 and the first quarter of 2006, at a rate of approximately 36,500 oz per month, and will again be accounted for as Russian supply.

NORTH AMERICA

Supplies of pgm from North America recovered last year, following a dip in output due to industrial action at Inco in 2003. Shipments of platinum rose by 34 per cent to 388,000 oz in 2004, although production was still below the level seen in 2002. Sales of palladium increased by 11 per cent to exceed 1 million oz, a record figure, reflecting strong performances from both Inco and North American Palladium but lower production at Stillwater Mining.

Canada

The North American Palladium mine at Lac des Iles accounts for over half of Canada's palladium production. In 2004, the open-pit operation processed 5.3 million tonnes of ore at a palladium grade of 2.41 grams per tonne, yielding 309,000 oz of palladium and 25,000 oz of platinum in concentrate. This represented an improvement in pgm output of around 7 per cent compared with 2003.

In late 2004 the installation of a secondary crusher was completed, lifting milling capacity to 16,000 tonnes of ore per day (up to 5.8 million tonnes per annum). This should help to maintain output in 2005, during a period when the open pit will be exploiting a lower-grade portion of the ore body. Output will subsequently increase when a new underground section comes on stream, exploiting a higher-grade ore body located directly beneath the existing open pit. First production from underground is expected during the second half of 2005, with the operation due to reach full capacity of 2,000 tonnes of ore per day in early 2006. With grades being comparatively high at 7.4 grams of pgm per tonne, the operation is forecast to produce around

110-120,000 oz of palladium annually over its 5-year life, and should increase total palladium output from Lac des Iles to well over 300,000 oz per annum.

Inco's deliveries of pgm in 2004 were substantially higher than the previous, strike-affected year. Platinum and palladium shipments more than doubled to 183,000 oz and 212,000 oz respectively, although rhodium sales contracted from 17,000 oz in 2003 to 9,000 oz last year, probably reflecting changes in the refining pipeline. About 92 per cent of Inco's by-product pgm production came from ores extracted at its Sudbury operations, with the remaining 8 per cent from its Manitoba mines. The company also refines small quantities of pgm from ore and intermediate materials supplied by other companies; in 2004, it purchased some 280,000 tonnes of nickel-copper ore from FNX Mining's Sudbury joint venture, and also bought concentrate from two Australian nickel producers.

PGM Supplies: North America
'000 oz

	2003	2004
Platinum	295	385
Palladium	935	1,055
Rhodium	26	18

JM

Inco expects its pgm production to decline in 2005, reflecting a planned reduction in nickel output at its Sudbury and Manitoba operations. Scheduled one-month maintenance shut-downs at the mines will result in the loss of an estimated 35,000 oz of pgm production; the company expects total pgm output to be around 370,000 oz this year.

Falconbridge's by-product pgm come from both its Sudbury ores (which contain platinum and palladium in an approximately 1:1.1 ratio) and its Raglan operation (where about 70 per cent of the pgm grade is palladium). The quantity of ore mined at the Sudbury operations declined by 3 per cent last year, but mill throughput was unchanged at 2.26 million tonnes. However, nickel grades fell slightly and output of nickel in concentrate declined to 22,600 tonnes. At Raglan the milling rate increased by 12 per cent to 945,000 tonnes of ore last year, but grades declined and nickel output rose by only 6 per cent to 26,550 tonnes.

In 2005, Falconbridge expects nickel output from its Sudbury operations to be steady. However, production at Raglan is likely to be sharply lower; this will have a negative impact on the company's output of by-product pgm, especially palladium.

Shaft sinking at Falconbridge's Nickel Rim South project in the Sudbury basin was expected to begin in early 2005. This project will replace declining nickel output from the company's other mines in the area, and may also result in an increase in total pgm production due to its relatively high grade.

USA

The Stillwater Mining Company in the USA produced 130,000 oz of platinum and 439,000 oz of palladium in 2004, down about 3 per cent compared with the previous year. Sales of pgm from the company's mines were slightly below these levels, at 125,000 oz and 432,000 oz respectively. In addition, Stillwater sold 375,000 oz of the 877,169 oz of palladium that it received under the acquisition of a 50.8 per cent share in the company by Norilsk Nickel. The sale of the Norilsk metal is not included in our estimates of North American supplies, but is instead incorporated in our figures for Russian sales.

The Stillwater mine at Nye was affected by a one week strike in July 2004, and mill throughput for the year fell by 3 per cent to 787,000 tons; the grade also fell slightly, to 0.56 oz per ton. At the newer East Boulder mine the milling rate increased by 6 per cent, treating 483,000 tons of ore at a grade of 0.39 oz per ton. However, East Boulder continued to under-perform the targets set by Stillwater's management; the mine was expected to achieve a production rate of 1,650 tons per day by the end of 2004 but output last year fell 20 per cent short of that figure. The company now expects the target rate to be achieved in mid-2006. Production by Stillwater this year is planned to be 550-570,000 oz of pgm, similar to the rate seen in 2004.

ZIMBABWE

Supplies of platinum from Zimbabwe increased by around 5 per cent to reach 145,000 oz in 2004, with small increases in shipments from both the Mimosa and Ngezi mines. However, the future of proposed expansions is in question, following changes to the regulations governing foreign currency accounts, and uncertainties regarding the structure of future black economic empowerment legislation.

At the Ngezi mine, which is effectively controlled by Impala via its 84.5 per cent stake in Zimplats, mill throughput rose by 5 per cent to 2.05 million tonnes in

Production of pgm from both the Mimosa and Ngezi mines in Zimbabwe increased moderately in 2004.

2004. This was achieved despite lower than planned production from the open pit due to poor machine availability and an earlier than usual start to the rainy season. The trial underground mining section also performed well, producing 240,000 tonnes of ore in 2004. However, ore stocks ahead of the concentrator were depleted during industrial action in June and July, and this could have a negative impact on production of refined metal in 2005.

Sales by Zimplats in 2004 totalled approximately 88,000 oz of platinum, 74,000 oz of palladium and 8,000 oz of rhodium. These metals were shipped in the form of matte to Impala, which undertakes the refining and marketing of all of Zimplats' pgm output.

PGM Supplies: Zimbabwe and Others
'000 oz

	2003	2004
Platinum	225	235
Palladium	245	265
Rhodium	14	16

JM

The Zimbabwe dollar's official fixed exchange rate posed serious problems for both Zimplats and the Mimosa operations in 2004, as rampant inflation drove significant increases in local currency costs. Profitability suffered accordingly. Zimplats, for example, had to agree a 31 per cent increase in its contract with an opencast mining contractor during the year, which called into question the long-term viability of open-cast mining at Ngezi. As a result Zimplats currently plans to phase out open-cast mining, gradually substituting this tonnage with material from underground operations.

The Mimosa mine (a 50:50 joint venture between Aquarius and Impala) operated close to its design rate of 1.32 million tonnes in 2004, an increase of 6 per cent compared with the previous year. Production of pgm in concentrate totalled 61,000 oz of platinum, 45,000 oz of palladium and 5,000 of rhodium. The company is considering a debottlenecking project, which would take production to around 80,000 oz platinum per annum, as well as a larger expansion which could potentially double output.

The expansion of Zimbabwe's platinum industry, however, hinges on the ability of platinum producers to obtain clarity from the government on a number of issues, including rules covering the repatriation of US$ revenues, security of tenure of mining leases, and black economic empowerment legislation.

New provisions published in February 2005 required platinum producers to liquidate their offshore accounts and deposit the proceeds into local foreign currency accounts (FCAs) by the end of that month. The future proceeds of sales must be deposited into FCAs, and any funds not allocated for loan repayments, dividends and specific creditors must be converted after 45 days into Zimbabwe dollars at the fixed exchange rate. This will affect producers' ability to invest in their operations and is likely to result in delays in expansion programmes, unless exemptions are granted.

There is also uncertainty over the issue of black economic empowerment; leaked draft proposals suggested that BEE investors should take 49 per cent shareholdings in the country's platinum producers, but this was later revised to 30 per cent within 10 years.

PLATINUM

AUTOCATALYST

The global autocatalyst industry purchased 3.51 million oz of platinum in 2004, an annual increase of 7 per cent. Once again, the greatest contribution to growth in platinum demand came from Europe, driven by another strong year of diesel car sales and tightening diesel emissions regulations. Japanese auto industry purchases of platinum also increased substantially as truck manufacturers prepared for the introduction of strict new heavy duty diesel emissions standards. Elsewhere in Asia, rising light vehicle production contributed to higher platinum demand. In contrast, demand for platinum from the US auto industry fell as programmes to reduce use of the metal in gasoline vehicle autocatalysts progressed.

Europe

European autocatalyst demand for platinum climbed by 14 per cent to a new high of 1.66 million oz in 2004 as sales of diesel-powered cars in Europe surpassed 7 million units for the first time. At the same time, tightening emissions standards for light duty diesel vehicles resulted in higher average platinum loadings in diesel autocatalysts.

Sales of diesel cars continued to gain market share in Western Europe in 2004, accounting for more than 48 per cent of total new car sales over the year as a whole. This translated into in excess of 800,000 additional diesels sold last year compared with 2003.

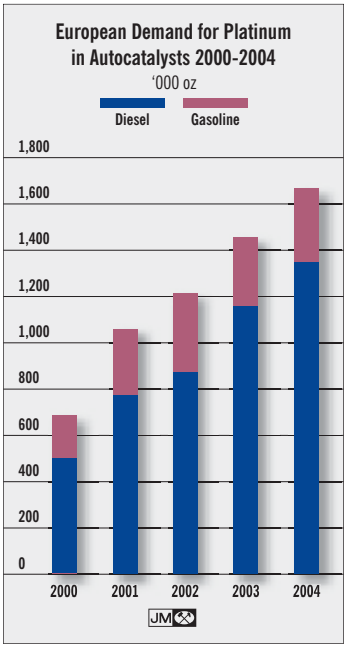
Increasing fuel prices helped to underline the appeal of diesels to car buyers in Europe: diesels are on average around 30 per cent more fuel efficient than their gasoline counterparts, and in a majority of European countries diesel is cheaper than gasoline. In addition, vehicle taxation in the region is increasingly linked to fuel efficiency and carbon dioxide (CO_2) emissions, which again favours diesel engines.

Platinum Demand: Autocatalyst
'000 oz

	2003	2004
Europe	1,455	1,660
Japan	500	590
North America	885	800
Rest of the World		
China	65	75
Other	365	385
Total	**3,270**	**3,510**

JM

Euro IV emissions standards, which set more stringent emissions limits for both gasoline and diesel light vehicles, came into effect in January 2005. The introduction of new Euro IV compliant cars during 2004 was a factor in higher autocatalyst platinum demand. In general, auto manufacturers were able to meet lower permissible NOx limits for diesel cars by modifying vehicles' engine calibrations, but meeting the necessary reductions in CO and particulate emissions typically required an increase in oxidation catalyst platinum loadings. On some larger, heavier diesel car models manufacturers introduced platinum-catalysed diesel particulate filters (DPF) in order to meet the Euro IV particulate matter standard. In addition, several European auto manufacturers began offering diesel particulate filters as optional extras.



Japan

Japanese purchases of platinum for autocatalysts jumped by 18 per cent to 590,000 oz in 2004. The rise was largely due to a combination of new demand from the heavy duty diesel sector and an overall increase in inventories of platinum held by vehicle manufacturers.

New national emissions standards for heavy duty diesel vehicles come into force in Japan in October 2005, and necessitate the use of diesel oxidation catalysts on new trucks for the first time. In 2004, the country's truck manufacturers rapidly introduced new models compliant with the 2005 regulations. Many of these are fitted with more than one oxidation catalyst or an oxidation catalyst in combination with a diesel particulate filter. Some of the largest new trucks utilise two oxidation catalysts as well as a DPF.

The introduction of emissions after-treatment systems onto heavy duty diesel vehicles, therefore, was a major component of the substantial increase in Japanese platinum demand last year. The need for truck manufacturers to establish initial working stocks of platinum, as well as the desire by some to hold strategic reserves of the metal, also contributed to the marked rise in purchases of platinum. Some Japanese

The use of after-treatment systems on heavy duty diesel vehicles made a significant contribution to growth in autocatalyst demand for platinum last year.

car companies are also believed to have increased their inventories of platinum last year.

A further, albeit small, factor in the growth in Japanese autocatalyst demand for platinum in 2004 was a 1 per cent increase in production of cars and light trucks, which was supported by an upturn in domestic car sales.

North America

Purchases of platinum by the North American auto industry dropped to 800,000 oz in 2004, a decline year-on-year of almost 10 per cent from the peak demand of 885,000 oz in 2003. Whilst light vehicle production in the region fell (imports taking an increased share of the market), the main cause of the slide in platinum demand was the ongoing replacement of gasoline autocatalyst systems containing platinum with palladium-based formulations. A significant number of the numerous new car, pick-up truck and sports utility vehicle models that were launched in 2004 make use of autocatalysts having little or no platinum content.

However, the pattern of North American auto industry demand for platinum was complicated by the phasing in of stricter federal Tier 2 vehicle emissions standards in the USA from the beginning of 2004. This had a small yet positive impact on the use of platinum. In addition, the number of heavy duty diesel vehicles in the USA that were retrofitted with diesel oxidation catalysts continued to increase steadily.

China

Growth in light vehicle production and sales in China, coupled with tightening emissions standards, resulted in a 15 per cent increase in autocatalyst demand for platinum to 75,000 oz in 2004. New car sales for the year increased by 13 per cent to 2.4 million; impressive in comparison to the performance of North American, Japanese and European markets but a considerably slower rate of growth than in 2003. Sales would almost certainly have been substantially higher had the Chinese government not introduced curbs on the availability of credit for new car purchases in mid-2004.

Autocatalyst demand for platinum was also boosted as limits on vehicle emissions in China continued to tighten. Euro II equivalent standards were extended from Beijing and Shanghai nationwide in July 2004; Euro III standards will be introduced in the capital in 2005 and are expected to be applied across the country from 2008 onwards.

Vehicle emissions limits equivalent to Euro II standards were applied across China in 2004, whilst Euro III regulations will be introduced in Beijing (above) in 2005.

Rest of the World

Autocatalyst demand for platinum in the Rest of the World climbed to 385,000 oz in 2004, an increase of just over 5 per cent thanks largely to rising light vehicle production and tightening emissions legislation in Asia. Strong increases in light vehicle output were seen in India, South Korea, Thailand and Malaysia last year.

At the same time, tightening emissions standards in a number of countries were also a factor in higher autocatalyst demand for platinum: a greater proportion of new vehicles in Thailand met Euro III equivalent standards; South Korean automakers began introducing models that met emission limits that subsequently came into force in January 2005; whilst in India an increasing number of light vehicles were produced to Euro III equivalent standards, which will apply in selected major cities from April 2005 onwards.

Autocatalyst Recovery

The volume of platinum recovered from recycled autocatalysts grew by nearly 9 per cent in 2004, reaching an estimated 700,000 oz. The rise was most

notable in Europe, where cars fitted with catalysts made up an increasing proportion of the total number of vehicles scrapped. In several countries (including Austria and Germany) effectively 100 per cent of cars now being recycled are equipped with catalysts. European targets covering the disposal and recycling of end of life vehicles (to be enforced from January 2006) also helped to push overall vehicle dismantling and catalyst recycling rates upwards.

Platinum Demand: Autocatalyst Recovery
'000 oz

	2003	2004
Europe	(115)	(140)
Japan	(60)	(60)
North America	(420)	(440)
Rest of the World	(50)	(60)
Total	**(645)**	**(700)**

JM

The volume of platinum recovered from autocatalysts in North America also increased, but not as rapidly as in Europe. However, with a long-established and competitive catalyst recycling industry, the overall collection rate in North America was significantly higher than in Europe. Greater volumes of catalysts were also recovered from scrapped vehicles in South America and parts of Asia, driven in part by higher metal prices.

JEWELLERY

Purchases of platinum for jewellery manufacture dropped by more than 12 per cent in 2004 to 2.20 million oz, the lowest level of demand since the late 1990s. The decline was largely a result of the strength and volatility of the platinum price, which in turn led to another significant fall in purchases of metal by the Chinese jewellery trade. In Japan and North America retail sales of platinum jewellery were also adversely affected by the rise in the metal price. In Europe, however, purchases of platinum for jewellery manufacture increased due to a combination of growth in the UK market and good sales of Swiss watches.

Europe

Total European jewellery demand for platinum rose by 8 per cent in 2004 to 205,000 oz. The growth was generated by increased sales of platinum jewellery in the UK and by relatively strong shipments of luxury Swiss watches to export markets. In contrast, consumer demand for platinum jewellery in continental Europe generally remained weak.

In the UK, the total volume of platinum jewellery hallmarked during the year increased by more than 12 per cent to just over 93,000 oz, of which around 70,000 oz was produced domestically. After several years of double-digit increases, however, the rate of growth in the UK is slowing.

Demand for platinum from the Swiss jewellery industry also climbed in 2004, reflecting continuing strong orders for platinum watches from export markets including the USA, Hong Kong, China, Singapore and parts of the Middle East.

In general, Italian companies also reported higher export sales of platinum jewellery last year, albeit compared with a weak 2003. In the domestic market, however, platinum's strong hold on the bridal sector was pressured by the rise in the price, white gold gaining some market share. In addition, the establishment of the Silplats jewellery joint venture diverted some platinum demand from Italy to South Africa *(see Rest of the World section)*.

Purchases of platinum by German jewellery manufacturers slipped lower in 2004; although some companies successfully increased export sales, the domestic jewellery market remained weak, and platinum lost further ground as consumers turned to less expensive alternative white metals.

Japan

Japanese jewellery demand for platinum slumped by 12 per cent in 2004 to 590,000 oz, contradicting earlier expectations that the market would stabilise after several years of decline.

The slide in purchases of platinum by Japanese jewellery manufacturers resulted from a combination of factors. Key amongst these was another drop in retail sales of platinum jewellery, due in part to the high price of the metal. Sales of both bridal and fashion rings decreased, whilst in the chain sector the average weight per piece fell. Competition from white gold remained high, sales increasing at the expense of both platinum and yellow gold.

Platinum Demand: Jewellery
'000 oz

	2003	2004
Europe	190	205
Japan	660	590
North America	310	290
Rest of the World		
China	1,250	1,010
Other	100	105
Total	**2,510**	**2,200**

JM

High quality, brand-name platinum jewellery continued to sell well in North America last year, despite the higher price of the metal.

The rising price of platinum also gave further momentum to the recycling of old platinum jewellery, both by consumers trading in old pieces and by retailers returning outdated stock to manufacturers in return for new designs. Higher and volatile metal prices also compounded cash flow problems for the wholesale side of the market, and further bankruptcies from within the trade contributed to the volume of platinum jewellery being recycled.

In addition, a small but increasing share of the Japanese market for platinum jewellery was taken by imports last year, as European and US brand name jewellery continued to gain sales at the expense of domestically produced products.

North America

Despite the robustness of the US economy, total sales of precious metal jewellery in North America were generally soft last year. At the same time, the increased price of platinum had a detrimental effect on purchases of the metal by jewellery manufacturers, as well as on certain sectors of the retail market. As a result, demand for platinum from the jewellery industry slipped by more than 6 per cent to 290,000 oz.

Higher metal prices caused some retailers to cut back their overall platinum stock levels, diverting a greater proportion of their display space to white gold. As the metal price increased it became harder for suppliers of platinum products to meet key price points, particularly at the lower end of the market. As the difference between the retail price of white gold and platinum widened, the task of convincing consumers with a limited budget to opt for the latter became a tougher proposition for sales staff. In contrast, at the upper end of the market sales of platinum jewellery increased due to the promotion of new product ranges.

China

The volume of platinum purchased by Chinese jewellery manufacturers dropped by 19 per cent in 2004 to 1.01 million oz. Whilst still substantial, the contraction in demand of 240,000 oz, compared to our revised estimate for the previous year, was not as great as earlier feedback from the market had suggested it might be. When set against the strength of the platinum price, the market demonstrated considerable resilience in absorbing 1 million oz of metal for the fifth year in succession.

The reasons for the fall in Chinese purchases of platinum for jewellery manufacture were largely related to the behaviour of the platinum price during the first few months of 2004. The rapid rate at which the price of the metal increased in early January and from February to mid-April resulted in an intense squeeze on profit margins throughout the platinum jewellery supply chain. As a consequence, many manufacturers of jewellery cut back production of platinum products and switched output to palladium items, which (at that time) were much more profitable.

The rise in the price of platinum and the resulting increase in metal funding costs also caused an overall reduction in the amount of platinum jewellery stocked across the trade. Greater volumes of unsold older platinum articles were returned by retailers and wholesalers to manufacturers for re-fabricating into new designs.

At the retail end of the market, platinum faced increased competition from white gold and, in some areas, from the introduction of palladium jewellery.

Despite these negative factors, demand for platinum was underpinned by the consumer preference for the metal in the larger, wealthier metropolitan areas,

where promotion and marketing of platinum jewellery has been concentrated. Sales of diamond-set platinum products, which carry higher profit margins than plain jewellery, increased, as did the range of platinum items sold into the nascent bridal market.

By the second half of 2004, margins on platinum jewellery had improved a little as the volatility of the platinum price subsided and retail prices in China moved up, helping to offset higher metal costs.

Rest of the World

Platinum demand for jewellery fabrication in the Rest of the World increased by 5 per cent last year to total 105,000 oz. In India, the developing market for platinum jewellery was given a boost by the government's decision to reduce the import duty on platinum, bringing it in line with the duty on gold. Domestic sales of platinum jewellery continued to rise but at a fairly slow pace. On the other hand, some smaller manufacturers in South East Asia cut back their platinum production in reaction to the high and volatile metal price.

The Silplats jewellery manufacturing joint venture, in which the Italian manufacturer Silmar and Impala Platinum are partners, generated a modest volume of new demand for platinum in South Africa in 2004.

CHEMICAL

Consumption of platinum in chemical catalyst applications grew by around 3 per cent to 330,000 oz in 2004. Although demand for platinum gauze for the production of nitric acid fell, this was offset by growth in sales of platinum-based catalysts to the bulk and speciality chemicals industries in Europe and Asia.

Purchases of platinum for the manufacture of catalyst gauze for nitric acid production slipped lower in 2004. Whilst a number of new plants and expansions to existing capacity were commissioned in Asia during the year, the extra demand for platinum that this generated was outweighed by metal returned for refining from the closure of older plants in both Asia and North America. In addition, an increased volume of platinum was recycled from residues recovered during plant maintenance programmes.

In contrast, demand for platinum-based catalysts for the manufacture of silicones increased strongly, reflecting good demand for silicones compounds worldwide. Manufacturing plants within the industry were generally run at high operating rates and additional capacity was brought on stream in Europe.

Platinum Demand: Chemical
'000 oz

	2003	2004
Europe	105	115
Japan	40	45
North America	95	90
Rest of the World	80	80
Total	**320**	**330**

JM

In Asia, the construction of new paraxylene manufacturing plants contributed to firm demand for platinum-based catalysts. Demand from the specialty chemicals sector was also good: the expansion of capacity for the production of linear alkyl benzene, for example, contributed to an upturn in platinum catalyst purchases in Japan.

ELECTRICAL

Demand for platinum used in electrical applications expanded by just over 13 per cent in 2004 to reach 295,000 oz. The growth was driven by the hard disk sector, which benefited from a sizeable rise in sales of electronic goods. Purchases of platinum for use in thermocouples and other electrical applications also increased.

Sales of personal computers jumped by approximately 15 per cent in 2004 compared with the previous year, due to a combination of strong consumer buying and an upturn in corporate IT spending. At the same time, sales of consumer electronic goods (such as digital video recorders and camcorders, and MP3 music players) accelerated. As a result, production and shipments of hard disk drives, particularly for mobile applications, climbed strongly throughout 2004. In addition, the trend towards the use of fewer disks per hard drive flattened out last year. These factors fed back into a substantial increase in demand for platinum, a key component of the magnetic alloy used for data storage in hard disks.

Platinum Demand: Electrical
'000 oz

	2003	2004
Europe	35	35
Japan	40	50
North America	85	90
Rest of the World	100	120
Total	**260**	**295**

JM

Orders for platinum wire thermocouples improved in 2004, reflecting higher production of steel, glass and semiconductors.

World crude steel production increased by almost 9 per cent, with output surging by more than 23 per cent in China and rising by between 2 and 6 per cent in all of the other top ten steel producing nations. This fed back to greater demand for high temperature thermocouples.

The semiconductor manufacturing sector enjoyed a strong first half of 2004, and with significant new capacity under construction, orders for platinum wire thermocouples from the industry were good. From July onwards, however, the rate of growth in production slowed markedly. Investment in new glass manufacturing capacity also contributed to higher thermocouple demand for platinum last year, in particular the construction of numerous new LCD glass furnaces in Asia *(see following section)*.

In the fuel cell arena, demand for platinum increased in 2004 but, in absolute terms, consumption remained small. In the automotive sector, research and development continued to target cost reductions and durability improvements for proton exchange membrane (PEM) fuel cells. Several new prototype vehicles were unveiled, whilst work on establishing suitable hydrogen storage infrastructure advanced. In the stationary market, the number of fuel cell systems installed for stationary power supply applications also increased, with rising interest in Japan in the commercial possibilities of residential fuel cells.

GLASS

After a relatively weak 2003, demand for platinum from the glass industry surged by 38 per cent to 290,000 oz last year. This reflected the rapid construction of new manufacturing capacity in Asia to meet burgeoning demand for high quality glass from the liquid crystal display (LCD) market. In North America, however, the closure of several glass furnaces led to a significant volume of platinum being recovered and re-refined.

Global demand for LCD panels accelerated rapidly during 2004. The growth in the LCD market was powered by a combination of factors: the ongoing replacement of cathode ray tube (CRT) televisions and monitors by flat screen alternatives; the trend towards larger screen sizes; and strong growth in sales of notebook computers, mobile phones and other consumer electronics containing LCDs.

Platinum Demand: Glass
'000 oz

	2003	2004
Europe	10	5
Japan	85	90
North America	(30)	(10)
Rest of the World	145	205
Total	**210**	**290**

JM

With strong growth in LCD demand forecast to continue, producers of the high quality glass used in their manufacture made substantial investments in the construction of additional capacity in Asia during 2004. At least 17 new furnaces were announced, commissioned or under construction in Taiwan, South Korea and Japan.

In addition to the investment in LCD glass production, new capacity for the production of conventional television glass and fibreglass also came on stream in China last year. The result of the expansion of Asian glassmaking facilities was an increase in demand for platinum of just over 40 per cent in the Rest of the World region to 205,000 oz. Much of this metal was first imported into Japan, where it was fabricated into equipment, before being re-exported to glass plants elsewhere. Purchases of platinum for use within Japan itself climbed by a more modest 6 per cent to 90,000 oz.

The situation in North America, however, was markedly different: the closure of the last television glass plants remaining in the USA led to the sale of a significant volume of metal back to the market.

PETROLEUM REFINING

Total demand for platinum used in petroleum refining catalysts climbed to 145,000 oz in 2004, an annual rise of 21 per cent. Most of the growth occurred in the Rest of the World region where investment in expanding catalytic reforming and isomerisation capacity was concentrated. Demand in the mature North American, European, and Japanese markets was little changed.

The construction of significant new petroleum reforming and isomerisation capacity in Asia, Africa and the Middle East, plus the commissioning of a large base-oil hydrocracking facility, led to an upturn in demand for

Platinum Demand: Petroleum Refining
'000 oz

	2003	2004
Europe	15	15
Japan	5	5
North America	40	35
Rest of the World	60	90
Total	**120**	**145**

JM

platinum catalysts in 2004. Total purchases of metal consequently climbed to 145,000 oz, despite the concurrent cancellation of a number of projects in South America.

Reforming and isomerisation capacity in North America and Europe, however, was largely unchanged and demand for top-up catalyst charges was stable.

OTHER

Small increases in demand for platinum were recorded for most other applications, including oxygen sensors, spark plugs, medical components and turbine blades. However, the use of platinum in stationary emissions control catalysts fell, whilst demand for the metal in dental alloys was flat. Total demand for platinum in other applications, therefore, was stable at 470,000 oz.

The use of dental alloys containing platinum, the largest single component of the 'other' category of demand, was stable in 2004. Despite their relatively high price compared to some alternatives, traditional high gold dental alloys (typically containing up to 15 per cent platinum) remain popular in several European countries and, to a lesser extent, in North America.

The use of platinum in non-catalyst automotive applications increased by around 3 per cent last year. This category comprises high-performance platinum-tipped spark plugs and oxygen sensors, which use platinum electrodes. Fitment of platinum spark plugs as original equipment by auto manufacturers in both Japan and North America grew steadily in 2004 but there was also increased competition from iridium-based alternatives.

Oxygen sensors are essential components of vehicle emissions control systems. Demand is related to vehicle output but can also be influenced by changes to emissions regulations. Increased light vehicle production in Europe and the advent of Tier 2 emissions standards in the USA led to modest increases in platinum demand from this sector in 2004.

The use of platinum in biomedical applications expanded steadily, with demand from both anti-cancer drugs and components for medical equipment continuing on an upward trend.

There was a small increase in the use of platinum to coat aircraft engine turbine blades in 2004. This was consistent with the long term trend for increased numbers of blades per engine to be coated and the need for increased coating thicknesses as turbines are operated at higher temperatures.

Platinum Demand: Other
'000 oz

	2003	2004
Europe	185	190
Japan	40	40
North America	215	205
Rest of the World	30	35
Total	**470**	**470**

JM

Platinum-based catalysts are used in a wide range of industrial applications to control emissions of volatile organic compounds (VOC), carbon monoxide and other pollutants in a wide range of industries including power generation, bulk chemicals, coatings and metals processing. After a relatively good year in 2003, demand for platinum from this sector dropped in 2004.

INVESTMENT

Net demand for platinum coins and bars improved to 40,000 oz in 2004. In Japan, although higher prices led to a rise in sales of bars back to dealers in the first quarter, platinum remained attractive as a long-term investment and demand for the year as a whole increased. Sales of platinum bullion coins by the US Mint, however, fell compared with 2003.

The platinum price in yen climbed from around ¥2,800 per gram at the start of 2004 to over ¥3,200 by mid-March due to a combination of the rally in the dollar price of the metal and a weakening of the yen versus the US currency. This led to an upturn in sales of platinum investment bars back to dealers by Japanese investors. However, once the platinum price fell back below ¥3,000 in mid-April, new purchases of large bars began to outweigh further disinvestment. Net Japanese demand for the year, therefore, totalled 15,000 oz.

Demand for the US Mint's platinum American Eagle bullion coins during 2004 slid to 20,100 oz, down from just over 24,000 oz the previous year. The rapid climb in the platinum price affected sales, with investor attention focused more on gold and palladium products. Purchases of platinum proof coins by collectors also fell in 2004, leaving net demand in North America at 20,000 oz.

Platinum Demand: Investment
'000 oz

	2003	2004
Coins and small bars		
Europe	0	0
Japan	5	5
North America	25	20
Rest of the World	0	0
	30	**25**
Large bars in Japan	**(15)**	**15**
Total	**15**	**40**

JM

20 Years of the *Platinum* Review

This year marks the 20th anniversary of Johnson Matthey's Platinum review. The first of the series, published in 1985, set out to "shed more light on the innumerable facets of platinum and the other platinum group metals", and that continues to be the primary purpose of the review.

In fact, Johnson Matthey (JM) has been making studies of the market for platinum for more than 75 years, starting soon after the discovery of the platinum-bearing reefs in South Africa in the mid 1920s. The first formal market analysis still present in the company's archives was conducted in 1930, around the time of the beginning of the JM's close relationship with Rustenburg Platinum.

The report describes how, in the late 1920s, the largest application for platinum was jewellery and that this accounted for almost two-thirds of demand. Other significant uses were in the electrical and chemical industries, and in dental alloys. One of the main electrical uses for platinum was in contacts for internal combustion engines, a growing market at that time. Demand in the chemical industry was primarily in catalysts for the production of nitric acid - a growing use - and sulphuric acid - a declining one.

The author of the review, Erroll Hay, expressed deep concern about the future of the platinum market, for two reasons. The first was the fear of declining industrial demand as the world moved into what became the Depression following the Wall Street collapse of 1929. The second was the potential for large increases in output from the newly discovered resources in South Africa and as a by-product of nickel mining in Canada. His suggestions to improve the market situation included supporting the jewellery market by introducing a hallmark, developing new applications for the metal, and establishing platinum as a backing for international currencies. The first of these three objectives was realised in the UK only as late as 1975, the second remains a cornerstone of the platinum industry's future, while the third disappeared from view completely.

As part of its ongoing relationship with Rustenburg Platinum, and its successor Anglo Platinum, JM has been analysing the platinum market ever since that first 1930 survey. Given the paucity of publicly available information on this market that existed even into the early 1980s, JM decided to make its analysis of the immediate past available to the public and the Platinum reviews were born, with Platinum 1985 being launched on 15th May 1985. Market data from these reviews are available back to 1975 at the Platinum Today website www.platinum.matthey.com. The article that follows discusses the very substantial changes that have occurred in the market since then.

A Brief History of Platinum

This article describes some of the most important changes that have occurred in the platinum market during the three decades for which data has been published in Johnson Matthey's **Platinum** reviews. The period has seen substantial growth in demand for platinum: in 1975 world consumption was 2.6 million oz.; in 2005 it should be close to 6.7 million oz. There have also been changes in the relative importance of the application sectors. In 1975 autocatalysts were brand new and accounted for just 14 per cent of demand; platinum jewellery purchases, which were booming in Japan, taking almost half of demand; with industrial applications accounting for the remainder. In 2005 the largest use for platinum will be autocatalyst at around 45 per cent of demand, with jewellery second at just over 30 per cent and industrial uses the remaining quarter of demand.

Autocatalyst Demand

The history of the development of autocatalysts was described in detail in Platinum 2004 and will not be repeated here. Suffice it to say that catalytic converters were first fitted to cars in the USA in 1974, spread to Japan in 1976, to Europe in mid 1980s, and are now fitted to approximately 93 per cent of new car production throughout the world. The auto industry currently accounts for just under half of the total consumption of the three autocatalyst metals — platinum, palladium and rhodium.

Platinum's use in autocatalysts has vied with that in jewellery as its largest consuming application over most of the 30 years in which catalytic converters have been fitted to cars. Jewellery has generally held sway except in those years when exceptionally high demand for auto use has put upward pressure on the price of the metal and squeezed jewellery demand. Thus, auto demand was the largest use for platinum in 1979 and 1980 in the run-up to the introduction of drastically tighter emission standards in the USA in model year 1981. It again overtook jewellery in the mid-1980s as voluntary fitment of autocatalysts to cars began in Europe. Latterly, in 2003, platinum resumed its premier position as demand for platinum-based diesel catalysts soared in Europe. Autocatalyst use overtook electronics as the largest application for palladium in 1996, while for rhodium it has been the principal use from the time of the introduction of the three-way catalyst in 1979/80.

Jewellery Demand

In jewellery, the use of platinum was dominated for many years by demand in Japan and as recently as 1995 some 82 per cent of platinum demand for jewellery originated in this country. Two factors have changed this outcome over the past decade. Most important has been the growth of demand in China, where the use of platinum in jewellery grew dramatically from virtually nothing in the early 1990s until it overtook Japan as the largest consumer in 2000.

"so MANY excellent properties united in a single METAL"

Antoine Baumé,
Master Apothecary, 1773

Second, has been the spread of what has been termed 'the white wave', in which jewellery made of the white metals platinum, white gold, silver and, most recently, palladium has eaten into the traditional yellow gold market. This is a phenomenon that has spread throughout the developed, and developing, world over the past decade, with white metals being seen as being modern and fashionable, and particularly appealing to the younger generation. Platinum has established itself as the most prestigious white jewellery metal, regaining the position that it held back in the 1920s.

Industrial Demand

Within the industrial sector, there have also been significant changes, both in the relative importance of the different industrial markets, as well as in the applications in which platinum is consumed within the individual industries. A good example is the electrical market where, in 1975, demand was mainly for thermocouples; now this sector is dominated by platinum's use in hard disks. The latter were not widely used before the advent of the IBM PC/XT computer in 1983 and it was not until 1989 that platinum was incorporated into the magnetic layers that store data, to increase significantly the storage capacity of these layers.

Another example is the glass industry where, in the past, demand was mainly for equipment used in the manufacture of glass fibre and optical glass. In 2004 the largest segment of demand in the glass industry was for the construction of plants to make glass for liquid crystal displays (LCD). The first operational LCD was introduced in 1968 and, in more advanced forms, the technology is now being applied to enormous quantities of consumer goods such as flat screen televisions, lap-top computers and mobile phones. Although much of the glass industry's technology is proprietary, it is believed that the first production-scale plant to manufacture the very high quality glass that is necessary for liquid crystal displays, for which platinum equipment is essential, was set up in 1984.

In 1975 the consumption of platinum by the chemical industry was led by its use in catalyst gauzes for the oxidation of ammonia, a critical step in the manufacture of nitric acid for the production of nitrate fertilisers and explosives. New gauze designs, better metal management and rationalisation of the industry have combined to reduce this segment of platinum demand. In contrast, the use of platinum in catalysts for the production of silicones has grown markedly, propelling this application to the head of a long list of uses of platinum in the chemical industry.

Investment Demand

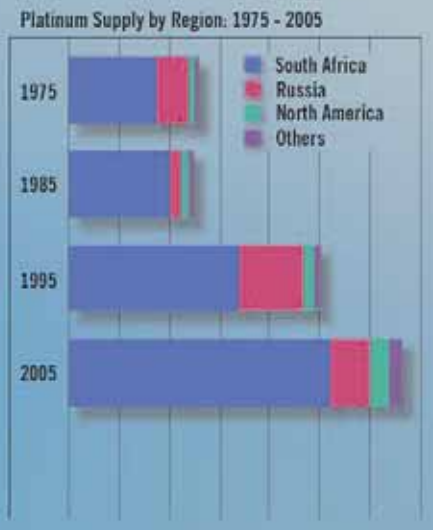
Platinum was first used for coinage by the Imperial Government in Russia in 1828 and over the next 18 years nearly half a million ounces of platinum were converted into coins. However, in 1846 minting of platinum roubles ceased and coins in circulation were recalled. It was not for another 130 years that platinum was once again incorporated into a legal tender coin. This was the Isle of Man Noble, first produced in 1977. The Noble was followed by the Canadian Maple Leaf and Australian Koala, both in 1988, and the US Eagle in 1997.

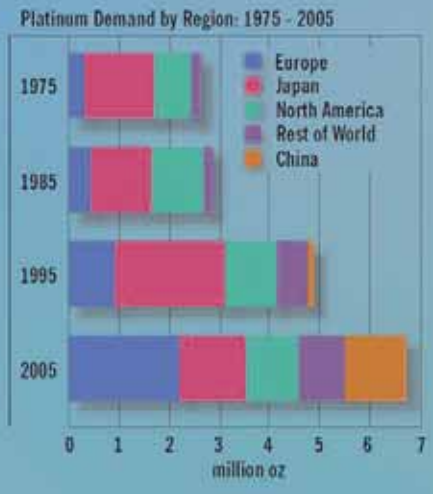
The other most popular forms of investment media for platinum are the 500g and 1kg bars sold in Japan. These first became popular at the time of the price peak in 1980, when platinum briefly exceeded $1,000 per oz.

Since it first became significant in 1980, investment demand for platinum has been patchy, peaking in 1988 at 660,000 oz as the new Canadian and Australian coins were launched. More recently, limited sales of new products, offset by returns as investors sold into higher platinum prices, have kept total net investment demand below 100,000 oz a year.

Regional Demand

The chart over the page shows that Japan and North America were the leading consumers of platinum in 1975, but both have fallen behind other regions, especially over the past decade. The main reasons for this has been the growth of autocatalyst use in Europe, due in no small part to the market share taken by diesel cars, and the growth of jewellery demand in China.



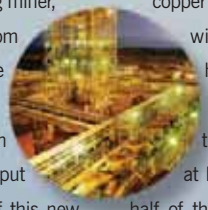


Supplies

Throughout the last 30 years South African mines have dominated supply of platinum. Russia has also been an important supplier, but its exports to the West have been erratic. Indeed, there seems to have been very little correlation between Russian production and Russian exports and this has injected a good deal of uncertainty into the market over the period.

South Africa

As recently as 1968, Rustenburg Platinum was the only producer of platinum in South Africa. However, the second half of the 1960s saw plans announced that led to the formation of Impala Platinum, which produced its first platinum in 1969, and Western Platinum (the original operation of what is now Lonmin Platinum), which produced its first metal in 1973. The initiative for these new mines, and expansion at the operations of the existing miner, Rustenburg Platinum, came primarily from the legislative decisions that led to the introduction of autocatalysts. However, the almost inevitable delays in bringing in the new technology meant that mine output expanded ahead of the establishment of this new demand sector. Fortunately this enabled the mines to supply metal to the fast growing Japanese jewellery market.



It was not until the second half of the 1980s, following a period of strong prices and with a positive outlook for future demand, that a similar spurt in production in South Africa seemed probable. At that time many companies announced plans to establish new mines in South Africa, or expand existing ones. In the event, a fall in prices in the early 1990s as Russia turned a strong seller of platinum in the period following the fall of the USSR and palladium gained market share in autocatalysts at the expense of platinum, led to a more difficult market and most of the proposed projects were shelved. It was not until the turn of the millennium that the market again looked sufficiently promising for a further wholesale expansion in platinum mining. As is discussed elsewhere in Platinum 2005, this too has not gone forward smoothly, with the sharp appreciation of the rand against the dollar making the economics of many potential new mines far less attractive than originally envisaged. It remains to be seen just how many will come on stream.

Russia

Outside South Africa, the most important producer of platinum is Russia. Platinum is the dominant metal in the two major alluvial deposits that are being exploited in the Far East Region of Russia. Mining began at the Kondyor deposit in Khabarovsk in 1984 and at the Koryak deposit in Kamchatka a decade later, in 1994. Both may already have passed their peak of production but it is entirely possible that similar deposits will be found in this vast, mineral-rich region of Russia.

Platinum is not the principal reason for mining at the operations of Norilsk Nickel in the Taimyr Peninsula in Northern Siberia. As the name of the company suggests, nickel is the prime metal, with copper also being very important. In common with other mines in the northern hemisphere, palladium is the most important of the platinum group metals in the Norilsk operations. Platinum production at Norilsk grew steadily for much of the first half of the last 30 years as major new mines at Oktyabrsky and Taimyrsky were opened and expanded. However, a sharp decline in output followed the fall of the USSR and it is only since 1998 that production has recovered, although still not to the level seen in the late 1980s.

Other

South Africa and Russia currently account for about 90 per cent of total world production of platinum, a proportion that is not much changed from 1975. However, there have been a number of significant new arrivals on the supply scene over the past 30 years. These include the Stillwater Mining in the USA, which produced its first platinum in 1987, and the various mines that have opened in Zimbabwe over the past decade. Although further expansion in Zimbabwe looks likely, especially when political and economic conditions there improve, and other prospects are currently under exploration in many places around the world, it seems certain that South Africa and Russia will continue to dominate platinum supply for the foreseeable future.

1975

1980

1985

1990

1995

2000

2005

Mid-1970s – New vehicle emissions legislation results in the introduction of autocatalysts in the USA and Japan

1977 – Prescription of the platinum-based anticancer drug Cisplatin begins

1980 – Platinum fixing price peaks at $1,047.50 in London following a surge in speculative investment in all precious metals

1984 – The first LCD glass manufacturing plant is constructed in the USA.

1985 – Johnson Matthey publishes its first Platinum review

1988 – Japanese investors purchase a record 415,000 oz of platinum bars and coins

1989 – The first hard disks containing platinum enter mass production

1991 – Russian exports of platinum expand following the fall of the USSR

1993 – Euro I vehicle emissions standards, which necessitate the use of catalytic converters, come into effect in the European Union

Mid-1990s – Platinum jewellery market begins to develop in China

1997 – The US Mint launches the Platinum Eagle series of bullion coins

2001 – China overtakes Japan as the world's largest platinum jewellery market

2003 – European diesel autocatalyst demand for platinum surpasses 1 million oz per year

2004 – South African production of platinum exceeds 5 million oz

PALLADIUM

AUTOCATALYST

Demand for palladium from the autocatalyst market grew by more than 10 per cent to 3.81 million oz in 2004. Purchases of metal by Japanese and US auto makers rose substantially as use of palladium-based autocatalysts increased, and in both countries the effects of year-on-year changes to inventories also had an impact. Demand in China and the Rest of the World region also expanded, in line with higher light vehicle production and tighter emissions standards. In Europe, however, autocatalyst demand for palladium fell once again as sales of gasoline-powered cars continued to trend downwards.

Europe

Western European sales of gasoline cars fell by 6 per cent in 2004 to a little over 7.5 million vehicles, a consequence of the ongoing rise in popularity of diesel cars. Palladium demand from European auto manufacturers contracted by 5 per cent to 1.16 million oz as a result.

At the same time, thrifting of palladium loading levels in autocatalysts continued to negatively affect metal demand. In particular, the increased use of close-coupled catalysts has allowed catalyst manufacturers to reduce palladium use significantly. These catalysts are fitted almost immediately downstream of the engine manifold (rather than under the floor pan) where exhaust gas temperatures are much hotter. This enables close-coupled catalysts to reach their optimum operating temperature very quickly once the engine is started, maximising catalyst efficiency.

Palladium Demand: Autocatalyst
'000 oz

	2003	2004
Europe	1,200	1,160
Japan	550	675
North America	1,205	1,445
Rest of the World		
China	95	105
Other	380	425
Total	**3,450**	**3,810**
Autocatalyst recovery	**(410)**	**(530)**

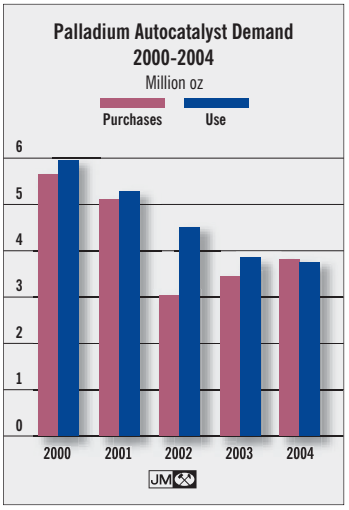
JM

The adverse effects of lower gasoline vehicle output and reduced metal loadings on palladium demand far out-weighed the continued move away from catalyst systems containing platinum to alternatives based on palladium-rhodium formulations. Furthermore, by the beginning of 2004 larger auto manufacturers were already using palladium catalyst systems on a majority of their gasoline car production, so with fewer vehicle models making the transition, there was less of an impact on metal demand.

Japan

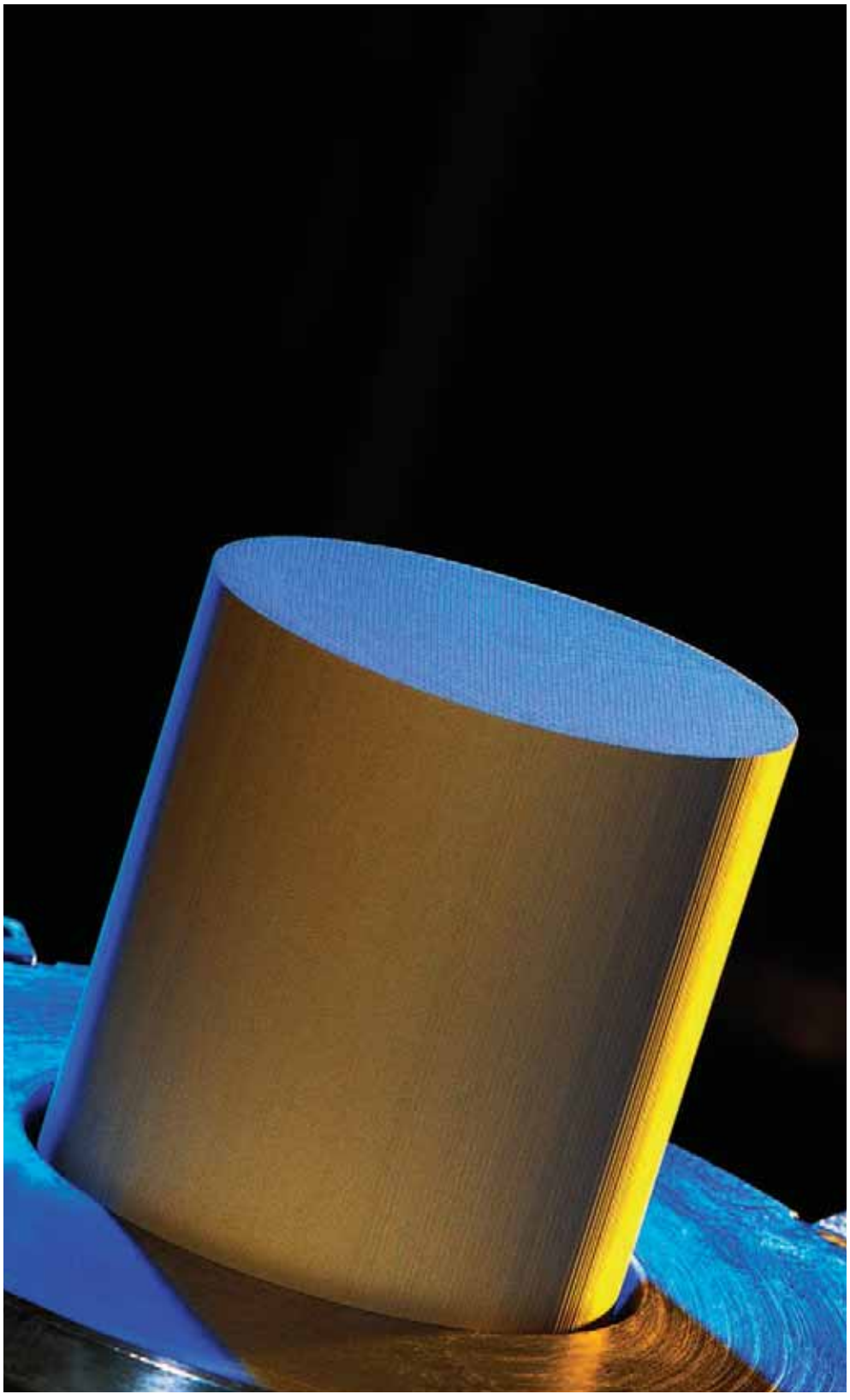
Purchases of palladium by the Japanese auto industry reached 675,000 oz in 2004, a year-on-year jump of 23 per cent. The surge in buying was largely the result of increased use of palladium-based autocatalysts, although stock building by some vehicle manufacturers, higher average pgm loading levels and increased light vehicle production also contributed.

Japanese auto manufacturers have, in general, been relatively conservative with regard to altering their use of pgm in response to changes in the prices of the metals. However, with the premium between the platinum price and that of palladium not only persisting but widening, and tightening emissions legislation pushing the average pgm content of emissions after-treatment systems upwards, an increasing proportion of new Japanese light vehicle models are switching to use of palladium-based catalysts. The effect of this on palladium demand increased markedly in 2004, when a significant number of new vehicle models with palladium-rhodium catalysts entered production.



With their future palladium requirements rising and the price of the metal weakening, some Japanese vehicle manufacturers are believed to have bought palladium to hold as stock in 2004, in addition to their purchases for current vehicle production. This was a contributory factor in the growth in total demand.

A third factor in the increased Japanese demand for palladium in autocatalysts was the ongoing tightening of emissions regulations in the country. A large proportion of new light duty vehicles manufactured in 2004 met the Japanese TLEV (transitional low emissions vehicle) standard, with a significant number certified to the stricter LEV and ULEV (ultra-low emissions vehicle) standards. This had the effect of increasing average pgm loading levels. In addition,



Autocatalyst demand for palladium was boosted in 2004 as auto manufacturers increasingly moved away from use of catalyst systems containing platinum in favour of those based on palladium.

many sports utility vehicles and multi-purpose vehicles (people carriers) were reclassified as cars instead of light commercial vehicles in Japan with effect from January 2004. As passenger car emissions limits are generally more stringent than those for light commercial vehicles, this contributed to the rise in overall average palladium loadings.

Finally, although Japanese light vehicle production only expanded by a little over 1 per cent last year, larger cars and SUVs accounted for a greater proportion of total output. These vehicles tend to require a greater volume of catalyst (and therefore pgm) than smaller-engined models.

North America

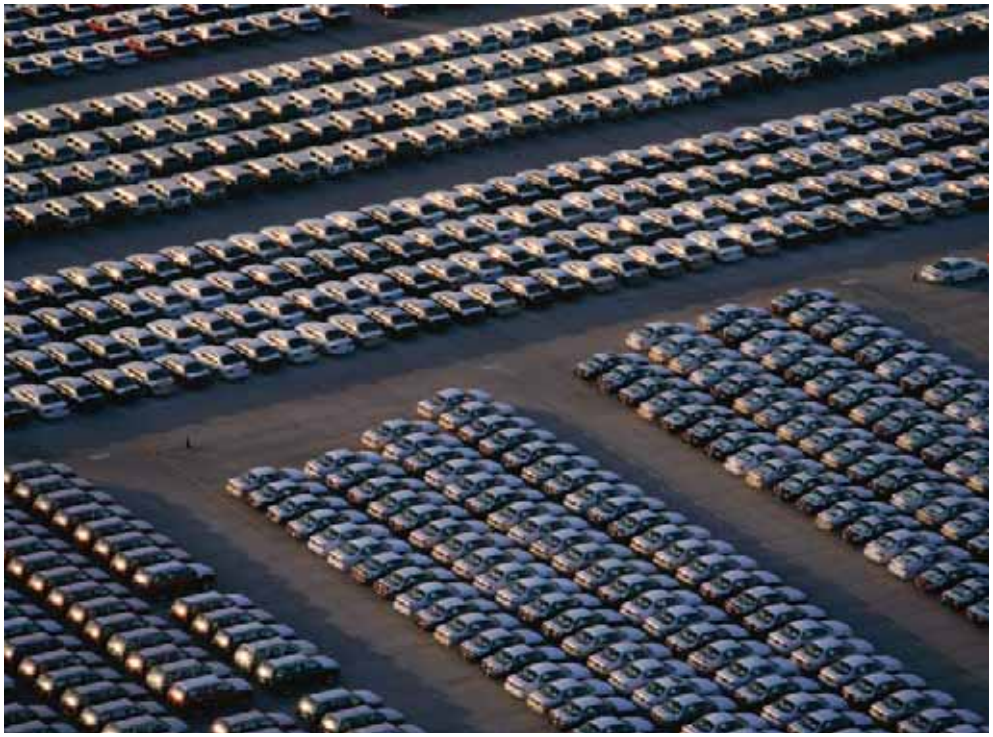
Purchases of palladium by the North American auto industry surged by 20 per cent to 1.445 million oz last year. Following substantial use of metal inventories in 2002 and (to a lesser extent) in 2003, auto company stocks of palladium had fallen close to target levels by the beginning of 2004. Little additional metal is believed to have been drawn from stocks during the year and so purchases of metal increased.

In contrast to purchases of the metal, however, the actual use of palladium on catalysts fell by 10 per cent year-on-year. This stemmed from further progress made in reducing the palladium content of autocatalysts, continuing the trend of the last few years. In the five years covering 2000 to 2004, the volume of palladium used on catalysts in North America fell by more than 50 per cent, from well over 3 million oz to less than 1.5 million oz. In 2004 the negative effect of this thrifting continued to outweigh the ongoing shift by US automakers towards greater use of palladium-based gasoline autocatalysts at the expense of catalysts containing platinum.

The reduction in the use of palladium on gasoline autocatalysts was also due in part to a fall of almost 2 per cent in US light vehicle production last year. Although sales of light vehicles held up well (supported by heavy discounting and other financial incentives for consumers) strong competition from imports, notably from Japanese automakers, resulted in total light vehicle production in the USA softening to around 11.6 million units.

China

Demand for palladium from the Chinese automotive



With inventories of new vehicles at high levels and imports rising, US light vehicle production fell by close to 2 per cent last year and this had a negative effect on palladium consumption.

industry increased by more than 10 per cent in 2004 to 105,000 oz. Although the rate of growth in light vehicle output slowed compared with the previous year, production nevertheless increased by around 12 per cent. At the same time the progressive tightening of Chinese emissions legislation contributed to higher autocatalyst demand for palladium.

Rest of the World

Autocatalyst demand for palladium in the Rest of the World increased by more than 12 per cent to 425,000 oz in 2004. The majority of the growth in metal demand was due to rising light vehicle production and tightening emissions legislation in Asia.

Indian light vehicle output surged by 29 per cent to over 1.3 million units last year, an increasing proportion of which met Euro II equivalent emissions standards. Light vehicle production in Thailand and Indonesia also grew at double-digit rates, with a rising proportion of new light vehicle models in the latter being fitted with catalytic converters. South Korean production of cars and light trucks also increased in 2004, despite poor domestic sales, on the back of rising exports to Europe and North America.

Autocatalyst Recovery

The total volume of palladium recovered from scrapped autocatalysts surged by 29 per cent to an estimated 530,000 oz in 2004. The biggest impact on the volume of metal recovered was the ongoing trend for an increasing number of relatively heavily-loaded palladium-based catalysts to enter the recycling chain in the USA. These catalysts date from the mid-1990s onwards and rising numbers of vehicles from that period are now being scrapped. Consequently, recovery of palladium in North America climbed by 75,000 oz to reach 345,000 oz last year.

In Europe, the proportion of scrapped vehicles fitted with catalytic converters continued to rise in 2004, reflecting their widespread introduction in the region a decade previously. With catalyst collection rates also trending upwards, the volume of palladium recovered jumped by 57 per cent to 110,000 oz. In the mature Japanese market, however, catalyst collection rates have flattened out and palladium recovery from vehicles scrapped in Japan was stable at around 40,000 oz last year.

CHEMICAL

Demand for palladium in chemical catalyst applications expanded by 15 per cent in 2004 to reach 305,000 oz. Good growth in palladium demand was seen in North America, Asia and the Middle East as new production capacity for bulk chemicals manufactured using palladium catalysts came on stream. Demand for palladium catchment gauze in the nitric acid industry also improved for the second year in succession.

Palladium Demand: Chemical
'000 oz

	2003	2004
Europe	65	65
Japan	25	25
North America	70	85
Rest of the World	105	130
Total	**265**	**305**

JM

Investment in new production capacity in the bulk chemicals industry pushed up orders for palladium-based catalysts significantly in 2004. The greatest impact on palladium demand came from the construction of new purified terephthalic acid (PTA) manufacturing plants in North America, China and South East Asia.

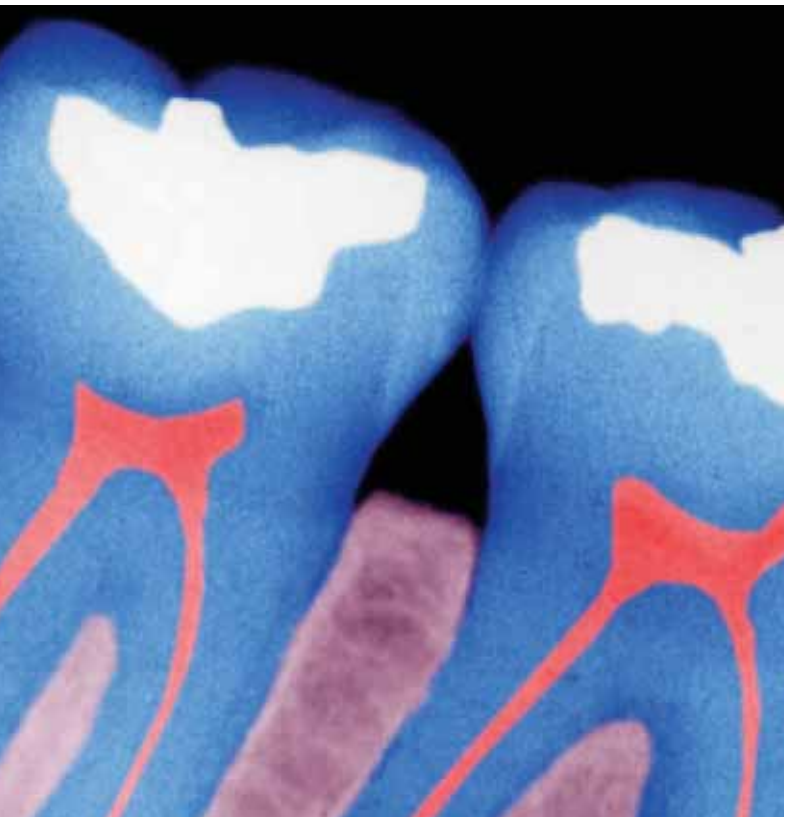
PTA producers made substantial investments in expanding their operations, in order to catch up with rapidly rising demand for the chemical in the manufacture of the plastic resin, polyethylene terephthalate (PET). Demand for PET, which is principally driven by the global packaging industry, continued to grow rapidly in 2004. Demand for palladium-based catalysts in North America was also boosted by the construction last year of substantial new capacity at a major hydrogen peroxide manufacturing plant.

The widening price differential between platinum and palladium began to stimulate greater demand for palladium catchment gauze in the manufacture of nitric acid in 2003, and this trend continued throughout 2004. With the economics of installing catchment gauze becoming more compelling as the platinum price increased, purchases of

Palladium Demand: Dental
'000 oz

	2003	2004
Europe	70	80
Japan	515	520
North America	225	235
Rest of the World	15	15
Total	**825**	**850**

JM



Use of palladium in dental alloys continued to recover slowly in 2004.

palladium for gauze manufacture increased, most noticeably in North America.

DENTAL

Demand for palladium in dental alloys grew by 3 per cent to 850,000 oz in 2004. Japanese and North American demand for alloys containing palladium increased marginally, while use of the metal in Europe improved for the second year in succession, a result of the low and relatively stable palladium price.

Demand for palladium in dental alloys in Japan, by far the largest market, was little changed in 2004, edging up to 520,000 oz. Production of 20 per cent palladium 'kinpala' alloys dipped when the proportion of the cost of treatment covered by the state-backed reimbursement scheme was cut from 80 per cent to 70 per cent in the first half of 2003. The fall in demand, however, was not as substantial as many kinpala producers had feared and production slowly recovered during the second half of 2003 and throughout 2004.

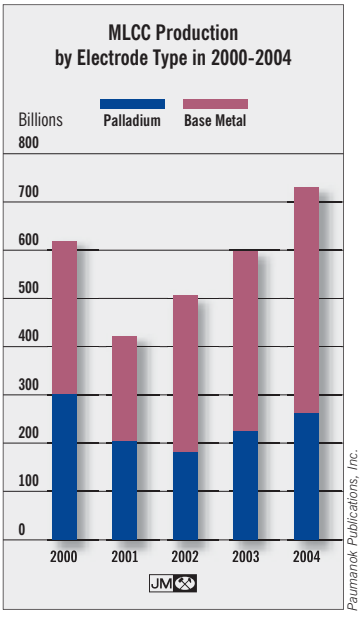
Demand for palladium in dental alloys in North America also increased slightly, reaching 235,000 oz in 2004. Alloys with around 30 per cent palladium remain popular in the region and the comparatively low price of the metal increased the competitiveness of palladium-based alloys compared to high gold alloys.

In Europe, palladium-based dental alloys were widely substituted by alternatives, including ceramic products, following the spike in the price of the metal in 2000 and early 2001. However, the relative stability of the palladium price since early 2003 (particularly versus the price of gold) has gradually drawn some demand back. In 2004, use of low-cost silver-palladium alloys in Germany in particular increased, and total European demand improved by 10,000 oz to 80,000 oz.

ELECTRONICS

Demand for palladium from the electronics industry grew to 955,000 oz in 2004, a rise of 7 per cent compared with the previous year. Use of palladium in all sectors of the market increased as a result of rapid growth in production of electronic equipment. The weak price of palladium also contributed to a strong rise in demand for the metal in plating applications. Most of the growth in demand came from China and elsewhere in Asia, reflecting the continuing concentration of component manufacturing capacity in the region.

Global production of multi-layer ceramic capacitors (MLCC), the largest single electronics application for palladium, increased by almost 22 per cent in 2004 to over 720 billion units. Component output climbed faster than the overall growth in production of electronic goods due to increased use of MLCC in automotive electronics and fast-selling consumer products such as mobile phones with cameras. As a result, the consumption of palladium in MLCC rose for the first time since the late 1990s.



Actual use of palladium in MLCC has lagged behind growth in capacitor production due to thrifting and miniaturisation

Palladium Demand: Electronics
'000 oz

	2003	2004
Europe	85	100
Japan	225	225
North America	215	205
Rest of the World	375	425
Total	**900**	**955**

However, the increase in use of the metal was just 1 per cent: the difference between the rate of growth in MLCC output and demand for palladium was due to the continuing miniaturisation of capacitors and further substitution of palladium by nickel.

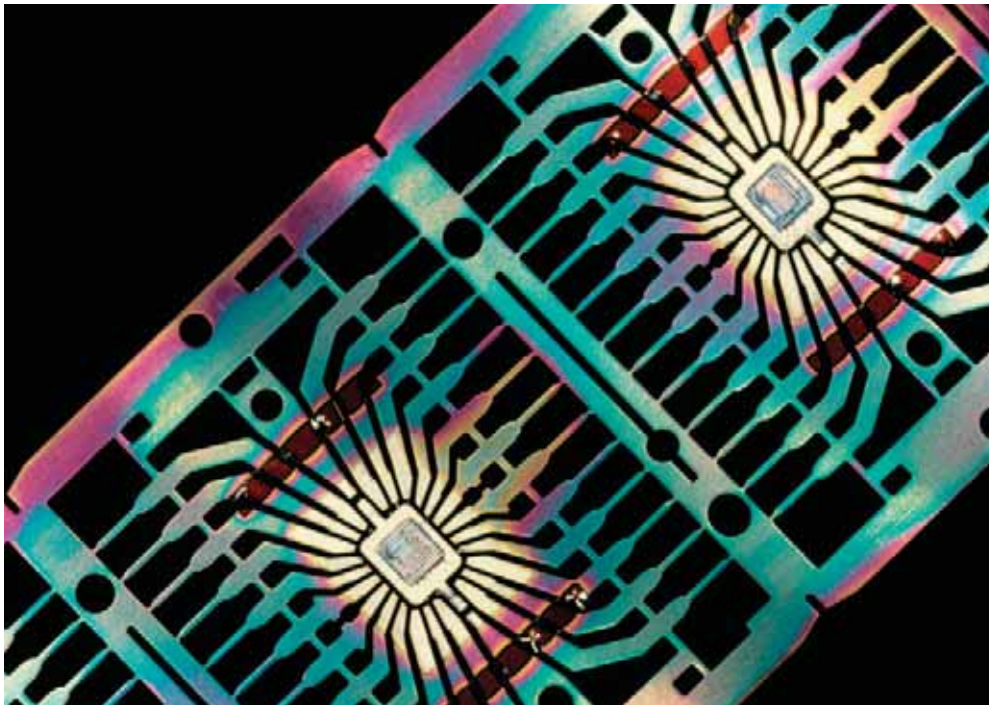
The effect of substitution on palladium demand remained significant in 2004, although the overall rate of replacement of palladium-based MLCC with nickel alternatives slowed slightly in terms of the numbers of capacitors produced.

The trend of component miniaturisation also continued to have a detrimental effect on palladium use. The latest generation of MLCC is substantially smaller than the preceding series, and the ongoing decrease in average capacitor size has had a pronounced impact on metal demand. Furthermore, the average palladium content of the thick film pastes used in MLCC manufacture also continued to decline slowly in 2004.

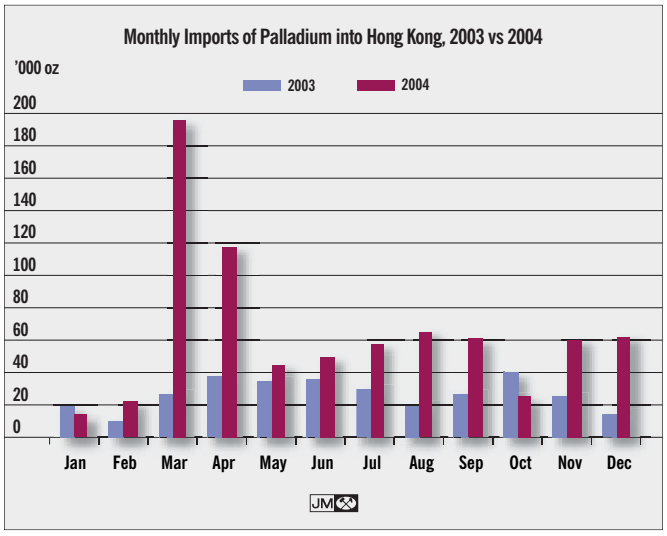
In contrast to the MLCC sector, sales of palladium pastes for use in hybrid integrated circuits (HIC) grew rapidly, increasing by 15 per cent last year. Robust growth in production of HIC was driven by strong demand for the components in automotive electronic applications and the commercialisation of new uses for HIC-based circuitry such as electronic price tags.

Use of palladium in plating applications surged by 25 per cent in 2004. This was a result of both firm growth in demand for connectors and lead frames (in line with rising output of electronic equipment) and the acceleration of programmes to remove lead (Pb) from solders. The weakness of the palladium price encouraged producers of connectors to make greater use of alloys containing palladium in preference to those based on gold. At the same time, the lead frame sector made further progress in switching from tin-lead (Sn-Pb) solders to alternatives using palladium, driven both by demands from manufacturers of consumer electronics for lead-free components and rising regulatory pressure on the industry to substitute hazardous metals with alternatives.

Finally, consumption of palladium in resistor chips and related products increased by 7 per cent last year. Higher production of components such as piezo-actuators to meet orders from the automotive and telecommunications markets led demand for palladium higher. This more than offset the ongoing miniaturisation of resistor components.



Use of palladium in electronic applications, including hybrid integrated circuits and lead frames (shown left), grew strongly last year.



Imports of palladium into Hong Kong jumped in early 2004 as the jewellery trade built up stocks of palladium products.

JEWELLERY

Global demand for palladium for the manufacture of jewellery soared from 250,000 oz in 2003 (much of which was used in white gold alloys) to 920,000 oz last year; a result of the rapid introduction of palladium jewellery in China. Purchases of palladium by Chinese jewellery producers surged to 700,000 oz: palladium jewellery is an entirely new product sector and the need to build stocks throughout the jewellery supply chain had a considerable impact on metal demand.

Purchases of palladium by the Chinese jewellery industry exceeded all expectations in 2004, reaching 700,000 oz. The overwhelming majority of this metal was used to produce palladium jewellery, with only small volumes used in the manufacture of other precious metal jewellery alloys.

The development of the palladium sector was led at first by jewellery manufacturers. During the first quarter of 2004 retail prices of platinum jewellery failed to keep pace with the rapid rise in the price of platinum, resulting in a sharp reduction in manufacturing margins on platinum jewellery. This prompted several companies to divert a proportion of their capacity towards the production of palladium pieces.

Palladium Demand: Jewellery
'000 oz

	2003	2004
Europe	35	35
Japan	160	155
North America	0	0
Rest of the World	55	730
Total	**250**	**920**

JM

With the initial profit margins on palladium jewellery at least five times those on platinum, the number of fabricators trialling production of the former quickly increased. Purchases of palladium consequently surged in March and April as manufacturers, wholesalers and retailers established stocks of product ahead of the May Day holiday period.

The introduction of palladium jewellery at the retail end of the market was largely confined to second and third tier cities. Retail sales of palladium jewellery developed unevenly, with some stores initially having to discount prices to stimulate sales of what for both customers and sales staff was an unfamiliar product.

However, by promoting palladium on the basis that it shares a number of attributes with platinum (e.g. its purity, durability, and the fact that it will not tarnish) and by virtue of its comparatively low price, stores were able to tap into a desire for affordable white precious metal jewellery amongst consumers.

With plain jewellery largely priced per gram of metal, the low density of palladium (it is roughly half the density of platinum and is significantly lighter than gold) also enhanced its price competitiveness. In addition, the notion that palladium jewellery had the potential to appreciate in value was frequently part of the sales message, with retailers citing both the recent example of platinum, as well as the rise in the palladium price to over $1,000 in early 2001.

Fewer retailers in the largest, most affluent metropolitan areas (particularly Beijing and Shanghai) decided to stock palladium jewellery. In these cities considerable effort and expense has been spent on establishing and reinforcing platinum's position as the precious metal jewellery to which consumers aspire; stores are therefore reluctant to allocate display space to an unfamiliar product that could detract from sales of platinum. The lack of promotional information, its 'cheaper' image, and the absence of a palladium contract on the Shanghai Gold Exchange were other deterrents for the leading retailers.

After the flood of palladium buying by manufacturers in March and April 2004 to establish stocks of product, demand for the metal eased but remained substantial: imports of palladium bullion to Hong Kong averaged more than 53,000 oz per month from May through to December *(see accompanying graph)*.

Demand became increasingly driven by retailers who continued to enjoy good margins on palladium sales, not least because (unlike platinum) the metal was not subject to a 5 per cent consumption tax. In contrast, the financial returns on palladium jewellery for manufacturers declined as competition increased; by the end of the year there was little difference between platinum, palladium and white gold in terms of profit margin per gram. Nevertheless, the weak price of palladium meant that it was relatively inexpensive to finance product inventories, whilst the low volatility of the palladium price during the second half of the year further reduced the risk of holding metal.

In summary, palladium jewellery rapidly established a presence in Chinese provincial cities, where it offered an affordable alternative for less affluent consumers seeking pure, white precious metal jewellery. In doing so, palladium took sales from plain platinum, white gold and even traditional yellow gold jewellery, but also helped to increase the total precious metal jewellery market.

Outside China, palladium is used as a component of platinum and white gold jewellery alloys in Japan and is also a common constituent of white gold alloys in Europe (where there are tight limits on the permissible nickel content of jewellery). Demand in Japan demand weakened in 2004 in concert with the drop in platinum jewellery production, whilst demand in Europe was largely stable.

OTHER

Demand for palladium in other applications jumped to 290,000 oz in 2004, up from 140,000 oz the previous year. Consumption of the metal in most minor industrial uses was fairly stable but sales of physical investment products to private investors in North America surged to an estimated 200,000 oz.

Demand for palladium as a physical investment in North America increased markedly in 2004. Sales of palladium coins and small bars (1 oz and 10 oz) to individual investors climbed rapidly and accounted for 200,000 oz of palladium demand in total.

The widening divergence between the price of palladium and platinum, and the gross underperformance of palladium compared with the rest of the commodities sector, fuelled a perception that the metal was therefore considerably undervalued. This, coupled with increased marketing and promotion of palladium investment products, resulted in a surge in sales, particularly during the first quarter of the year when the price of the metal rallied from less than $200 to over $300.

Palladium Demand: Other
'000 oz

	2003	2004
Europe	20	25
Japan	5	10
North America	95	235
Rest of the World	20	20
Total	**140**	**290**

JM

Much smaller volumes of palladium were used in the production of commemorative coins in China and Europe. The People's Bank of China issued 8,000, half-ounce palladium Panda coins in 2004, the first time the coins had been reproduced since their initial launch in 1989. In Europe, a palladium-gold coin was minted in Slovakia to commemorate the country's accession to the European Union.

In the industrial arena, demand for palladium-based hydrocracking catalysts from the petrochemicals sector edged lower in 2004, reflecting the mature nature of the market. Use of palladium in photographic film also slipped downwards, a result of the wider trend towards digital imaging. However, these reductions in demand were largely offset by small increases in consumption of palladium in catalysts for stationary emissions control applications, gas sensors and hydrogen purification. Total palladium demand from minor industrial applications, therefore, was unchanged at 80,000 oz.

China issued palladium 'Panda' coins in 2004 but by far the greatest demand for investment products was in the USA.

OTHER PLATINUM GROUP METALS

RHODIUM

Demand for rhodium, net of recycling, rose by 19 per cent to 740,000 oz in 2004. Overall use of rhodium in autocatalysts grew strongly in Europe and Asia as average loading levels increased ahead of tighter emissions legislation. In addition, some auto makers are understood to have added to their strategic stocks of metal during the year. Purchases of rhodium by the glass industry also increased markedly last year, reflecting the rapid expansion of LCD glass manufacturing capacity in Asia.

Autocatalyst

Auto industry purchases of rhodium jumped to 773,000 oz in 2004, an increase of 17 per cent on the previous year. However, the year-on-year comparison may be somewhat misleading as it appears likely that a proportion of the surplus for rhodium recorded in 2003 *(see table below)* was purchased by auto companies on forward contracts.

In 2004, Japanese autocatalyst purchases of rhodium surged by 33 per cent to 229,000 oz. This figure encompassed a build-up of inventories of metal by the Japanese auto industry, a consequence of what, during the first half of the year at least, were relatively low rhodium prices.

Rhodium Supply and Demand
'000 oz

	2003	2004
Supply		
South Africa	544	587
Russia	140	105
North America	26	18
Others	14	16
Total Supply	**724**	**726**
Demand		
Autocatalyst: gross	660	773
recovery	(124)	(141)
Chemical	39	41
Electrical	6	6
Glass	26	46
Other	13	15
Total Demand	**620**	**740**
Movements in Stocks	**104**	**(14)**

JM

The actual use of rhodium in autocatalysts climbed in reaction to tightening limits on vehicle NOx emissions. Rhodium is highly effective at catalysing the conversion of NOx to nitrogen and in many instances average rhodium loading levels were increased to enable auto makers to meet the stricter limits.

Similarly in Europe, an overall increase in average rhodium autocatalyst loading levels was driven by the introduction of new vehicle models that comply with Euro IV emissions standards. These reduce allowable NOx emission limits by up to 50 per cent for gasoline light duty vehicles. Purchases of rhodium increased by 8 per cent to 202,000 oz in 2004 as a result.

In North America, purchases of metal by automakers rose to 225,000 oz, an annual increase of 12.5 per cent. In contrast to Japan, however, the rise was largely due to the fact that less metal was drawn down from auto company inventories than the year before, and so more rhodium was purchased in the market.

Demand for rhodium in the Rest of the World increased by 17 per cent in 2004 due to the combination of higher light vehicle output and tightening emissions limits, primarily in Asia.

The recycling of rhodium from scrapped autocatalysts advanced by almost 14 per cent to 141,000 oz in 2004, with the greatest increase in volume terms coming in North America. This, in turn, was a result of changing ratios of pgm used in catalysts some 10 to 12 years previously. Recovery of rhodium in Europe and the Rest of the World also grew due to increased catalyst collection rates, although the volumes of metal recycled in these regions lag well behind North America.

Other

Purchases of rhodium for use in chemical, glass and other applications jumped by more than 28 per cent in 2004 to 108,000 oz, primarily due to a surge in purchases of metal by the glass manufacturing industry.

After a relatively subdued 2003, purchases of rhodium by glass manufacturers jumped to 46,000 oz last year, an increase of 20,000 oz. The increase in demand was primarily a result of the rapid expansion of glass manufacturing capacity in Asia (particularly for LCD glass production), which led to strong demand for rhodium-platinum equipment.

Demand for rhodium from the chemicals industry edged up to 41,000 oz in 2004. The modest improvement was related to the construction of new capacity for the manufacture of acetic acid in Asia and growth in demand from the oxo-alcohols sector in North America. Consumption of rhodium in platinum alloys for use in nitric acid gauze slipped slightly lower due to plant closures in the USA.

Use of rhodium in thermocouple wire and other electrical applications was largely stable in 2004, whereas demand for rhodium plating salts from the

Chinese jewellery industry increased. Virtually all white gold and palladium jewellery manufactured in China is rhodium-plated, as is the majority of platinum, although this application remains a small market in volume terms for rhodium.

RUTHENIUM & IRIDIUM

Demand for ruthenium climbed by 9 per cent in 2004 to 674,000 oz. Use of the metal in chemical applications fell but this was outweighed by a strong increase in purchases by the electronics industry. Demand for iridium also increased by a little over 9 per cent last year, rising to 116,000 oz, although in contrast to ruthenium the increase was driven by greater consumption of iridium-based catalysts.

After a very substantial rise in demand for ruthenium in chemical process catalysts in 2003, purchases of metal last year fell by 14 per cent to 123,000 oz. The year-on-year changes in demand reflect the considerable impact that catalyst orders for new chemical manufacturing plants can have on the consumption of minor metals.

Ruthenium Demand by Application
'000 oz

	2003	2004
Chemical	143	123
Electrochemical	120	96
Electronics	277	388
Other	77	67
Total	**617**	**674**

JM

The use of ruthenium in the electrochemicals industry also slipped lower in 2004 , sliding to 96,000 oz as the global trend to convert chlor-alkali plants using older diaphragm technology to modern membrane production continued. The diaphragm process utilises only ruthenium-coated anodes whereas membrane plants employ ruthenium-iridium anodes with a lower overall ruthenium content.

Demand for ruthenium from the electronics industry, however, increased substantially last year, climbing to 388,000 oz. Strong growth in sales of both industrial and consumer electronics drove a marked rise in purchases of ruthenium pastes from producers of resistor components. At the same time, rising shipments of hard disks led to a notable increase in orders for ruthenium sputtering targets from hard disk manufacturers – the addition of ruthenium to the magnetic alloy significantly increases the amount of data that can be stored per disk.

Use of ruthenium in other applications slipped lower in 2004 due to reduced demand for an alloy used in corrosion-resistant piping, which has applications in geothermal power plants and parts of the petroleum refining industry.

Iridium Demand by Application
'000 oz

	2003	2004
Chemical	20	25
Electrochemical	23	26
Electronics	28	30
Other	35	35
Total	**106**	**116**

JM

The most significant increase in demand for iridium came from the chemicals industry, consumption of the metal in iridium-based process catalysts rising by 5,000 oz to 25,000 oz. The production of acetic acid continued to be the main source of growth in this sector. Electrochemical demand for iridium also improved, use of the metal by chlor-alkali manufacturers increasing to 26,000 oz.

Total electronics demand for iridium expanded to 30,000 oz in 2004. Good demand from the mobile phone and medical imaging industries for components manufactured from high-purity crystals led to increased orders for the iridium crucibles in which these crystals are grown.

Purchases of iridium for use in other applications remained stable overall at 35,000 oz. Increased consumption of the metal in the manufacture of high performance spark plugs was offset by small declines in demand from other sectors such as jewellery alloys and cathodic protection.

OTHER PGM SUPPLIES

Supplies of rhodium increased only marginally in 2004 to 726,000 oz. South African shipments of metal expanded by 8 per cent to 587,000 oz, rising in line with higher platinum production. However, sales from North America fell and substantially less rhodium was shipped from Russia compared with the year before. Russian mine production of rhodium is believed to have been stable in 2004 so the fall in exports infers a reduction in sales from state stocks.

With demand exceeding mine supply, availability of rhodium was tight for much of the year. This was reflected in the price, which climbed from $500 in January to over $1,500 in August, before easing a little to end the year at $1,330.

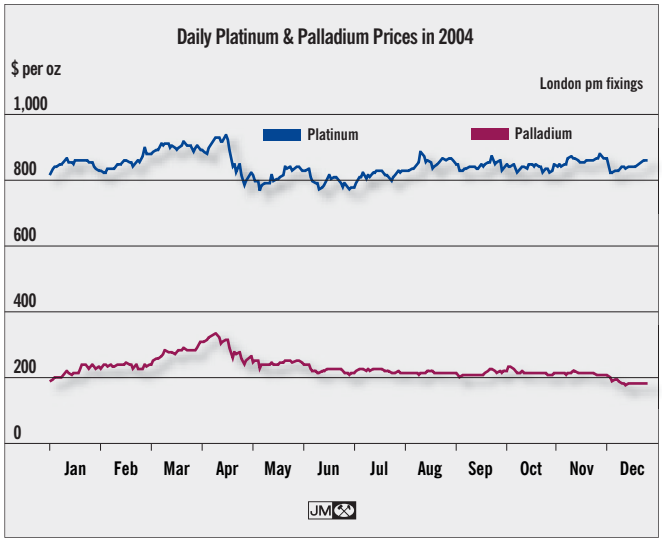
Supplies of ruthenium and iridium, predominantly from South Africa, were again more than sufficient to meet industrial demand. However, the involvement of speculators pushed the prices of both metals up substantially during the first quarter of the year.

PRICES & FUTURES MARKETS

PLATINUM

The depreciating US dollar drew increased levels of speculative investment into most commodities in 2004, including precious and base metals. With platinum supplies closely matching demand, this flow of fund money was the primary influence on the price. This was especially so during the first seven months of the year when platinum moved in a $170 range between $767 and $937 on the London fixings. Physical purchases from the more price-sensitive jewellery markets, particularly China, were adversely affected as a result.

From mid-August onwards the trading range narrowed, platinum fluctuating between $820 and $880 for most of the remainder of the year. Increased demand for physical metal provided support when the price dropped towards the lower end of the range, whilst fund profit-taking tended to cap rallies towards the upper end.



The platinum price opened **January** 2004 at $815 and soon started to climb, as Chinese jewellery manufacturers began purchasing substantial volumes of platinum ahead of the lunar New Year holiday. In addition, funds that had liquidated long futures positions at the end of 2003 became net buyers again on the NYMEX and TOCOM exchanges. As a result, the platinum price surged to $868 on the 13th. The pressure then eased as the speculative buying slowed, and when investors took profits towards the end of the month platinum slipped to $829.

A slide in the value of the US dollar during **February** encouraged renewed fund investment in platinum and the price climbed to reach $864 on the 18th. In Japan, yen weakness then encouraged further heavy buying of platinum futures on TOCOM (and a subsequent squeeze of short positions) that propelled another surge in the price, the metal ending February with a fixing of $877.

Average PGM Prices in $ per oz

	2003	2004	Change
Platinum	691.86	845.75	22%
Palladium	200.61	230.03	15%
Rhodium	530.27	981.73	85%
Iridium	93.07	186.32	100%
Ruthenium	35.04	64.68	85%

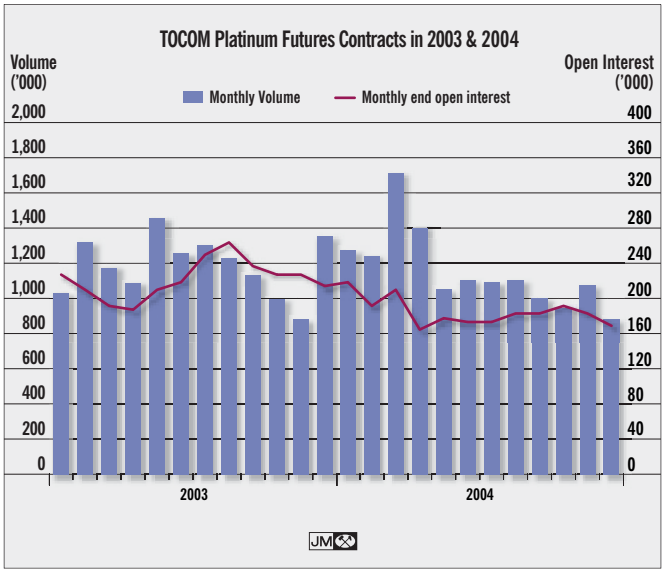
Platinum and palladium prices are averages of London am and pm fixings. Other pgm prices are averages of Johnson Matthey European base prices

JM

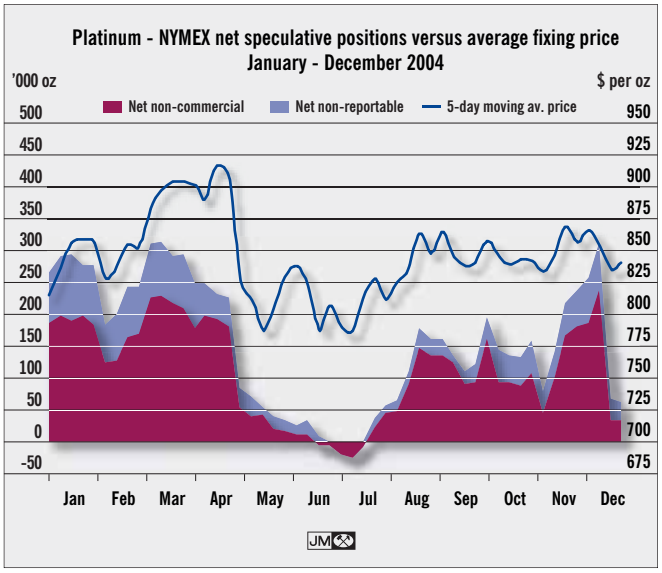
The platinum price continued to rally into **March**, hitting $900 on the afternoon of the 1st in London as funds made substantial additions to their long futures positions. The speculative buying, particularly via the Tokyo exchange, sustained the price in the region of $900 throughout much of March and into **April**. As the rally gathered momentum, funds investing on the basis of technical indicators continued to increase their exposure. Physical demand from end users, however, contracted. The escalation in the platinum price culminated with a fixing of $937 on the 19th of April, a 24-year high.

A subsequent increase in the strength of the dollar on the back of growing expectations of a rise in US interest rates encouraged a sudden and intense round of long liquidation by funds across a range of commodities. The platinum price plunged by more than $150 in the space of ten days to fix at $783 on the 29th April. This drop resulted in a marked upturn in purchasing by Chinese jewellery manufacturers ahead of the May Day national holiday and this briefly steadied the price.

The relationship between the US dollar and other currencies, particularly the yen, continued to influence the actions of funds and other investors during **May**. Dollar strength during the early part of the month extended the long liquidation that had begun during the second half of April, and with most Chinese buyers absent from the market the platinum price slid to $767 on the 10th – a five-month low. However, when the dollar weakened again, investor buying in Japan accelerated once more, leading to a sharp rally in platinum that reached $845 on the 27th.



The volume of platinum contracts traded on TOCOM peaked in March 2004 as fund investment pushed the price above $900.



Speculative buying of platinum on NYMEX by hedge funds ('non-commercial') and managed futures funds ('non-reportable') had a major bearing on the price in 2004.

June was marked by another round of fund long liquidation of platinum futures on both TOCOM and NYMEX, again in response to a strengthening of the dollar against other major currencies. This dragged the platinum spot price down to a low of $774 on the 15th and investor sentiment remained predominantly bearish for the remainder of the month, the net speculative position on NYMEX entering negative territory for the first time since November 2001.

Support for the price, however, emerged at around $780 in the form of physical demand, with steady purchasing from both the jewellery trade and a number of industrial sectors.

During **July** the price of platinum climbed back over $800, with the strength of the South African rand increasing concerns over the economic viability of planned mine expansions. By the 12th the price had risen to $824 on the back of renewed fund investment and by mid-month the net speculative short position that had accumulated on NYMEX during late June had been reversed as the rand moved under $1=R6. Japanese investors also switched an increasing proportion of their funds into commodities on TOCOM as the price of oil soared and the Tokyo equities market fell. The platinum price consequently hit $836 on the 20th before easing back to $818 at the month's end.

The rally in the price of platinum accelerated in **August** as speculative long positions on both NYMEX and TOCOM continued to rise. Investors reacted to the increasing possibility that mine workers in South Africa would strike, setting aside the longer-term positive implications for platinum supply of a sharp weakening of the rand versus the dollar. The platinum price surged from an opening fixing of $827 to a peak of $885 on the 16th. After briefly falling back under $850 platinum ended the month firmly at $864.

September was initially marked by a speculative sell-off in platinum, gold and silver as funds took profits. After touching $873 on the 2nd, platinum slid rapidly to $827 on the 9th. The drop in the price again sparked an upturn in orders for physical metal from industrial and jewellery end users and platinum recovered to trade either side of $840 until the 20th.

Disruption to pgm production in South Africa then sparked another price rally: a fire at Northam's mine was followed by the announcement of wage disputes at Anglo Platinum and Impala Platinum. With the rand also resuming its appreciation versus the dollar, investors and funds renewed their buying of platinum futures. This propelled the price up to $875 on the 28th, before profit-taking saw platinum soften to end September at $854.

With mine workers on strike at both Anglo Platinum and Impala operations, platinum began **October** strongly with a fixing of $863. However, on the 4th the price dropped by more than $30 as funds rapidly closed out long positions, ending the day at $827 bid in New York. The spark for the sell-off appeared to be technical in nature: the spot price slipped below its 200-day moving average, a move that initiated sell

orders from funds trading on technical indicators. The selling was reflected in a large decline in the net long position held by speculators on NYMEX, which fell by more than 25 per cent to 145,000 oz.

The remainder of the month was marked by considerable volatility, the price fluctuating between $820 and $860 in response to the ebb and flow of fund investment. The value of the dollar, combined with price trends in other commodities (especially gold and oil), were the main influences on the platinum price, with support at the lower end of the range provided by increased demand for metal from Chinese buyers. The price hit a low for the month of $821.50 on the 28th, reflecting fund liquidation across the oil and metals markets, but then recovered to $835 the following day.

From early **November** onwards increasing US dollar weakness spurred investors to rebuild long positions in precious and base metals. The platinum price moved above $850 on the afternoon of the 4th and by the 12th had passed $871. In contrast to the futures activity, demand for metal from the Chinese jewellery sector became subdued as the platinum price climbed. The rally peaked at $878 on the 15th, at which point profit-taking by investors in Japan began to outweigh further steady accumulation of long positions by funds in the USA. Falling short term lease rates, which slipped under 5 per cent, also helped to cap the rally in the spot price. Nevertheless, platinum ended the month well supported at $867, the net speculative position on NYMEX having exceeded 250,000 oz for the first time since March.

The fund buying continued into early **December** on the back of ongoing US dollar weakness and the strength of the South African rand, which reached a 6-year high of $1=R5.65. This lifted the platinum price to a peak of $884 on the 2nd. However, when the dollar staged a sudden recovery on the 8th funds began swiftly liquidating long positions across the metals markets. As a result the platinum price slumped to $822, a drop of $50 from the previous day's close in New York. Over the next few days increased demand from end users and renewed fund buying then helped platinum recover to $840, and the metal traded near to this level through to the 23rd. The Christmas period then saw a sharp run up in the price in very thin trade. The price jumped to reach $868 by the close of trading in New York on the 28th as the dollar weakened once more, before ending 2004 firmly with a fixing of $861 on the 31st.

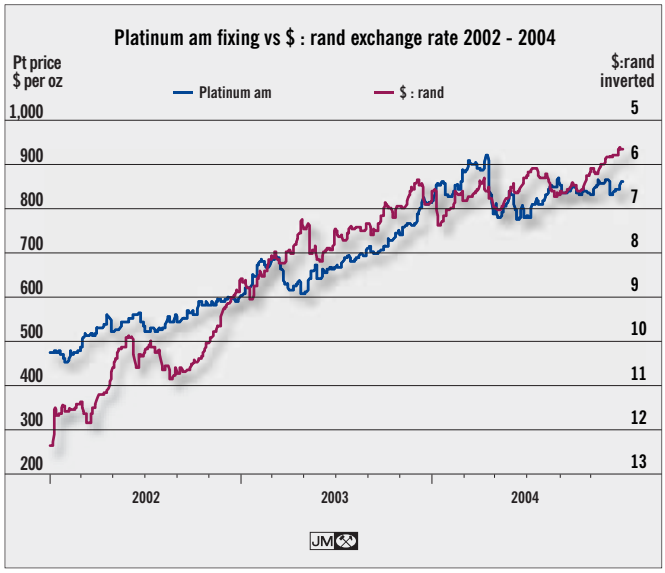
In dollar terms, the price of platinum appreciated by 5.6 per cent over the course of the year, rising from $815 to $861. However, much of the dollar price strength of platinum was due the depreciation of the US currency. In yen terms the price of platinum ended the year little changed, in euros platinum fell by almost 3 per cent. The impact of exchange rate movements was more pronounced for South African pgm producers: the price of platinum in rand dropped by almost 10 per cent from around R5,400 per oz at the start of January to R4,880 at the end of December.

Platinum Prices in 2004
London am and pm fixings, $ per oz

	High	Low	Average
January	868.00	815.00	851.32
February	877.00	822.00	846.21
March	923.00	878.00	899.54
April	937.00	783.00	880.43
May	845.00	767.00	809.43
June	844.00	774.00	807.35
July	836.00	776.00	809.33
August	885.00	824.00	847.39
September	875.00	827.00	847.90
October	863.00	821.50	842.82
November	878.00	826.00	854.30
December	884.00	822.00	849.34

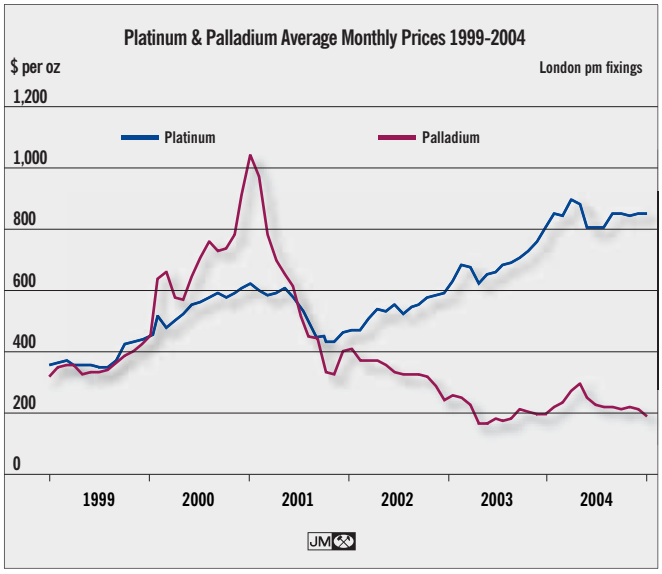
JM

The strengthening of the rand versus the dollar has been a key influence on the platinum price since 2002



PALLADIUM

The price of palladium climbed from an opening fixing of $194 to over $240 during the first three weeks of 2004, the momentum being provided by fund buying of substantial volumes of palladium derivatives. The rally accelerated in March, supported by a surge in Chinese purchases of metal for jewellery manufacture, and peaked with a fixing of $333 on the 13th of April. However, with plenty of metal available to cover both speculative and end



user demand, the price collapsed when funds started taking profits. Palladium dropped below $240 before the end of April, touched $230 in May, and fell beneath $220 in June.

Volatility in the palladium market reduced considerably during the second half of the year. A trading range of just over $140 in the first half narrowed to less than $30 from July to the end of November, the metal trading between $205 and $235 for almost the entire period despite renewed fund buying. The end of the year was marked by further weakness in the palladium price – a reaction to another round of speculative profit-taking and substantial offers of metal on the London fixings. Palladium slid below $200 during the second week of December and ended the year at $184.

The palladium market began 2004 positively as fund buying lifting the price from an opening fixing of $194 to $201 on the 6th of **January**. This buying accelerated quickly the following week, with a substantial number of new long futures positions opened on NYMEX and relatively large volumes of metal traded across the fixings in London. The price jumped from around $200 on the morning of the 12th to over $220 by the close of trading in New York the following day.

Good offers of metal then held the price in check until the 21st, when speculative buying succeeded in pushing the price up to $230. The rally reached $242 on the 22nd, before the buying slowed and the price dropped back to end January at $230.

Funds continued to add to their net long positions in palladium during **February**, both via the NYMEX and TOCOM futures markets and through over-the-counter deals involving derivatives and physical metal. Despite this, offers on the spot market (believed to have been largely of Russian metal) were sufficient to restrain the palladium price: a slow climb up from $230 to $246 was followed by a slide back to $230.

The fund buying of palladium persisted throughout **March** and into early **April**, and was complemented by a surge in demand for physical metal from Chinese jewellery manufacturers. As a result the price soared from $235 on the 1st of March to reach a peak fixing of $333 on the 13th of April. By that time the net speculative long position on NYMEX alone had grown to the equivalent of almost 990,000 oz, up from a little over 500,000 oz at the start of the year. The speculative buying was stimulated in part by an announcement that a diesel autocatalyst containing palladium had been developed. However, the rally was extremely short-lived; when funds started taking profits across almost the entire spectrum of precious and base metals the price of palladium slumped, falling under $240 on the 29th of April.

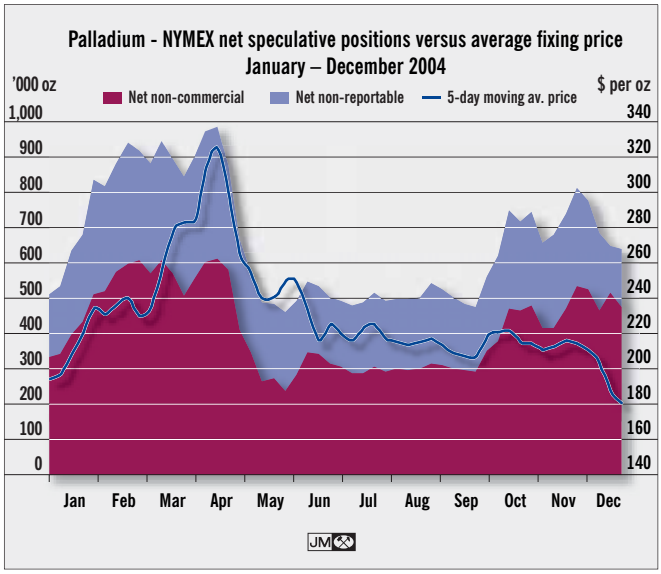
After a brief rebound to $265 on the 4th of **May**, the palladium price fell further as funds continued to close out their long positions. With demand for metal from the Chinese jewellery industry also decreasing from the high levels seen in April, the palladium price dropped to $229 on the 10th, mirroring the falling platinum and gold markets. When the rate of fund selling eased the palladium price bottomed out and volatility dropped; the metal subsequently fluctuated between $230 and $255 for the remainder of the month. By that stage the net speculative long position on NYMEX had been cut to less than 460,000 oz, a reduction of over 500,000 oz in just six weeks.

The price of palladium continued to follow platinum downwards during the first half of **June**, sliding from $250 at the opening fixing to a low of $215.50 on the 15th. From then on trading was slow, both for physical metal in the spot market

Palladium Prices in 2004
London am and pm fixings, $ per oz

	High	Low	Average
January	246.00	192.00	216.27
February	246.00	223.00	235.04
March	288.00	235.00	268.99
April	333.00	237.00	295.46
May	265.00	229.00	246.03
June	252.00	215.50	228.93
July	228.00	209.00	220.37
August	223.00	211.00	215.51
September	224.00	204.50	211.35
October	234.00	212.00	218.18
November	220.00	209.00	213.83
December	211.00	178.00	191.95

JM



and on the futures exchanges. The price struggled back upwards to $230 on the 21st but then softened again, ending June at $217.

Palladium made small gains in mid-**July**, once more responding to rallies in the platinum and gold prices. However, after reaching a high of $228 on the 20th it subsided to $216 at the month end, in line with good availability, uninspiring physical demand and modest fund selling on NYMEX.

The palladium market remained dull throughout **August** and into **September**. There was no fundamental news of note to move the market; supply remained ample to meet physical demand; and there was little movement in fund positions on the New York and Tokyo futures markets.

The price held close to $220 for the duration of August before slipping to a low of $204.50 in early September. An upturn in fund interest was seen later in the month, which was reflected in a rise in the net long position on NYMEX from around 475,000 oz to over 560,000 oz. This carried the palladium price up to $224 on the 28th of September but the rally quickly evaporated, the metal ending the month at $217.

After briefly slipping lower in early **October** (in line with platinum), palladium rallied steadily to a four-month high of $234 on the 8th. US funds made substantial additions to their long positions, the net position on NYMEX rising by 185,000 oz in the two weeks to the 12th of October to total 747,000 oz. The price subsequently weakened when some investors took profits, falling to a low of $212 on the 13th before trading in a narrow range either side of $215 for the remainder of the month

The palladium market was fairly listless in **November**, despite further substantial investment by funds and rallies in other precious and base metal markets. The price was anchored between $210 and $220 for almost the entire month as the fundamental imbalance between supply and demand countered another increase in the net speculative position on NYMEX to 812,000 oz.

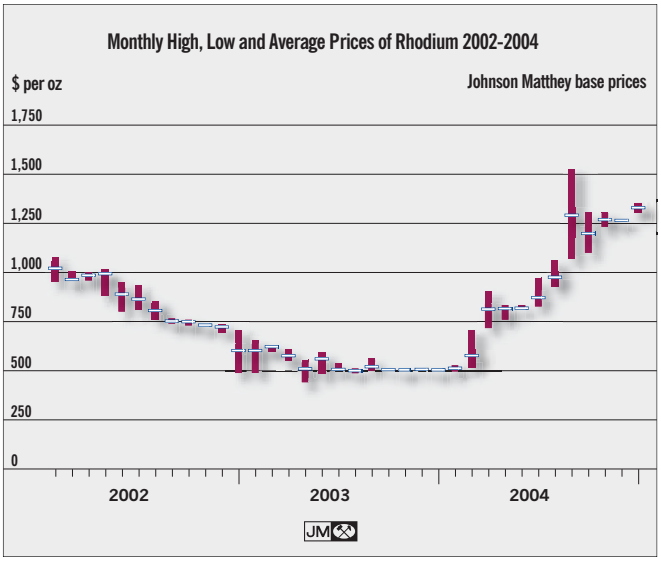
The speculative support that had kept the price of palladium above $200 throughout the year finally gave way in early **December**. The market underwent a round of fund selling, in common with platinum, gold and base metals, and the volume of physical metal offered around the fixings in London increased noticeably. Imports of Russian palladium by Switzerland jumped in November and December and it seems likely that a significant proportion of this metal was sold across the fixings on behalf of either the Russian Treasury (Gokhran) or the Russian Central Bank.

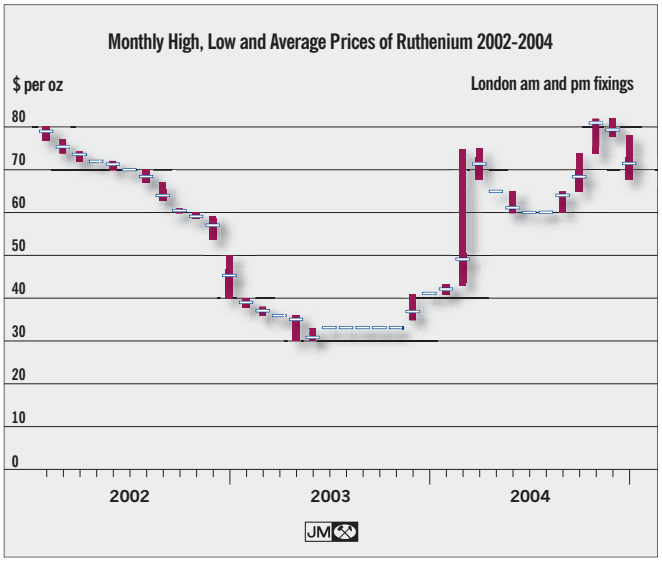
The palladium price consequently dropped from around $210 at the start of the month to under $180 by the 16th. The closure and liquidation of the assets of a single US-based hedge fund that had specialised in commodities may have contributed to the fall. In contrast to platinum, the weak fundamentals for palladium meant that the price failed to recover significantly and the metal ended 2004 at $184, exactly $10 below the opening fixing of the year.

OTHER PGM

The prices of the minor metals were also influenced by speculative buying during 2004. Rhodium climbed from $500 to $900 between January and March; slipped back to trade either side of $800 until the middle of the year; then began to rally again when metal was withdrawn from the leasing market. Rhodium reached $1,525 in August in very thin trade before greater offers of spot metal resulted in the price easing back a little. Nevertheless, the market remained relatively firm, rhodium ending the year at $1,330.

The price of iridium surged from $87 to $230





during the first quarter of 2004, whilst ruthenium jumped from $41 to $75. The price of both metals then lost ground, iridium falling back to $170 and ruthenium to $68.

The Johnson Matthey base price for rhodium began 2004 at $500 and the metal traded near to that level throughout January, supply and demand being closely matched. From late February onwards, however, speculative buying came into the market and the price of rhodium began to climb rapidly, reaching $900 in early March. Bids for increased volumes of metal from end users, concerned about the possibility of a large price spike, contributed to the rally.

The rise in price resulted in increased volumes of metal being offered and rhodium slipped back to trade between $760 and $840 until mid-June. The price then began moving upwards again as physical availability tightened, with less Russian metal in particular in evidence compared with 2003. By late July rhodium had risen above $1,000 as speculators held back metal from the lending market, squeezing lease rates higher. Consequently, an increasing number of industrial end users sought to buy rather then borrow metal, accelerating the rise in the price.

The JM base price reached $1,525 in early August, although very little physical metal changed hands at this level. The move in the price above $1,500 saw greater offers of metal come into the market and lease rates and the spot price eased down. Rhodium slipped to $1,100 in mid-September before firming again to end the month at $1,300. The price stabilised at this level until mid-October, when a modest increase in offers of spot metal began to put downward pressure on the market and the price dropped back to $1,235. Rhodium moved up over $1,300 once again in early November and then steadied to trade in a narrow band between $1,300 and $1,345 through to the end of the year.

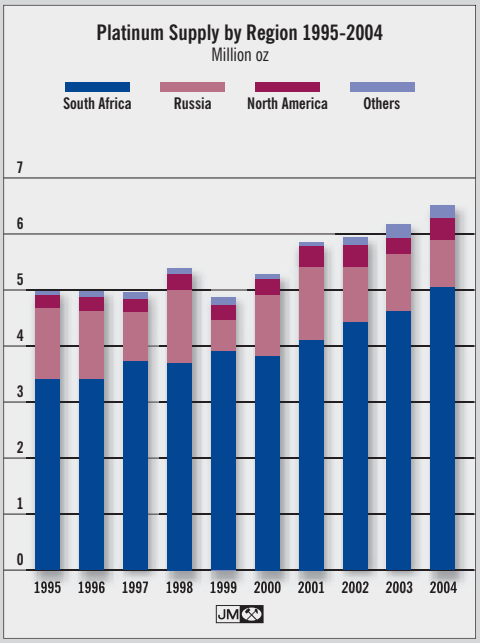
The iridium and ruthenium markets were not exempt from speculative interest during the first quarter of 2004. After spending the whole of January at $87, the JM iridium base price then surged to $230 between early February and mid-March at a time when fund buying of precious and base metals was reaching a peak. The price then flattened out and iridium traded quietly either side of $200 from May through to November, before slipping lower in December to end the year at $170.

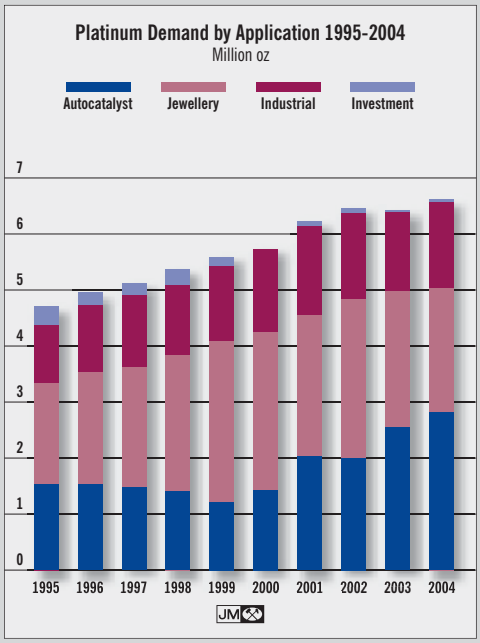
The price of ruthenium followed a similar course to that of iridium during the early part of 2004; after edging up from $41 to $43 during January, the price jumped to $75 by the end of February as speculative bids came into the market.

Ruthenium then lost ground during March and settled into a $60 to $65 range from April through to mid-September. Renewed light speculative interest and firmer industrial off-take subsequently spurred another rally that peaked at $82 in October, but in the face of good availability of metal the price eased again, ending December at $68.

Platinum Supply and Demand

'000 oz	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Supply										
South Africa	3,370	3,390	3,700	3,680	3,900	3,800	4,100	4,450	4,630	5,030
Russia	1,280	1,220	900	1,300	540	1,100	1,300	980	1,050	850
North America	240	240	240	285	270	285	360	390	295	385
Others	100	130	120	135	160	105	100	150	225	235
Total Supply	**4,990**	**4,980**	**4,960**	**5,400**	**4,870**	**5,290**	**5,860**	**5,970**	**6,200**	**6,500**
Demand by Application										
Autocatalyst: gross	1,850	1,880	1,830	1,800	1,610	1,890	2,520	2,590	3,270	3,510
recovery	(320)	(350)	(370)	(405)	(420)	(470)	(530)	(565)	(645)	(700)
Chemical	225	230	235	280	320	295	290	325	320	330
Electrical	250	275	305	300	370	455	385	315	260	295
Glass	245	255	265	220	200	255	290	235	210	290
Investment: small	75	110	180	210	90	40	50	45	30	25
large	270	130	60	105	90	(100)	40	35	(15)	15
Jewellery	1,880	1,990	2,160	2,430	2,880	2,830	2,590	2,820	2,510	2,200
Petroleum	135	185	170	125	115	110	130	130	120	145
Other	230	255	295	305	335	375	465	540	470	470
Total Demand	**4,840**	**4,960**	**5,130**	**5,370**	**5,590**	**5,680**	**6,230**	**6,470**	**6,530**	**6,580**
Movements in Stocks	**150**	**20**	**(170)**	**30**	**(720)**	**(390)**	**(370)**	**(500)**	**(330)**	**(80)**



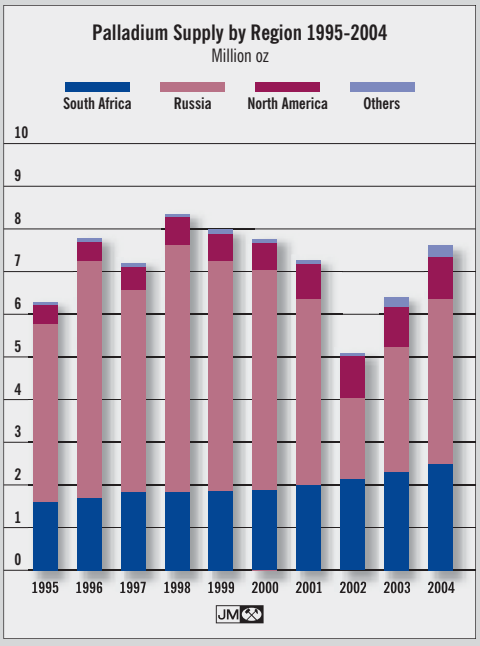


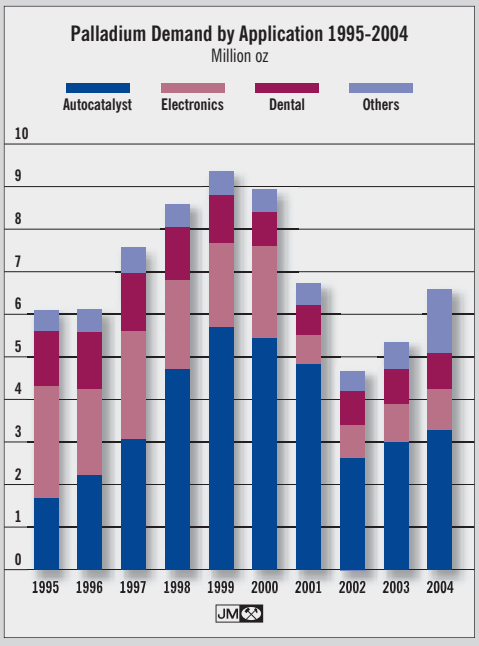
Platinum Demand by Application: Regions

'000 oz	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Europe										
Autocatalyst: gross	560	515	510	545	560	680	1,060	1,210	1,455	**1,660**
recovery	(15)	(20)	(25)	(30)	(30)	(40)	(70)	(90)	(115)	**(140)**
Chemical	55	60	70	60	80	100	105	115	105	**115**
Electrical	25	25	45	45	70	80	65	40	35	**35**
Glass	35	40	20	25	20	20	10	10	10	**5**
Investment: small	10	5	5	5	5	0	0	0	0	**0**
Jewellery	120	125	150	160	185	190	170	160	190	**205**
Petroleum	15	15	15	15	15	15	15	15	15	**15**
Other	75	75	85	85	90	105	155	190	190	**190**
Total	**880**	**840**	**875**	**910**	**995**	**1,150**	**1,510**	**1,650**	**1,880**	**2,085**
Japan										
Autocatalyst: gross	270	245	255	240	250	290	340	430	500	**590**
recovery	(40)	(50)	(50)	(55)	(60)	(60)	(55)	(55)	(60)	**(60)**
Chemical	20	20	20	20	20	20	25	30	40	**45**
Electrical	45	45	65	55	75	90	80	55	40	**50**
Glass	105	80	85	80	65	65	85	60	85	**90**
Investment: small	35	25	25	25	20	5	5	5	5	**5**
large	270	130	60	105	90	(100)	40	35	(15)	**15**
Jewellery	1,480	1,480	1,390	1,290	1,320	1,060	750	780	660	**590**
Petroleum	5	5	5	5	5	5	5	5	5	**5**
Other	25	25	30	30	35	35	35	55	40	**40**
Total	**2,215**	**2,005**	**1,885**	**1,795**	**1,820**	**1,410**	**1,310**	**1,400**	**1,300**	**1,370**
North America										
Autocatalyst: gross	820	850	800	775	535	620	795	570	885	**800**
recovery	(260)	(275)	(290)	(310)	(315)	(350)	(370)	(380)	(420)	**(440)**
Chemical	70	80	80	80	95	100	100	100	95	**90**
Electrical	115	130	100	105	120	145	120	100	85	**90**
Glass	25	30	45	20	25	50	35	30	(30)	**(10)**
Investment: small	25	75	145	175	60	35	45	40	25	**20**
Jewellery	65	90	160	270	330	380	280	310	310	**290**
Petroleum	40	60	50	40	40	35	40	45	40	**35**
Other	115	140	160	170	190	210	250	265	215	**205**
Total	**1,015**	**1,180**	**1,250**	**1,325**	**1,080**	**1,225**	**1,295**	**1,080**	**1,205**	**1,080**
Rest of the World										
Autocatalyst: gross	200	270	265	240	265	300	325	380	430	**460**
recovery	(5)	(5)	(5)	(10)	(15)	(20)	(35)	(40)	(50)	**(60)**
Chemical	80	70	65	120	125	75	60	80	80	**80**
Electrical	65	75	95	95	105	140	120	120	100	**120**
Glass	80	105	115	95	90	120	160	135	145	**205**
Investment: small	5	5	5	5	5	0	0	0	0	**0**
Jewellery	215	295	460	710	1,045	1,200	1,390	1,570	1,350	**1,115**
Petroleum	75	105	100	65	55	55	70	65	60	**90**
Other	15	15	20	20	20	25	25	30	30	**35**
Total	**730**	**935**	**1,120**	**1,340**	**1,695**	**1,895**	**2,115**	**2,340**	**2,145**	**2,045**

Palladium Supply and Demand

'000 oz	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Supply										
South Africa	1,600	1,690	1,810	1,820	1,870	1,860	2,010	2,160	2,320	**2,500**
Russia	4,200	5,600	4,800	5,800	5,400	5,200	4,340	1,930	2,950	**3,800**
North America	470	455	545	660	630	635	850	990	935	**1,055**
Others	70	95	95	120	160	105	120	170	245	**265**
Total Supply	**6,340**	**7,840**	**7,250**	**8,400**	**8,060**	**7,800**	**7,320**	**5,250**	**6,450**	**7,620**
Demand by Application										
Autocatalyst: gross	1,800	2,360	3,200	4,890	5,880	5,640	5,090	3,050	3,450	**3,810**
recovery	(110)	(145)	(160)	(175)	(195)	(230)	(280)	(370)	(410)	**(530)**
Chemical	210	240	240	230	240	255	250	255	265	**305**
Dental	1,290	1,320	1,350	1,230	1,110	820	725	785	825	**850**
Electronics	2,620	2,020	2,550	2,075	1,990	2,160	670	760	900	**955**
Jewellery	200	215	260	235	235	255	230	260	250	**920**
Other	110	140	140	115	110	60	65	90	140	**290**
Total Demand	**6,120**	**6,150**	**7,580**	**8,600**	**9,370**	**8,960**	**6,750**	**4,830**	**5,420**	**6,600**
Movements in Stocks	**220**	**1,690**	**(330)**	**(200)**	**(1,310)**	**(1,160)**	**570**	**420**	**1,030**	**1,020**





Palladium Demand by Application: Regions

'000 oz	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Europe										
Autocatalyst: gross	650	860	1,100	1,370	1,530	1,900	1,730	1,370	1,220	**1,160**
recovery	0	(5)	(5)	(5)	(10)	(15)	(30)	(45)	(70)	**(110)**
Chemical	65	65	70	65	65	95	65	70	65	**65**
Dental	250	255	260	210	180	100	50	55	70	**80**
Electronics	325	300	340	270	255	265	35	85	85	**100**
Jewellery	30	30	50	50	50	45	35	35	35	**35**
Other	20	20	25	25	25	20	20	15	20	**25**
Total	**1,340**	**1,525**	**1,840**	**1,985**	**2,095**	**2,410**	**1,905**	**1,585**	**1,425**	**1,355**
Japan										
Autocatalyst: gross	145	180	245	480	600	510	505	520	550	**675**
recovery	(25)	(30)	(45)	(50)	(55)	(50)	(40)	(40)	(40)	**(40)**
Chemical	20	20	20	20	20	20	20	20	25	**25**
Dental	580	600	620	590	545	470	475	505	515	**520**
Electronics	1,600	990	1,390	1,060	980	990	260	140	225	**225**
Jewellery	115	115	110	105	105	150	140	165	160	**155**
Other	10	10	10	10	10	15	10	10	5	**10**
Total	**2,445**	**1,885**	**2,350**	**2,215**	**2,205**	**2,105**	**1,370**	**1,320**	**1,440**	**1,570**
North America										
Autocatalyst: gross	950	1,230	1,680	2,820	3,490	2,805	2,375	640	1,205	**1,445**
recovery	(85)	(110)	(105)	(115)	(125)	(155)	(200)	(260)	(270)	**(345)**
Chemical	70	70	70	70	75	65	75	75	70	**85**
Dental	410	410	415	390	350	230	190	215	225	**235**
Electronics	545	490	550	460	405	485	250	210	215	**205**
Jewellery	5	5	10	10	10	10	0	0	0	**0**
Other	65	90	55	55	50	5	15	45	95	**235**
Total	**1,960**	**2,185**	**2,675**	**3,690**	**4,255**	**3,445**	**2,705**	**925**	**1,540**	**1,860**
Rest of the World										
Autocatalyst: gross	55	90	175	220	260	425	480	520	475	**530**
recovery	0	0	(5)	(5)	(5)	(10)	(10)	(25)	(30)	**(35)**
Chemical	55	85	80	75	80	75	90	90	105	**130**
Dental	50	55	55	40	35	20	10	10	15	**15**
Electronics	150	240	270	285	350	420	125	325	375	**425**
Jewellery	50	65	90	70	70	50	55	60	55	**730**
Other	15	20	50	25	25	20	20	20	20	**20**
Total	**375**	**555**	**715**	**710**	**815**	**1,000**	**770**	**1,000**	**1,015**	**1,815**

Rhodium Supply and Demand

'000 oz	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Supply										
South Africa	342	359	377	400	410	457	452	490	544	**587**
Russia	80	110	240	110	65	290	125	90	140	**105**
North America	13	5	16	16	18	17	23	25	26	**18**
Others	1	2	3	4	8	3	4	10	14	**16**
Total Supply	**436**	**476**	**636**	**530**	**501**	**767**	**604**	**615**	**724**	**726**
Demand by Application										
Autocatalyst: gross	464	424	418	483	509	793	566	599	660	**773**
recovery	(37)	(45)	(49)	(57)	(65)	(79)	(88)	(99)	(124)	**(141)**
Chemical	13	21	36	31	34	39	44	39	39	**41**
Electrical	8	9	9	6	6	7	6	6	6	**6**
Glass	17	53	43	34	35	42	41	37	26	**46**
Other	9	9	10	10	9	10	10	10	13	**15**
Total Demand	**474**	**471**	**467**	**507**	**528**	**812**	**579**	**592**	**620**	**740**
Movements in Stocks	**(38)**	**5**	**169**	**23**	**(27)**	**(45)**	**25**	**23**	**104**	**(14)**

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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 consuming industries 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

BEE	black economic empowerment
CO	carbon monoxide
DPF	diesel particulate filter
HC	hydrocarbons
HIC	hybrid integrated circuit
LCD	liquid crystal display
Merensky, UG2, Platreef	platiniferous orebodies in South Africa
MLCC	multi-layer ceramic capacitor
NOx	oxides of nitrogen
NYMEX	New York Mercantile Exchange
PM	particulate matter
TOCOM	Tokyo Commodity Exchange

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Johnson Matthey

40-42 Hatton Garden, London EC1N 8EE, England

Telephone: +44 (0)20 7269 8390 Fax: +44 (0)20 7269 8389

www.platinum.matthey.com