PLATINUM 2009

Johnson Matthey

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Flotation processing of milled ore is an important step in the production of platinum group metals in South Africa.

PLATINUM 2009

by David Jollie

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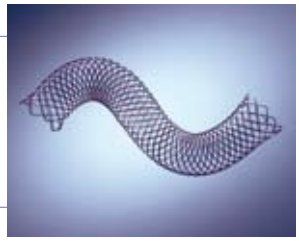
EXECUTIVE SUMMARY



The platinum market was in deficit by 375,000 oz in 2008. Global platinum supplies fell heavily to 5.97 million ounces. Net demand for platinum decreased by 5.0 per cent to 6.35 million ounces, as a number of sectors were affected by the economic slowdown. Supply disruptions drove the price to a record $2,276 in March 2008 before investor sales forced it sharply down later in the year, to a low of $756 in October.

Global supplies of platinum declined by 9.5 per cent in 2008 to 5.97 million ounces. Sales of platinum from South Africa decreased to 4.53 million ounces, driven lower by a combination of bad weather, geological issues, safety closures, smelter problems and a shortage of skilled staff. Russian platinum supplies fell to 820,000 oz, while sales of metal from other producing nations were marginally up at 295,000 oz .

Gross autocatalyst demand for platinum fell by 8.2 per cent to 3.81 million ounces in 2008. European auto makers purchased less platinum for use in catalytic converters than they bought in 2007 due to lower light duty vehicle production, despite

the greater use of platinum-containing diesel particulate filters. Platinum use in other regions fell, reflecting lower vehicle output and continuing efforts to replace any remaining platinum in gasoline catalyst formulations with palladium.

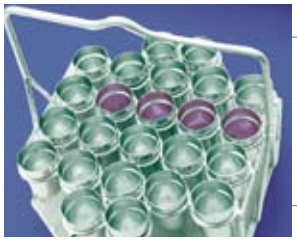
Jewellery demand, net of recycling, declined by 6.2 per cent to 1.37 million ounces in 2008. Manufacturing volumes and retail sales were depressed by the high metal prices in the first half of the year in every region, but recovered later in China and Japan once the platinum price declined. Recycling volumes were very large in Asia earlier in the year but decreased sharply in response to the price change.

Net physical investment demand for platinum grew strongly, from 170,000 oz in 2007 to 425,000 oz in 2008. Purchasing of metal through the Exchange Traded Funds was volatile, with heavy buying in early 2008 and heavy selling later in the year. The fall in the platinum price in the final months of the year was met by very strong buying interest from Japanese investors, which accounted for the year-on-year increase.

Demand for platinum for industrial applications fell by 4.9 per cent to 1.76 million ounces in 2008. Purchases of metal fell in the chemical and electrical sectors as the global economy slowed in

the second half of the year but more metal was purchased by the petroleum refining industry. Glass sector demand fell due to the closure of a number of conventional television glass factories.

The rhodium market moved from a deficit of 20,000 oz in 2007 to a surplus of 6,000 oz in 2008. Global supplies fell by 15.7 per cent to 695,000 oz as production problems in South Africa hit rhodium output. Net rhodium demand fell by 18.4 per cent to 689,000 oz as autocatalyst demand dropped due to lower vehicle production. While the price reached a record $10,100 in June, it ended the year at a much weaker $1,250.



The palladium market was in surplus by 460,000 oz in 2008. Net palladium demand climbed by 15,000 oz to 6.85 million ounces despite the economic slowdown. Palladium supplies fell to 7.31 million ounces due to lower production in Russia, South Africa and North America and lower sales of Russian state stocks than in 2007. The palladium price followed platinum, reaching a peak of $588 before ending the year at $183.50.

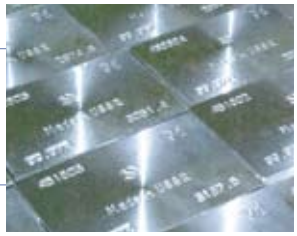
Supplies of palladium decreased to 7.31 million ounces in 2008, a fall of 14.8 per cent. South African sales of palladium fell by 335,000 oz to 2.43 million ounces due to the wide range of problems experienced by its mining industry. North American supplies of palladium decreased as production was cut in the final quarter of the year. Total Russian supplies declined to 3.66 million ounces: primary production fell and sales of palladium from state stocks were over half a million ounces lower than in the previous year.

Gross autocatalyst palladium demand decreased by 3.6 per cent in 2008 to 4.38 million ounces. Palladium demand in North America fell heavily as automotive sales were hit by economic conditions.

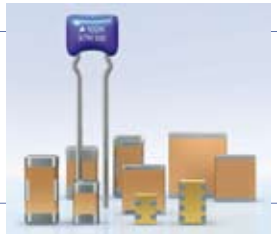
In Europe, palladium use rose as more of this metal was employed in the diesel sector. Rising vehicle output in China and the Rest of the World region also gave some support to palladium demand.

Net demand for palladium from the jewellery industry climbed by 19.6 per cent to 855,000 oz in 2008. Palladium demand in Europe and North America grew to a combined 105,000 oz. In China, demand rose from 500,000 oz in 2007 to 650,000 oz in 2008 as the flow of recycled old jewellery stock decreased and manufacturing volumes of palladium jewellery were strong in the first three quarters of the year.

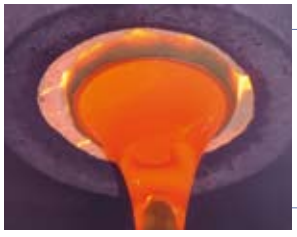
Physical investment demand for palladium climbed by over 50 per cent to 400,000 oz in 2008. Net purchases through Exchange Traded Funds rose to 370,000 oz as investors were steady buyers of palladium for most of the year. Demand for the production of coins and small bars climbed to 30,000 oz.



Industrial demand for palladium climbed by 2.4 per cent to 2.39 million ounces in 2008. Net purchases of palladium by the electronics sector grew again, to 1.33 million ounces, as the number of



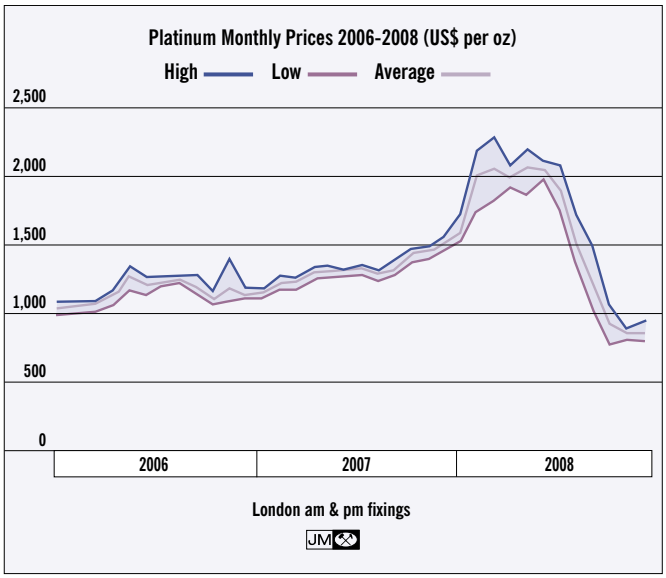
palladium-containing multi-layer ceramic capacitors manufactured rose. Dental sector use of palladium was flat at 630,000 oz while demand for palladium from the chemical industry fell to 350,000 oz.



Ruthenium demand fell for a second successive year, to 669,000 oz in 2008. The electronics industry purchased substantially less metal for the production of perpendicular magnetic recording hard disks as manufacturers continued to reduce their working stocks of ruthenium. **Iridium demand fell by 2,000 oz to 102,000 oz due to a decline in demand for crucibles for crystal growing.**

SUMMARY

PLATINUM



2008 was a year of highs and lows for the platinum price with fundamentals and investor activity both having a profound influence.

Net global demand for platinum fell by 5.0 per cent to 6.35 million ounces in 2008. Gross autocatalyst demand was depressed by the slowing world economy and fell heavily to 3.81 million ounces. Industrial demand weakened rapidly towards the end of the year and fell to 1.76 million ounces. Annual physical investment demand rose by 150 per cent to 425,000 oz. Net jewellery demand fell to 1.37 million ounces, a fall of 6.2 per cent, a much smaller decrease than previously expected.

A series of challenges – from electricity supply to safety shutdowns, and from skills shortages to bad weather – depressed South African platinum supplies by 10.7 per cent in 2008 to 4.53 million ounces. With Russian platinum production also falling, total platinum supplies decreased by 9.5 per cent to 5.97 million ounces. With demand exceeding supply – despite a slowing global economy – the platinum market was in a deficit of 375,000 oz in 2008.

Demand for platinum fluctuated during 2008 in response to the volatile platinum price and the weakening economy. As a result, we have made significant revisions to our previous estimates for demand in the autocatalyst sector – where working stocks of catalysts were run down further than initially forecast – and in the jewellery and investment sectors – where the falling platinum price prompted extremely strong demand in late 2008 in Asia.

The weakness in the automotive industry was widely reported in the media during 2008 but intensified only later in the year. Falling output was seen earliest in North America where annual light duty vehicle production dropped by nearly twenty per cent. The economic slowdown was seen later in Europe where light duty vehicle output fell by only six per cent. There was support for automotive platinum demand from tightening emissions legislation in Europe, which encouraged greater use of platinum-rich diesel particulate filters on passenger cars, and from rising vehicle production in China. Overall, gross autocatalyst platinum demand fell by 8.2 per cent in 2008 to 3.81 million ounces.

Platinum Supply and Demand
'000 oz

	2007	2008
Supply		
South Africa	5,070	4,530
Russia	915	820
North America	325	325
Others	290	295
Total Supply	**6,600**	**5,970**
Demand		
Autocatalyst: gross	4,145	3,805
recovery	(935)	(1,005)
Jewellery	1,455	1,365
Industrial[1]	1,845	1,755
Investment	170	425
Total Demand	**6,680**	**6,345**
Movements in Stocks	**(80)**	**(375)**

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[1] *Industrial includes chemical, electrical, glass, petroleum refining and other industrial demand.*

The weight of platinum recovered from spent catalytic converters climbed to 1.01 million ounces in 2008. This growth was driven partly by an increase in average metal loadings of the catalysts being collected and partly by the high metal prices in the first half of the year which encouraged the recycling industry to process stocks it had previously hoarded.

Net platinum demand from the jewellery industry fell by 6.2 per cent to 1.37 million ounces in 2008. In the first six months of the year, record prices weakened consumer purchasing in every market and prompted increased recycling of old jewellery in Asia. However, as the price fell, retailers and manufacturers in China in particular took the opportunity to rebuild their stocks of platinum jewellery. Many retailers also reduced store prices, stimulating higher consumer sales. The softening price caused recycling volumes to diminish rapidly in China and in Japan. Net platinum demand was therefore particularly strong in the final quarter of the year and in early 2009. However, demand remained weak in Europe and North America where low consumer confidence limited sales of all precious jewellery.

Industrial demand for platinum fell from 1.85 million ounces to 1.76 million ounces in 2008 and was especially soft in the final quarter of the year. Demand decreased in the chemical sector as production was cut in response to weak consumer demand in late 2008. As a result, while some new plant capacity was installed during the year, platinum demand steadily

weakened and fell to 395,000 oz. In the glass sector, there was good demand for platinum from the construction of factories producing fibre glass and LCD television glass in Asia. However, net platinum demand was reduced to 390,000 oz by the sale back to the market of metal from a number of Chinese cathode ray tube (CRT) glass factories which closed during the year. Net demand in the electronics sector was driven lower, to 225,000 oz, by a decrease in the hard disk industry's working stocks, despite an increase in the amount of platinum actually coated onto hard disks. Meanwhile, the petroleum refining sector purchased 245,000 oz of platinum, 40,000 oz more than one year earlier. Other applications took 500,000 oz of platinum in 2008.

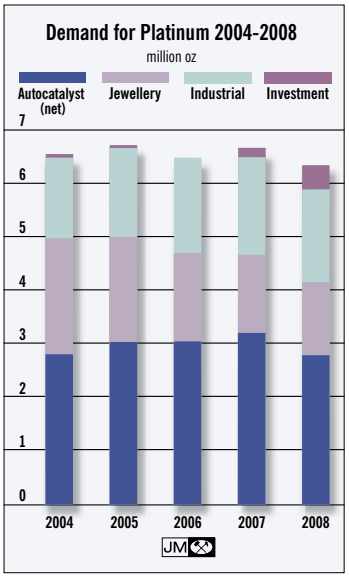
Annual net physical investment demand rose by 150 per cent to 425,000 oz. Buying through the European Exchange Traded Funds (ETFs) was very strong in early 2008. However, as commodity and equity prices plunged in the second half of the year, investors sold much of this metal. The behaviour of individual Japanese investors was quite different. They sold more metal than they bought in the first few months of 2008 but purchased extremely large quantities of platinum bars in the final quarter in response to the fall in the metal price.

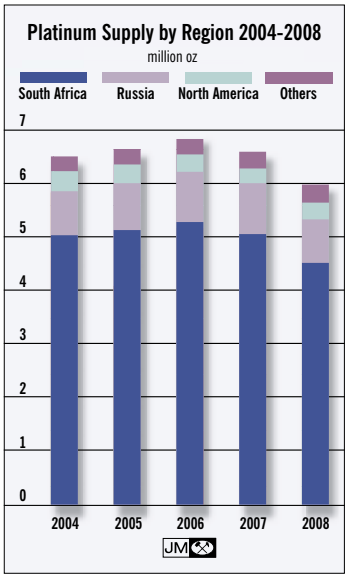
Global platinum supplies dropped from 6.60 million ounces in 2007 to 5.97 million ounces in 2008. Production fell steeply in South Africa and also decreased in Russia. Supplies of platinum from North America were unchanged from 2007. Sales of metal from Zimbabwe and other minor producing nations were almost flat at 295,000 oz as the Zimbabwean producers maintained production levels in a difficult political and economic environment.

South African supplies of platinum were disappointing in 2008, falling 540,000 oz to only 4.53 million ounces. The three largest mining houses – Anglo Platinum, Impala and Lonmin – all recorded lower output than in 2007 with bad weather, safety shutdowns, industrial unrest and skills shortages amongst the numerous causes. An intermittent electricity supply had initially been expected to have a substantial impact across the country but direct losses were limited to roughly 60,000 oz of platinum production. There were, though, improved performances at some of the smaller mines: Modikwa, Northam, Two Rivers and Crocodile River all reported modest increases in production of pgm in concentrate.

Russian platinum supplies also decreased in 2008, primarily due to lower output from Norilsk Nickel where platinum sales fell from 727,000 oz to 632,000 oz. North American platinum supplies were flat at 325,000 oz. There were lower sales from Stillwater and North American Palladium but a rise in platinum production as a by-product from the Canadian nickel mines. Zimbabwean platinum production increased despite a very difficult political and operating environment. Supplies from Zimbabwe and other producing countries rose by 5,000 oz to 295,000 oz.

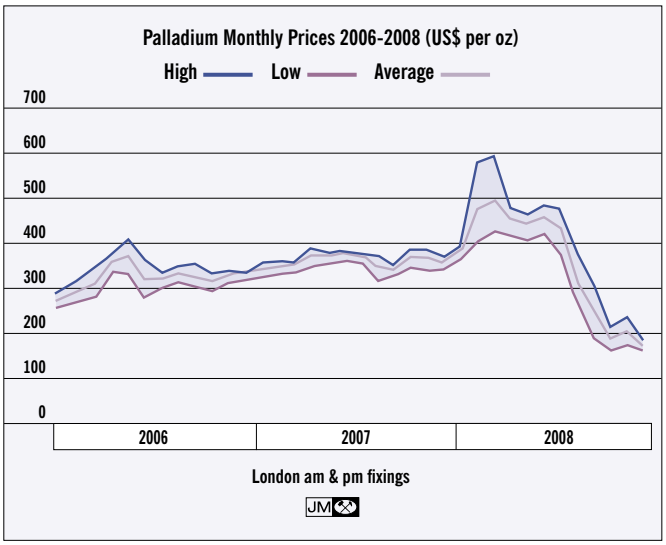
The volatility in the platinum price during 2008 was without precedent. The first fix of the year was at $1,530, just a few dollars below the previous record price of $1,544 recorded in December 2007. Disruption to platinum supplies from South Africa combined with a weak US Dollar to drive platinum to a record $2,276 on the 4th of March. The price remained high until the middle of the year when escalating concerns over the global economic situation prompted many funds to liquidate large positions in commodity and equity investments. While fundamentals did play a part in price movements, fund investment activity was more important. The purchasing of metal over recent years had helped drive the price to record levels but much of this metal – in the form of forward purchases, futures positions and physical metal – was sold in the second half of 2008. With several million ounces of long positions having been liquidated, the platinum price crashed to $756 in October before recovering to end the year at $899.





PALLADIUM

Net global palladium demand increased by 15,000 oz to 6.85 million ounces in 2008, despite the worsening economic climate. Falling vehicle production in North America cut demand there by 350,000 oz but gross global autocatalyst demand fell by only 165,000 oz to 4.38 million ounces due to a strong performance in other regions. Demand from the electronics sector rose to 1.33 million ounces. Dental usage of palladium remained steady at 630,000 oz. Palladium offtake for jewellery manufacturing improved, with lower recycling of old stock in China helping drive net global demand higher to 855,000 oz. Demand in the physical investment market strengthened to 400,000 oz.



The palladium price reached a multi-year high of $588 in March but slumped back to end the year below $200.

Global palladium supplies decreased by 14.8 per cent to 7.31 million ounces during 2008. The problems that depressed platinum production in South Africa also hit palladium output, which fell to 2.43 million ounces. In North America, mine production was cut in late 2008 and supplies dropped to 910,000 oz. Sales of palladium from Russian primary production fell by 350,000 oz to 2.70 million ounces. We estimate that sales of palladium from Russian state stocks decreased too, from 1.49 million ounces in 2007 to 960,000 oz in 2008. As a result of these sales, the palladium market was in oversupply, by 460,000 oz, during 2008.

In the autocatalyst sector, gross palladium demand fell by 3.6 per cent in 2008 to 4.38 million ounces. Although North America remains the largest market in terms of palladium consumption, purchases of metal in this region decreased by 350,000 oz – more than twenty per cent – to 1.35 million ounces in 2008. Light duty vehicle production fell throughout the year as the economy weakened. A lack of consumer confidence and high oil prices hit sales of larger vehicles especially, further depressing palladium demand.

Palladium Supply and Demand
'000 oz

	2007	2008
Supply		
South Africa	2,765	2,430
Russia		
Primary Production	3,050	2,700
State Sales	1,490	960
North America	990	910
Others	285	310
Total Supply	**8,580**	**7,310**
Demand		
Autocatalyst: gross	4,545	4,380
recovery	(1,015)	(1,170)
Jewellery	715	855
Electronics	1,240	1,325
Other[1]	1,350	1,460
Total Demand	**6,835**	**6,850**
Movements in Stocks	**1,745**	**460**

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[1] *Other includes physical investment, dental, chemical and other industrial demand.*

In Europe, light duty vehicle production fell and the amount of palladium used on gasoline vehicles decreased as a direct result. However, increasing use of platinum/palladium catalysts in the diesel sector in place of platinum-only formulations drove total palladium demand 30,000 oz higher in this region to 950,000 oz. Gross autocatalyst demand for palladium climbed in China, Japan and the Rest of the World region too.

The weight of palladium recovered from spent autocatalysts increased to 1.17 million ounces in 2008. The percentage of end-of-life vehicles from which the catalyst is recovered is rising in every region. Average palladium loadings of these spent autocatalysts are also increasing, leading to long-term growth in recovery of palladium from this source. In 2008, recycling volumes were particularly strong as high metal prices encouraged the processing of catalysts which had previously been hoarded. Recovery rates, however, decreased at the end of the year as prices fell, and remained depressed in early 2009.

Net demand for palladium for use in jewellery manufacturing climbed by 19.6 per cent to 855,000 oz in 2008. Net Chinese demand for palladium increased strongly to 650,000 oz. Lower amounts of old Pd950 stock (95 per cent purity alloy) were recycled than had been the case in 2007 and little of this stock now remains. Additionally, a number of manufacturers switched some of their jewellery production into palladium in the first half of 2008 in response to high platinum and gold prices. This switching was reversed later in the year as the platinum price fell, lending some uncertainty to the prospects for jewellery industry demand for palladium in China in 2009. In Europe and North America, palladium

continued its steady development into a mainstream jewellery metal and demand rose in both regions.

Industrial demand for palladium climbed by 55,000 oz to 2.39 million ounces. The chemical industry bought a net 350,000 oz of palladium in 2008, a decrease of 25,000 oz from 2007 and less than we had previously forecast. Fewer new chemical plants were constructed in 2008 than in 2007 and demand was trimmed further at the end of the year as low operating rates in this industry translated into reduced requirements for top-up catalyst.

Dental sector demand for palladium was unchanged at 630,000 oz. Net palladium use in Japan was flat at 275,000 oz as lower gross manufacturing demand was balanced by a fall in recycling of scrap dental alloy. In North America, demand rose by 5,000 oz to 270,000 oz.

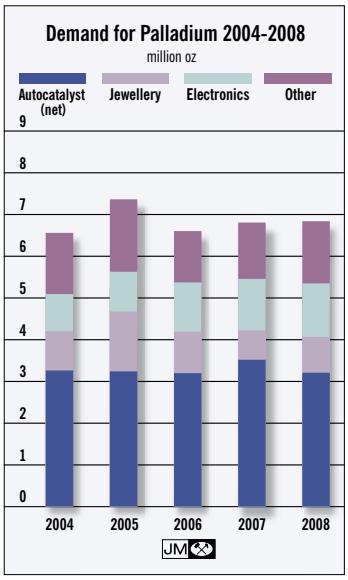
The electronics industry purchased a net 1.33 million ounces of palladium in 2008, representing the seventh successive year of demand growth in this sector. The increasing complexity of consumer electronics has driven a long-term increase in the number of passive components – such as palladium-containing multi-layer ceramic capacitors – per device. Consumer sales were strong for much of 2008 before weakening in the final months. Palladium demand therefore grew in 2008 but is expected to shrink in 2009.

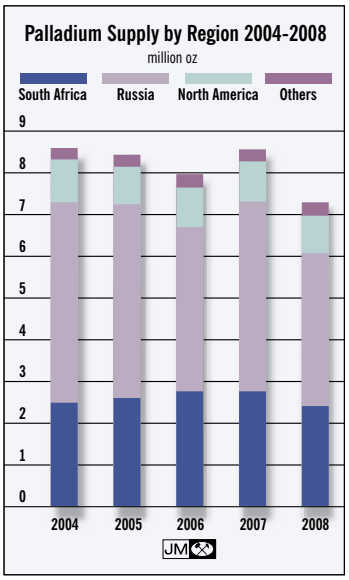
Physical investment demand for palladium increased by 140,000 oz in 2008 to 400,000 oz with European investors buying 370,000 oz of palladium through Exchange Traded Funds (ETFs). Compared to the platinum market, buying and selling of metal were not so closely related to movements in the metal price, suggesting that investors in this metal may be acquiring it for longer-term returns. While platinum ETF demand fell, palladium demand through ETFs climbed by 90,000 oz. Net purchases of coins and large bars rose to 30,000 oz.

Global supplies of palladium fell by 14.8 per cent in 2008 to 7.31 million ounces. Supplies from South Africa decreased by 12.1 per cent to 2.43 million ounces, reflecting the range of problems experienced there. Russian mine production slipped from 3.05 million ounces in 2007 to 2.70 million ounces in 2008 despite stable nickel output. North American supplies of palladium fell by 80,000 oz to 910,000 oz as Stillwater refocused production on its larger mine and North American Palladium placed its Lac des Iles mine on care and maintenance in the final quarter of the year. Supplies of palladium from Zimbabwe and elsewhere grew from 285,000 oz to 310,000 oz.

We believe that sales of Russian state stocks (metal which had not previously been priced) decreased from 1.49 million ounces in 2007 to 960,000 oz in 2008. There were substantial shipments of metal from Russia to Switzerland in December 2007 and in the second half of 2008. However, we do not believe that all of this metal was sold into the market: our current expectation is that the remainder of this metal will instead be sold in the next few years.

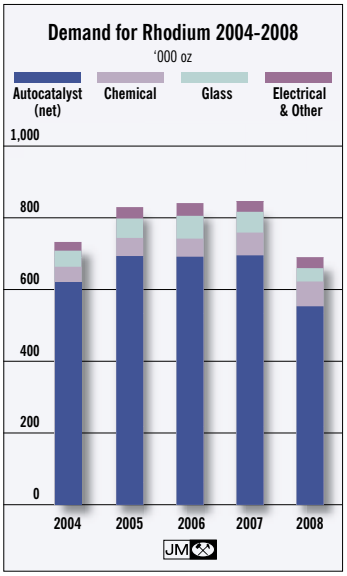
The palladium price largely tracked movements in the platinum price for much of 2008. It started the year at $370 and followed platinum higher in the first quarter of the year. It reached a peak of $588, its highest price since 2001, on the 4th of March before the price retreated to $450 by the middle of the year. In the second half of 2008, industrial purchasing weakened, removing some support from the palladium price. Investors reacted to the panic in the financial markets by selling very large quantities of palladium. The US Dollar strengthened too, reinforcing the downward move in the palladium price. As worries over the credit ratings of some of the auto makers intensified, the price was driven to a low of $164 in early December. In the final weeks of 2008, US government proposals to provide some support to the car manufacturers helped the price to recover some lost ground to end the year at $183.50.





OTHER PGM

Rhodium



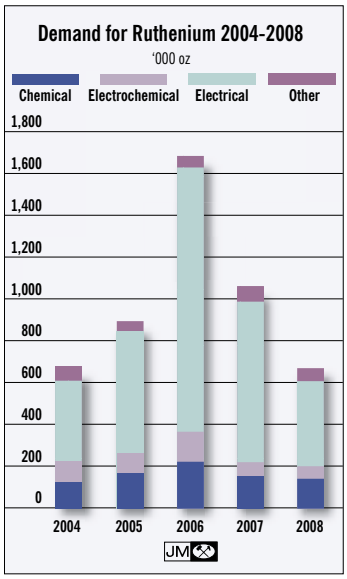
Net rhodium demand fell by 18.4 per cent to 689,000 oz in 2008. A slowdown in demand from the global automotive market was the main cause of this fall as gross demand in the sector decreased by 14.3 per cent to 760,000 oz. Demand from the glass sector also declined despite continued growth in production capacity for LCD glass. Supplies of rhodium, from South Africa and elsewhere, fell to 695,000 oz. Rhodium was therefore, after four successive years of deficits, in a small surplus of 6,000 oz.

Gross automotive industry purchases of rhodium fell by 127,000 oz to 760,000 oz in 2008. The high price of rhodium in recent years has driven extensive development activity by the car manufacturers and catalyst producers on reducing consumption of this metal. The results of this work were apparent in 2008 as auto makers were able to fit new, thrifted, lower-rhodium three-way catalyst formulations on many of their vehicles. The average rhodium content of a gasoline vehicle therefore fell in most regions. In Japan, for instance, where production was almost flat, gross rhodium demand fell by 14,000 oz to 222,000 oz.

However, the poor state of the automotive market also played its part in driving rhodium demand lower. Plunging vehicle production in North America depressed gross demand there by a third to 194,000 oz. In Europe, a less steep fall in output meant that demand fell by only 14.6 per cent to 124,000 oz. Only in China, where vehicle production grew and new emissions legislation came into force in 2008, did rhodium demand increase.

The weight of rhodium recovered from spent catalytic converters climbed by 13,000 oz to 205,000 oz last year. High metal prices in the first half of the year – particularly that of rhodium – encouraged the processing of a backlog of catalysts that had previously built up at collectors. The average rhodium content of a spent catalyst continued to rise, further boosting the weight of rhodium recovered.

In the glass industry, rhodium demand decreased by over a third to 38,000 oz. Significant amounts of new production capacity for LCD glass were installed in Asia during 2008 to meet rising demand for flat screen televisions. However, the high rhodium price drove many glass producers to thrift rhodium from the alloys they use in their processes – so-called dealloying. Although this decreases the lifetime of a typical coated component, the extra cost of more frequent replacement of these components was outweighed by the lower metal cost.



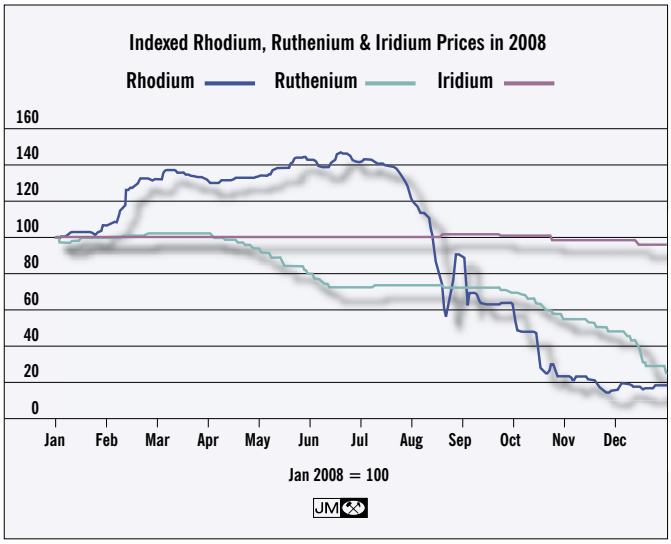
Glass sector rhodium demand was further hurt by the return of some rhodium to the market in China. Most manufacturing of cathode ray tube (CRT) television glass is now carried out in China and, as demand for these sets has fallen, a number of factories have closed, releasing several thousand ounces of rhodium which we believe has been sold.

Demand from the chemical sector climbed to 68,000 oz as new production capacity for acetic acid was installed in China to meet growing domestic demand.

Supplies of rhodium fell in 2008, to 695,000 oz, from 824,000 oz a year earlier. Numerous production problems in South Africa drove supplies of refined metal sharply lower to 574,000 oz. Russian supplies of rhodium fell by 5,000 oz to 85,000 oz. Combined supplies of rhodium from other producing nations fell to 36,000 oz.

The rhodium price was exceptionally volatile during 2008, even by its own standards. It started the year at $6,850, strong buying could not be met by weak supplies from South Africa and the price rose rapidly to peak at an all-time record of $10,100 in June. However, as automotive output around the world worsened in the second half of the year, physical demand for rhodium dwindled. With rumours of metal sales by speculators and car companies emerging, the fall in the rhodium price was even more spectacular than its earlier rise and it ended the year at $1,250.

Ruthenium



The rhodium price was exceptionally volatile during 2008. The ruthenium price lost considerable ground as purchasing from the electrical sector weakened. Iridium, however, moved little.

Net demand for ruthenium fell by 36.8 per cent to 669,000 oz in 2008. This sharp decrease was mainly due to lower net purchases of ruthenium by the electronics industry. Although much of the mining industry does not publish figures for production of the minor platinum group metals, we believe that ruthenium production fell last year. However, production of ruthenium still exceeded demand during 2008.

In the electrical sector, ruthenium remains an important material for the production of hard disks, thick film chip resistors and, to a lesser extent, plasma display panels (PDP). Net demand fell in each of these applications, driving overall electronics industry demand down from the 776,000 oz purchased in 2007 to only 414,000 oz in 2008.

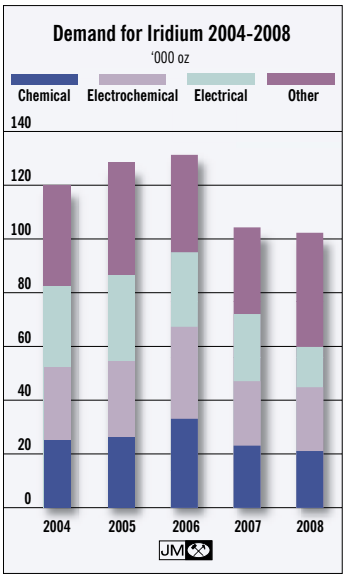
Perpendicular magnetic recording technology (PMR) – which uses ruthenium to increase the data that can be stored on a hard disk – captured further market share during 2008. By the end of the year almost one hundred per cent of all hard disks manufactured used this technology. The weight of metal actually coated onto disks therefore rose. However, refining pipelines continued to shorten last year, allowing sputtering target manufacturers and producers of hard disks to meet an increasing proportion of their metal requirements from recycling material they already owned. As a direct result, net ruthenium demand softened considerably.

In the chip resistor market, a rise in the number of resistors manufactured was offset by a trend towards miniaturisation of these components. This meant that the average ruthenium content of a chip resistor fell and demand decreased accordingly. Ruthenium pastes are also used in the production of plasma display panels for flat screen televisions. However, the industry has moved to cut costs by reducing the ruthenium content of a typical paste: ruthenium demand has therefore shrunk even as the plasma display panel market has grown.

Electrochemical sector demand for ruthenium remained strong as the chlor-alkali industry continued replacing its mercury-based technology with diaphragm or membrane cells. Demand from the chemical industry fell to 139,000 oz as less ruthenium was required for the installation of new capacity than in 2007.

While ruthenium production declined, the decrease in demand for ruthenium and the rise in metal recovered by the hard disk industry meant that it was in plentiful supply during most of 2008. As a result, the price continued its fall from its February 2007 highs. It started the year at a Johnson Matthey Base Price of $415 and fell rapidly, particularly in the second half of 2008 as already quiet buying weakened further, ending the year at a very soft $100.

Iridium



Demand for iridium fell by 2,000 oz in 2008 to 102,000 oz. Weak demand for iridium crucibles for crystal growing outweighed healthy requirements from most other sectors. Electrochemical sector demand was strong as new membrane cells were installed for the chlor-alkali process. Demand for iridium in spark plugs and aero engine ignitors was flat. As with ruthenium, little information exists on iridium production but we believe that supplies of iridium were readily able to meet this level of demand. The iridium price moved little: it started the year at a Johnson Matthey Base Price of $450 and softened marginally as industrial purchasing slowed, ending the year at $435.

OUTLOOK

The greatest uncertainty in the platinum group metal industry in 2009 is the weak state of the global economy. While this is expected to affect demand in many of platinum's applications, its impact is likely to be complex.

In some sectors, however, the outlook for demand is fairly clear. For example, purchases of all three major platinum group metals (pgm) by the automotive industry are expected to fall heavily this year as global vehicle production continues to struggle. Most other industrial sectors are also expected to take less metal as demand for their products remains comparatively weak and little new plant capacity is added.

It is important, though, to remember that platinum group metal prices were extremely high for the first half of 2008. In the more price-sensitive applications, therefore, annual demand could strengthen despite the economic downturn. For example, increases in net metal purchases were seen in the investment and jewellery markets towards the end of 2008. Should the current price environment persist, it would support platinum and palladium demand again in 2009.

On the supply side, 2008 had initially been expected to show a rise in platinum group metal supply from 2007. However, these expectations were not met, as supplies from most producing countries fell. South African production was hit by bad weather, geological problems, safety shutdowns, smelter closures and shortages of skilled staff as well as the electricity supply interruptions of early 2008. While we expect to see higher global platinum group metal production in 2009 than in 2008, none of these challenges is likely to disappear and any growth in output will consequently remain quite limited.

With base and precious metal prices having fallen sharply during the second half of 2008, the mining industry has started to cut its output. However, with a mothballed mine costing a substantial amount of money to reopen, relatively few companies have cut any significant capacity so far within the platinum industry. The new lower palladium price has, though, already had an impact on North American production. The main response seen to date in South Africa has been a reduction in capital expenditure. Although this will have little short-term impact on South African platinum group metal production, it will constrain any growth in output over the longer term.

PLATINUM

The global economic slowdown had a negative effect on net demand in many applications during 2008. These effects were felt primarily in the second half of the year in most regions. Consequently, the impact of the continued economic problems on many platinum demand sectors will be greater in 2009 than in 2008. However, there are some bright spots in the market in terms of demand.

In the automotive sector, the outlook for vehicle production remains very weak and gross platinum demand will fall in 2009. A number of manufacturing plants were temporarily closed during the first quarter of the year and output is therefore expected to be well below previous year levels in Europe, North America and Japan. However, recent activity from a number of national governments in the form of lower vehicle taxes (in Brazil and China for instance) or incentives to scrap older vehicles in favour of newer, more environmentally-friendly cars (in much of Europe) may support vehicle demand to some extent.

The fate of the European automotive sector is of particular relevance in terms of platinum demand. Very large amounts of platinum are used in diesel exhaust aftertreatment within Europe and lower vehicle production will depress platinum demand in this region. However, the introduction of Euro 5 light duty vehicle emissions rules will drive the use of diesel particulate filters higher, raising the average platinum content of a European light duty diesel vehicle.

The impact of the frail global economy on industrial platinum demand was relatively limited in 2008. In many of the sectors where platinum is used – including the glass industry and much of the chemical industry – demand is driven by the construction of new manufacturing facilities. A slowdown in requirements for flat panel glass and many commodity chemicals came fairly late in the year. Although output of many of these industrial products was cut back in the final quarter, platinum demand was little affected in 2008. However, the weak economy and a lack of availability of project finance for new construction is likely to cut metal demand in 2009 and in the following few years.

By contrast, we expect net demand for platinum from the jewellery industry to rise strongly in 2009. Although there were very high levels of recycling of

second-hand jewellery in China and in Japan in the first half of 2008, the decrease in the metal price since then has driven recycling volumes sharply lower. At the same time, industry participants have increased their previously low stocks of metal and of finished jewellery. Consumer purchasing strengthened in the final quarter of 2008 and remained strong in the first quarter of 2009 in China as the affordability of platinum jewellery improved.

This has been reflected in extraordinarily strong purchasing of platinum through the Shanghai Gold Exchange so far in 2009. While we do not expect net jewellery industry purchases of platinum to continue at this rate for the entire year, increased Chinese platinum demand will easily outweigh the weakness in the North American and European jewellery markets.

Investment demand remains subject to movements in the platinum price and is consequently hard to forecast accurately. However, it is clear that the fall in the platinum price in the second half of 2008 reinvigorated the purchasing of platinum by individual Japanese investors. Purchasing rates in this sector – while still substantial – have since slowed and annual demand might not reach the exceptionally strong figure seen in 2008.

After heavy sales of metal from the European Exchange Traded Funds (ETFs) in the second half of 2008, buying returned in early 2009. If the platinum price continues to rise, we expect that net demand through the ETFs will be higher than in 2008. Moreover, there have also been recent proposals to launch platinum and palladium ETFs in the USA. Although it is by no means certain that regulatory permission will be granted, if this does happen, it is likely to significantly boost physical investment demand.

We currently expect global platinum supplies in 2009 to be marginally higher than in 2008. There will be some limited growth in South African platinum supplies. However, sales of platinum from North America and Russia are forecast to fall. Although the rapid transition from an environment of record platinum prices in mid-2008 to the current one of significantly lower prices has driven many producers to trim their capital expenditure budgets, little production has been cut. This will have only a minor impact on supplies during this calendar year but it will constrain growth in platinum production in the longer term.

Changes in the economic environment and in metal prices during 2008 caused significant disruption to all segments of the platinum group metal markets.

Overall, we expect that supply and demand will be more closely matched in 2009 than during 2008. Automotive demand is expected to remain weak but purchases of physical metal by investors and by the Chinese jewellery industry have been strong so far in 2009. Considerable uncertainty remains as to the precise trajectory of the global economy during the rest of the year and it is unclear how demand will fare. With mining production also hard to forecast, there is no clear prognosis for the balance of the platinum market in 2009.

At the start of last year, strong commodity prices and supply disruption in South Africa pushed the platinum price above $2,000, before falling industrial output and a strong US Dollar – a beneficiary of the economic crisis – combined with investor sales of commodities to send the platinum price below $1,000 only a few months later. Forecasting precious metal prices in an environment of such unprecedented volatility and turbulence is extremely challenging.

However, although we do not see a strong recovery in automotive and industrial purchasing of platinum within the next six months, any concrete signs of improvement in the economy should attract increasing fund investor interest and platinum could strengthen and trade as high as $1,350 during the next six months. The price should derive good support from strong physical buying in Asia and from platinum's good longer-term fundamentals and we therefore believe that platinum should trade above a floor of $950 during the same six month period.

PALLADIUM

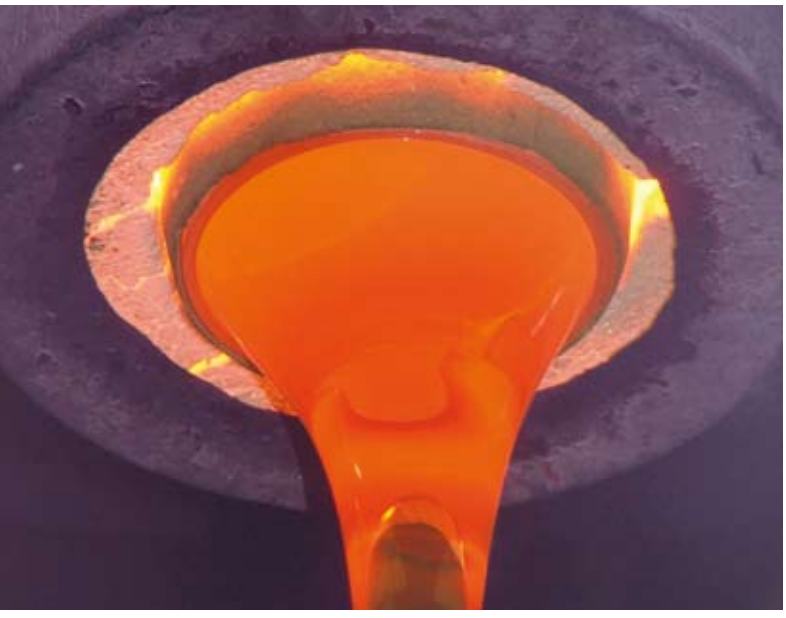
Palladium demand grew by 15,000 oz during 2008 to 6.85 million ounces. However, demand is now being negatively affected by the weakness in the global economy and is expected to fall in 2009.

Purchases of palladium for use in catalytic converters are likely to decline by several hundred thousand ounces due to falling global vehicle production. In North America, there is a possibility that the economy will start recovering during 2009. However, consumer credit remains hard to obtain and any significant recovery in vehicle output is likely to be slow to emerge.

European automotive demand for palladium will find some support from the introduction of new emissions legislation. Palladium will also make further inroads into the diesel sector, where it will be used in an increasing number of catalysts alongside platinum. This will not, however, prevent palladium demand in this region from falling. Palladium autocatalyst demand in Japan and in the Rest of the World region is also likely to decline. Only in China will palladium purchases by the automotive sector rise.

Recovery of palladium from spent autocatalysts was exceptionally strong in early 2008 as high metal prices drove recyclers and refiners to process their stockpiles of these catalysts. However, when prices fell, recycling volumes slumped. Recycling rates remained low in the first quarter of 2009 and we anticipate that they will be lower in 2009 as a whole than in 2008.

Platinum, rhodium and iridium are all used to prolong the life of equipment used in the glass manufacturing industry.



In the electronics sector, consumer demand weakened in late 2008 and remains soft. While the historical trend of increasing complexity of electronic devices seems set to continue, production volumes are likely to remain depressed for much of 2009. Demand from palladium's use in multi-layer ceramic capacitors is likely to fall. However, palladium competes with gold in some other applications such as plating and connectors where the large difference in price between these two metals may drive a slow increase in demand. Palladium use in the dental sector should also benefit from a high gold price, driving the use of lower-gold content, palladium-rich alloys in the USA.

The prospects for the palladium jewellery sector are less clear. In Europe and North America we expect steady growth in demand in 2009. In China, the improved performance of 2008 was partly due to strong manufacturing output in the first half of the year and partly due to decreased rates of recycling of old Pd950 (95 per cent pure palladium alloy) jewellery stock. The fall in the price of palladium in the second half of 2008 prompted strong buying of palladium by the industry too and we believe that stocks of metal rose strongly.

The original Pd950 stock is now effectively exhausted and with relatively low rates of exchange of second-hand jewellery from the public, net demand will mainly reflect Chinese manufacturing volumes and changes in the level of industry stocks of unrefined metal.

However, manufacturing volumes fell in late 2008 in China as some manufacturers switched production from palladium jewellery to platinum as the platinum price fell. Production of platinum jewellery continued to be strong in the first quarter of 2009, limiting the capacity available for the manufacturing of palladium jewellery. If the price of platinum remains close to current levels, this situation is expected to persist and palladium demand would be unlikely to rise significantly above 2008 levels. However, any substantial increase in the platinum price could well translate into additional palladium demand from this sector.

Physical investment demand for palladium is forecast to remain strong in 2009. Investors bought large amounts of metal through the Exchange Traded Funds (ETFs) during 2008 and their behaviour suggests that many are holding this metal in pursuit of longer-term profits. If this is the case, they may view the

current price of palladium as a buying opportunity and drive demand higher. Should a North American ETF be approved during 2009, we would expect still stronger physical investment purchasing in response.

Primary palladium production is set to fall in 2009. The closure of North American Palladium's Lac des Iles mine will depress output from North America. South African palladium supplies should rise but we expect Russian mine production to fall.

We estimate that roughly 960,000 oz of palladium were sold from Russian state stocks in 2008, leading to a surplus of 460,000 oz, rather than the deficit which would otherwise have occurred. Trade statistics suggest that much larger amounts of metal were exported from these stocks. However, we believe that some of this metal was shipped in readiness for future sales and that it will reach the market in the next one to three years. If none of this pre-shipped metal is sold during 2009, the palladium market is likely to be in deficit. However, we forecast that stock sales may again be sufficient to keep the market in surplus for another year.

Movements in the price of palladium during 2008 bore little relationship to its market fundamentals. Instead, the price was largely driven by investors and followed trends in the prices of platinum, gold and other commodities and this behaviour can be expected again during 2009. The ratio of the palladium price to the platinum price stands at a multi-year low, which might suggest to investors that palladium is underpriced. A rise in investment in commodities could thus benefit palladium and allow it to trade as high as $280 within the next six months. However, without this investor interest, palladium's weaker current fundamentals could see it further underperform platinum and trade as low as $180 during the same period.

OTHER PGM

The outlook for rhodium demand in 2009 is poor. Demand for this metal is highly dependent on vehicle output which is currently very weak. Also, car makers are reducing average rhodium loadings in catalysts – the result of thrifting programmes carried out at higher metal prices. Although vehicle production is expected to rise from the very low levels of early 2009, gross rhodium autocatalyst demand is expected to fall sharply this year.

The effects of the high rhodium price were also seen in the glass sector last year. Rhodium/platinum alloys are used to prolong the working life of components which are in contact with molten glass. At the highest rhodium prices, the cost savings made by dealloying – the glass industry's form of thrifting – drove the greater use of lower-rhodium alloys and demand for rhodium fell substantially.

However, the glass industry is able to vary its use of platinum group metals quite rapidly. The dramatic fall in the rhodium price from its mid-2008 peak has already prompted many glass makers to revert to using the more efficient, higher-rhodium content alloys and rhodium demand from this sector is thus unlikely to fall during 2009.

The volatility of the rhodium price was also felt in the recycling industry. High metal prices drove the processing of large numbers of spent catalysts in early 2008. Since the rhodium price has fallen, recycling rates have decreased and the weight of rhodium recovered from this source will fall this year.

With South African output of rhodium set to grow, the rhodium market should move into a more substantial fundamental surplus during 2009.

The fate of the **ruthenium** market is closely tied to that of the electronics sector. With consumer and business purchasing of electronic goods currently weak, gross ruthenium demand is expected to soften. Additionally, the sector is likely to be able to meet most of its ruthenium requirements for the production of hard disks by using metal recycled from its own manufacturing processes. At current price levels, it remains attractive to recycle much of the scrap produced in the manufacture of hard disks. However, at prices significantly below this, recycling becomes less attractive than purchasing new metal. If the price falls further, therefore, net demand could rise strongly, providing some support for the metal price.

The outlook for **iridium** demand in 2009 is weak. Demand for iridium crucibles for the growth of high quality crystals started to decrease in 2008 and will decline further this year. Use of this metal in spark plugs and aero engine ignitors is also likely to soften. However, newer technology used in the chlor-alkali process will continue to replace older mercury-based cells, leading to steady iridium demand from the electrochemical industry.

SUPPLIES, MINING & EXPLORATION

Global platinum supplies fell in 2008, for the second successive year, to 5.97 million ounces, a level last seen in 2002. Supplies of platinum from South Africa decreased by 10.7 per cent to 4.53 million ounces. Russian platinum supplies also fell by over 10 per cent to 820,000 oz. Total palladium supplies fell by 14.8 per cent to 7.31 million ounces, their lowest for five years, due to lower mine production in South Africa, Russia and North America and reduced sales of Russian state stocks compared to the previous year.

A very wide range of problems afflicted the mining industry during 2008. At the start of the year, interruptions to electricity supplies in South Africa caused great uncertainty in the market. In fact, only a limited amount of platinum production – around 60,000 oz – was lost directly due to the power situation but bad weather conditions in the first quarter, industrial unrest, skills shortages and numerous safety shutdowns further depressed production. Smelter problems at some of the major South African mining houses also had a significant impact on output.

Later in the year, the mining industry was forced to react to sharp falls in metal prices. In North America, some pgm and nickel mines were placed under care and maintenance and other operations have been reorganised with the aim of ensuring their economic sustainability, with an associated cut in production capacity. In South Africa, planned capital expenditure has been cut heavily at most mines. In contrast to North America, however, relatively little current production capacity has been closed with only a limited number of shafts, pits or smaller operations affected so far.

SOUTH AFRICA

Supplies of platinum from South Africa fell by 10.7 per cent to 4.53 million ounces in 2008. A range of issues confronted the South African platinum mining industry, from electricity problems and safety shutdowns to bad weather and industrial unrest. Annual palladium supplies also decreased for the same reasons – by 12.1 per cent – to 2.43 million ounces.

PGM Supplies: South Africa
'000 oz

	2007	2008
Platinum	5,070	4,530
Palladium	2,765	2,430
Rhodium	696	574

JM

Anglo Platinum

Production of platinum from Anglo Platinum's refineries fell by 4 per cent to 2.39 million ounces in 2008. However, output would have been almost unchanged from the previous year had it not been for shutdowns at the group's smelters, with run-outs at Polokwane in February and November, and at the Waterval slag-cleaning furnace in May and June. These incidents resulted in the build-up of a backlog of 78,000 oz of unprocessed platinum at the year-end: this metal should add to refined output in 2009.

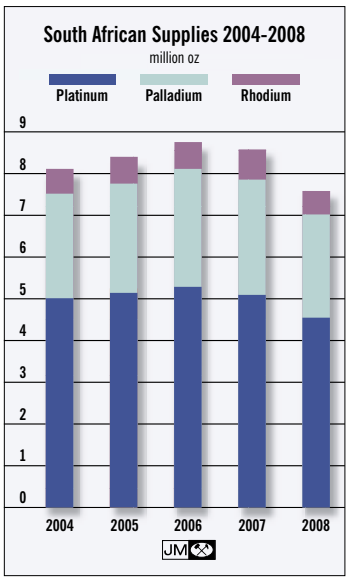
Sales, meanwhile, totalled 2.22 million ounces, substantially lower than refined output, with the company adding just under 170,000 oz of refined platinum to stocks.

During 2008, all Anglo Platinum's operations were affected by issues that reduced production across the South African platinum industry: electricity cuts, safety stoppages, industrial relations difficulties and skills shortages. The group's two largest operations, Rustenburg and Amandelbult, both endured a very difficult year. The former lost around 36,000 oz of production during the closure of the Turffontein shaft for refurbishment, while flooding cut platinum output at Amandelbult by 67,000 oz. Smaller production losses were recorded at BRPM, Lebowa and Mototolo (a joint venture with Xstrata), principally due to skills shortages and safety stoppages.

These losses were offset by increased pgm production from a number of the group's smaller mines. At Modikwa (a 50:50 joint venture with African Rainbow Minerals) higher mill throughput and an improvement in grade lifted platinum output by 15 per cent. There was also a modest increase in production at Mogalakwena (formerly PPRust), following the commissioning of the Mogalakwena North expansion in the first half of 2008; however, higher mill throughput was largely offset by a sharp fall in grade due to the processing of low pgm-content ore.

Although there was little change in total pgm output from the Kroondal and Marikana mines (which are operated by Aquarius under Pool & Share agreements), Anglo Platinum processed a larger share of the pgm produced at these operations. Since the second quarter of 2008, all concentrate from Kroondal has been refined by Anglo Platinum,

Supplies of platinum from each of the three largest mining houses in South Africa fell in 2008.



A range of problems affected the entire South African platinum mining industry during 2008, driving pgm production sharply lower than in 2007.

and the company also received more pgm from Marikana in 2008. At the Kroondal mine itself, mill throughput was up marginally on the previous year despite the winding down of open pit operations. The mine produced around 235,000 oz of platinum in concentrate in 2008. At Marikana, although the quantity of ore processed rose, this was offset by lower grades, leaving output of platinum in concentrate stable at 83,000 oz.

Anglo Platinum's refined output was further boosted by the purchase of concentrate from Xstrata's Elandsfontein Platinum mine, which in its first full calendar year of operation produced close to 100,000 oz of platinum.

In February 2009, Anglo Platinum outlined changes to its business plan, reflecting lower pgm prices and depressed demand from the automotive industry in particular. Its capital expenditure programme has been cut back, and a number of expansion and replacement projects have been delayed: for example, shaft sinking at the Styldrift project has been delayed for 18 months, while the Twickenham expansion has been slowed down by 6 months. The company has reduced its production target for calendar year 2009 to 2.4 million ounces of platinum.

Impala Platinum

Impala Platinum's lease area produced 984,000 oz of platinum in 2008, a decline of 9 per cent compared with the previous year. This reflected a 5 per cent reduction in mill throughput, combined with lower grades due to lower output of Merensky ore, and an increase in dilution. Electricity cuts reduced platinum production by some 8,000 oz, while safety stoppages resulted in the loss of a further 22,000 oz. In addition, high staff turnover and shortages of critical skills had a negative impact on productivity and mining efficiencies.

In February 2009 Impala announced that it had conducted a review of its project pipeline, capital expenditure and operating costs. The previously announced capital expenditure programme is to be cut by around R10 billion to R20 billion, via the deferral of long lead-time projects; however, expenditure on a series of deep-level replacement shafts at Impala as well as the expansion at Zimplats (see section on Zimbabwe on page 22) has been maintained.

At Marula, the ramp-up in production has fallen behind schedule in the wake of skills shortages, safety stoppages and unofficial strikes. Mill throughput was flat at just under 1.5 million tonnes in 2008, but improved grades (a result of the shift from mechanical mining methods towards the use of conventional mining processes) contributed to a 5 per cent rise in production of platinum in concentrate, to 71,000 oz. Impala now expects full conventional mining production (around 130,000 oz of platinum annually) to be achieved by 2011.

A feasibility study of the Marula Merensky expansion was completed in 2008. Impala had intended to begin development of the project this year: on this schedule, it would have come on-stream in 2014 and reached full production of 115,000 oz of platinum per annum by 2016. However, following sharp falls in pgm prices, the company announced in February 2009 that the

Platinum production at the Impala Lease Area decreased by 9 per cent in 2008 as mill throughput fell and grades declined.

project had been deferred indefinitely, as part of Impala's decision to reduce total capital expenditure by a third over the next five years.

Another victim of the capital expenditure cuts was the Leeuwkop project, purchased from Afplats in 2007 and previously expected to begin production in around 2015. Some preparatory work at the shaft site was undertaken in 2008, but the project has since been halted until further notice.

In October 2008, it was announced that Impala had expressed an interest in acquiring the entire issued capital of Northam, owner of the Booysendal project. However, volatility in commodity and share prices made it impossible for the two parties to reach agreement, and discussions were terminated in January 2009.

Lonmin

Lonmin endured another very difficult year, with production of platinum in concentrate falling 14 per cent to 716,000 oz, and platinum sales down 11 per cent to 708,000 oz. All three of the company's operations recorded declines in mill throughput, while overall grades were also sharply lower.

A number of closures of smelters operated by Lonmin disrupted the flow of metal to the markets throughout the year and had some impact on overall production, particularly during the planned rebuild of the Number One furnace in the final quarter of 2008. However, furnace availability did improve compared to the previous year and lower production meant that there was little build-up in pipeline stocks.

At Marikana, the build-up of production from the new mechanised shafts remained behind schedule, with the result that only 11.1 million tonnes of ore were fed to the plants – a 12 per cent fall compared with 2007, and over 20 per cent lower than the peak levels recorded five years previously.

In the second half of 2008, Lonmin announced a change in its strategy towards mechanisation. With productivity at its fully-mechanised shafts poor, leading to excessively high costs, Lonmin has decided to convert the Saffy shaft at Marikana to hybrid mining (a mixture of conventional labour-intensive stoping methods and mechanised development), while the K4 shaft, due into production in 2010, will also be developed as a hybrid operation.

High costs and lower pgm prices also resulted in a decision to close the open pits that have delivered a significant proportion of the ore processed at Marikana in recent years (6 per cent of total tonnage in 2008, down from 13 per cent the previous year). Open pit operations were suspended at the end of December 2008. However, Lonmin expects improved output from its underground operations to compensate for the loss of open pit production: sales of pgm this year from production at Marikana are expected to be similar to those in 2008.

At the Pandora joint venture, Lonmin continues to mine ore from open pits as well as an underground section accessed via the neighbouring Marikana shaft infrastructure. This ore (833,000 tonnes in 2008, down 2 per cent on 2007) is purchased from the joint venture and processed through the Marikana concentrators. Last year, a pre-feasibility study of the full-scale development of the Pandora mine was completed: this was based on a 2.9 million tonne per annum operation which would yield around 170-180,000 oz of platinum annually (compared with production of just under 50,000 oz in 2008). The likely timing of this expansion is not yet known.

The small Limpopo mine on the Eastern Bushveld produced just 20,000 oz of platinum in 2008, down a third on the previous year. Output was interrupted by a six-week shutdown of the concentrator and by the existence of an iron-rich geological intrusion. Lonmin has stated that at current prices the operation

Lonmin is to move towards hybrid operation of its fully-mechanised shafts at its Marikana operations.

Platinum output fell marginally at Mototolo – a joint venture between Anglo Platinum and Xstrata – during 2008.

is uneconomic, and it was confirmed in February 2009 that the mine is to be placed on care and maintenance.

Northam

At the Northam mine, production from the UG2 reef increased significantly in 2008: the plant treated 1.06 million tonnes of UG2 ore, up 24 per cent on the previous year. Previously, UG2 throughput was restricted by the need to limit chrome levels in the smelter; however, the addition of a second sparger column cell at the UG2 concentrator has improved the removal of chrome at the concentrator stage. In addition, Northam is sending some high-chrome material for smelting by Braemore Resources (this metal is subsequently returned to Northam for further refining and marketing).

Despite a decline in Merensky tonnages, total mill throughput was up 6 per cent, and production of pgm in concentrate rose to 309,000 oz. Going forward, the company expects production from the Merensky reef to increase, which should boost total pgm output.

As part of the ongoing upgrade to its metallurgical facilities, Northam's smelter was closed for refurbishment during November and December 2008: during this period, some concentrate was sent for toll-treatment, in order to avoid a build-up in inventories of unprocessed pgm. Starting in 2009, Northam will begin to smelt concentrates purchased from Platmin's Pilanesberg mine: the additional Merensky concentrate from this source should improve smelter performance and give the company flexibility to treat greater quantities of UG2 concentrate.

In a complex transaction, Northam aquired the Booysendal property, adjacent to Aquarius's Everest mine on the Eastern Bushveld, in mid-2008. A bankable feasibility study of the Booysendal project is scheduled for completion in the second half of 2009. Initially, it is expected that the mine will be developed as a 120,000 tonne per month UG2 operation; additional modules could be added at a later date, as market conditions and the availability of power and water permit. The company believes that mining could start as early as the final quarter of 2010, with concentrator commissioning in early 2012.

Aquarius Platinum

Aquarius Platinum's Everest mine produced 75,000 oz of platinum in concentrate in 2008, a decline of 28 per cent compared to the previous year, following a number of incidents which disrupted underground production. Palladium production in the same period fell by 29.5 per cent to 37,000 oz.

In January, following a series of unofficial work stoppages, the underground mining contractor resigned, and Aquarius took the decision to convert Everest to an owner-operated mine. Underground mining resumed in February, but the ramp-up in output was affected by another unofficial strike in May, and by geological disturbances encountered on the North side of the mine during the third quarter. Then, on the 8th of December, it was announced that Aquarius had suspended operations at Everest due to subsidence in a mined-out portion of the mine, including the upper levels of the decline shaft. Production of platinum in the second half of 2008 was only 38,000 oz as a result and the mine will be closed for at least six months to permit a full assessment of the situation.

Aquarius' two other mines, Marikana and Kroondal, form part of Pool & Share agreements with Anglo Platinum and are discussed on pages 14 and 15.

In 2008, Aquarius purchased a 50 per cent interest in Platinum Mile Resources, which operates a tailings retreatment plant adjacent to the Kroondal mine. The plant produces some 20,000 oz of pgm annually and the concentrate is sold to Anglo Platinum and is included in that company's production statistics.

ARM Platinum

The Two Rivers mine (which is 55 per cent owned by ARM and 45 per cent owned by Impala) operated at close to full capacity in 2008, producing approximately 110,000 oz of platinum. At the year-end, the mine had a surface ore stockpile amounting to over 243,000 tonnes; this will be processed during the first half of 2009, substituting some underground tonnage as part of a cost-containment initiative. In the second half of this year, a concentrator plant optimisation programme is expected to be commissioned, enhancing recoveries and margins.

The Modikwa joint venture (whose production is reported as part of Anglo Platinum's refined output) had a positive year, with mill throughput, grade and pgm output all up compared with 2007. Total platinum production climbed 15 per cent to 135,000 oz in 2008. However, due to lower pgm prices, trial mining of the Merensky reef has been halted, the deepening of the existing declines has been postponed, and approval of a phase two UG2 replacement project has been delayed in order to reduce capital expenditure.

The Nkomati Nickel mine (a 50:50 joint venture between ARM and Norilsk Nickel) has completed the transition from small-scale processing of high-grade underground ores to the larger-scale treatment of lower-grade ore from open pits. Mill throughput more than doubled and we estimate that sales of pgm in concentrate totalled around 42,000 oz, up by around a quarter on the previous year.

Eastern Platinum

At Eastern Platinum's Crocodile River mine, mill throughput fell by 17 per cent to 1.3 million tonnes in 2008, due to a reduction in the quantity of low-grade tailings fed to the plant. However, grades and recoveries rose strongly, as mill feed was increasingly sourced from underground operations: production of pgm in concentrate rose by 9 per cent to 118,000 oz.

The fall in pgm prices has resulted in the suspension of development at the nearby small Crocette section, which was due to add to production in 2009, while the company's projects on the eastern limb – including Spitzkop and Kennedy's Vale – have also been temporarily put on hold.

Other

Three new pgm mines will add to supplies in 2009. The first to join the ranks of platinum producers was Platinum Australia's small Smokey Hills operation, which delivered its first concentrate to Impala Refining Services (IRS) in early 2009. Initial production was from open pit mining, but this will be replaced by shallow underground mining once the pit is depleted in mid-year. The concentrator is designed to treat up to 720,000 tonnes of UG2 ore annually, yielding around 95,000 oz of platinum group metals.

Ridge Mining's Blue Ridge project was commissioned during the first quarter of 2009, with the first ore being processed in mid-February and deliveries of concentrate to Impala Refining Services beginning in April. The company had built a stockpile of 325,000 tonnes of ore above ground by the end of February and it expects to reach full capacity – around 125,000 oz of pgm annually – by the third quarter of the year. An expansion of Blue Ridge is currently being evaluated, but a second project, at Sheba's Ridge, has been put on hold.

In February 2009, Aquarius Platinum announced that it planned to make a formal offer for Ridge Mining. The details were agreed at the end of March and Aquarius subsequently tendered an all-share offer.

At Platmin's Pilanesberg mine, the first ore was fed to the UG2 plant in March 2009, and the Merensky concentrator will start to process ore in May. The company expects steady state production levels

Platinum Australia continued the construction of its Smokey Hills mine during 2008 and shipped its first concentrate in early 2009.

(around 250,000 oz of pgm annually) to be achieved during the second half of this year.

In December, it was announced that Pallinghurst Investment Consortium was to acquire a controlling stake in Platmin via the purchase of shares in both the company itself and in its black empowerment partner, the Bakgatla Pallinghurst Joint Venture (BPJV) which already holds a 27.6 per cent stake in Platmin's South African holding company Boynton.

Under the transaction, Pallinghurst has invested US$125 million in exchange for Platmin shares, while a further $50 million has been injected into the company via the BPJV. The deal gives Pallinghurst an effective 69.8 per cent stake in Platmin. The injection of $175 million will be used to complete the development of the Pilanesberg mine.

Sylvania Resources' Millsell and Steelpoort plants, which treat pgm-bearing tailings from chrome mining, produced around 23,000 oz of pgm in 2008 (their first full year of operation). A third chrome tailings operation, Lannex, was commissioned in March 2009 and is scheduled to produce 2,100 oz of platinum group metals per month by mid-2009. Sylvania is developing three more pgm recovery plants, due to be commissioned later this year. The company also has a 50 per cent share in the Chrome Tailings Retreatment Plant, located at the Kroondal Platinum mine: this operation produced just under 5,000 oz of platinum last year.

The rapid decline in the price of platinum and the other platinum group metals in the second half of last year has significantly affected the economics of a number of possible new mining projects within South Africa. Additionally, the current limited availability of project finance has made the development of many of these sites less attractive. As a result, a number of the junior mining companies are currently reviewing their project plans.

Bad weather prevented the shipment of pgm-rich ore from the Komsomolsky mine to the Norilsk concentrator in early 2008.

RUSSIA

In 2008, supplies of platinum from Russia decreased by 10.4 per cent to 820,000 oz, reflecting lower total output from Norilsk Nickel and the alluvial platinum miners. Primary production of palladium fell by 11.5 per cent, to 2.70 million ounces. Palladium sales from Russian state stocks were 960,000 oz, lower than in the previous year, meaning that overall palladium supplies from Russia fell by 19.4 per cent to 3.66 million ounces.

Primary production of palladium at Norilsk Nickel's Russian operations declined from 3.05 million ounces in 2007 to 2.70 million ounces in 2008, below the original forecast made at the start of the year. Platinum production fell from 727,000 oz to 632,000 oz over the same period. This occurred despite little change in the output of nickel from these operations, partly due to a temporary change in the ore mix processed (although actual ore mix ratios have not yet been published) and a decrease in pgm grades at the mill.

First quarter production of platinum group metals was negatively affected by severe winter weather on the Taimyr peninsula. This prevented shipping of the palladium-rich cuprous ore from the Komsomolsky mine to the Norilsk concentrator. Production was further depressed by delays in shipping metal to the pgm refinery in Krasnoyarsk in southern Siberia.

The rebuild of a smelter at the Nadezhda Metallurgical Plant in the first and second quarters of 2008 was followed by scheduled maintenance in the third quarter which again cut palladium output. Norilsk Nickel also reported that pgm production was further depressed by the shipment of nickel ores to the Harjavalta refinery in Finland for trial processing. Annual production from this facility was 11,000 oz of palladium and 5,000 oz of platinum which we include in our "Others" supplies figures.

Looking further forward, Norilsk Nickel has cut some

PGM Supplies: Russia '000 oz	2007	2008
Platinum	915	820
Palladium:		
Primary Production	3,050	2,700
State Sales	1,490	960
Rhodium	90	85

of its base metal production outside Russia but plans to maintain Russian output, suggesting that pgm production should remain at similar levels to last year during 2009.

Other producers – principally alluvial miners in the East of Russia – sold a total of 190,000 oz of platinum during 2008, close to 2007 levels. At Amur, a transition to mining wider areas of the alluvial deposit enabled a small increase in platinum output to roughly 120,000 oz. Meanwhile, production from the Korjak deposit decreased slightly from the previous year. Production from placer deposits in the Ural mountains remained relatively steady at close to 15,000 oz.

We estimate that 960,000 oz of palladium was sold from Russian state stocks during 2008, a significant decrease from the 1.49 million ounces sold in 2007. There were substantial shipments of palladium from Russia to Switzerland in December 2007 and again in August, September and October of 2008. In total, these amounted to just over 3 million ounces. We do not believe, however, that all of this metal which was shipped into Switzerland was actually sold into the market and therefore do not include it all in our 2008 supplies figures. We currently expect the remainder of this metal to be sold in the short to medium term.

In addition, there was a large shipment of Russian metal into the USA in November 2008 but close examination of the trade statistics suggests that, although of Russian origin, this metal had previously been priced and therefore did not represent new supply to the market.

NORTH AMERICA

North American platinum supplies in 2008 were unchanged from 2007 levels at 325,000 oz. However, palladium supplies from the same region's mines dropped from 990,000 oz to 910,000 oz. Output of both platinum and palladium slipped at North American Palladium and at Stillwater's operations but platinum group metal production from nickel mining in the Sudbury, Ontario area climbed, despite the closure of some mines in late 2008.

Canada

North American Palladium, Canada's only primary pgm producer, placed its Lac des Iles mine on care and maintenance at the end of October 2008. Preliminary indications suggest that a palladium price of at least $340 would be required for the mine to re-open; however, the company's management is working on a mine restart plan with the intention of streamlining operations and reducing costs.

The company's palladium output in 2008 totalled 212,000 oz, down 26 per cent from the previous year's 286,000 oz. Palladium production fell by 11.2 per cent in the first three quarters of the year due to bad weather and scheduled maintenance. However, output fell by a further 50,000 oz in the final quarter once production was halted. Production of platinum fell from 24,000 oz in 2007 to 16,000 oz in 2008.

Xstrata's Sudbury nickel operations reported a fall in nickel and copper output in 2008, reflecting a 12 per cent decline in mill throughput as the existing mines approach the end of their life. Although the company does not publish data on pgm production we believe that output of platinum and palladium from Sudbury ores fell last year.

Reacting to lower base metal prices, the company announced in November 2008 that it planned to close the Thayer-Lindsley and Craig mines ahead of schedule, in January and June 2009 respectively. Production from these mines will be replaced by the new Nickel Rim South and Fraser Morgan mines both of which are expected to come on-stream this year.

Xstrata continues to expand its Raglan nickel mine in northern Quebec, which produces some pgm (principally palladium) as a by-product. Mill throughput was up 16 per cent in 2008, but metal output was largely unchanged due to a fall in grade.

The other major Canadian nickel producer, Vale, reported a strong increase in nickel, platinum and palladium production from its Sudbury operations in 2008. A good operational performance from the mines helped to lift palladium output by 21 per cent to 231,000 oz, and that of platinum by 19 per cent to 166,000 oz. However, falls in

PGM Supplies: North America '000 oz	2007	2008
Platinum	325	325
Palladium	990	910
Rhodium	20	18

base metal prices have resulted in some production cuts being announced for this year: in Sudbury, the Copper Cliff South mine has been shut down indefinitely, while development of the Copper Cliff Deep project has been delayed for 12 months, trimming capital expenditure by $138 million.

USA

Stillwater reported a 7.2 per cent decline in platinum and palladium production in 2008, to 499,000 oz – 384,000 oz of palladium and 115,000 oz of platinum – from 538,000 oz one year earlier. Output from the Stillwater mine fell by only 10,000 oz to 349,000 oz but production at the smaller East Boulder operation was down 16 per cent to 150,000 oz, reflecting the downsizing of this operation which commenced in the final quarter of the year in response to lower metal prices. High employee turnover and a shortage of key mining skills affected operations in the first half of the year and production was hit in the final quarter by a short suspension of activities at East Boulder.

Stillwater has reported that during the final quarter of 2008, average realised prices were below the cash cost of production. The company has therefore introduced measures intended to preserve liquidity, including deferring expenditure on development, reducing the contractor workforce, and restructuring the higher cost East Boulder mine to focus on production from the most economically-attractive sectors of the mine.

The company expects to produce 495,000 oz of primary pgm in 2009, with the transfer of miners from the downsized East Boulder operation expected to boost output from the higher-grade Stillwater mine to in the region of 370,000 oz.

ZIMBABWE

Despite the country's political crisis and accompanying economic meltdown, Zimbabwe's two platinum mines recorded a surprisingly steady performance in 2008. Both mines maintained production levels and progressed their expansion programmes, although weaker pgm prices resulted in the closure of the Zimplats open pit in November. Output from the pit will be replaced by ore from the new underground portals.

Production of platinum group metals in Zimbabwe grew during 2008 despite a very challenging political climate.

At Zimplats, mill throughput was down marginally at just under 2.2 million tonnes, while grades and recoveries also fell slightly. As a result, production of pgm in concentrate fell by 5 per cent to 188,000 oz; however, sales of pgm in matte were up 10 per cent at 200,000 oz. This was a consequence of the relining of the smelter in the second half of 2007: the resulting backlog of unprocessed concentrate was treated in early 2008.

The Phase I underground expansion remains on schedule. The development of the first of two new portals was completed in September 2008, and the new Ngezi concentrator is due to be commissioned in April 2009. Full production, around 180,000 oz of platinum annually, is scheduled to be achieved from June this year.

The Mimosa mine (a 50:50 joint venture between Impala and Aquarius Platinum) continued to implement incremental expansions in 2008. The Wedza Phase 5 expansion project was commissioned in April 2008, taking annual plant capacity to 2.1 million tonnes. As a result, mill throughput rose by 5 per cent last year, although grades and recoveries fell slightly, with the result that platinum output rose only marginally, to 81,000 oz. The Wedza Phase 5.5 expansion is due for completion in the first half of 2009, and should lift annual capacity to just over 2.2 million tonnes of ore, or just under 100,000 oz of platinum.

PGM Supplies: Zimbabwe and Others
'000 oz

	2007	2008
Platinum	290	295
Palladium	285	310
Rhodium	18	18

PLATINUM

Net platinum demand declined by 5.0 per cent in 2008 to 6.35 million ounces. Gross autocatalyst demand fell to 3.81 million ounces, largely due to the drop in vehicle production in Western Europe and North America. Industrial demand for platinum was negatively affected by economic conditions and contracted to 1.76 million ounces. Jewellery manufacturers bought a net 1.37 million ounces of new metal with demand exceptionally strong in the final quarter of the year. Investors, especially in Japan, responded to the falling platinum price in late 2008, boosting physical investment demand by 150 per cent to 425,000 oz.

AUTOCATALYST

Gross global autocatalyst demand for platinum fell by 8.2 per cent in 2008 to 3.81 million ounces. Slowing vehicle production drove European platinum demand 1.7 per cent lower, to 2.02 million ounces. Japanese, North American and Rest of the World region platinum demand fell too but metal purchases by the automotive sector rose in China.

Europe

Platinum purchases by the European autocatalyst sector fell by 35,000 oz in 2008 to 2.02 million ounces, the first time that demand in this sector has fallen.

A worsening economic climate impacted increasingly upon the European automotive market during the year. Although Eastern European vehicle output grew, production in Western Europe fell by 1.1 million units, cutting total European production by 6 per cent. To add a further negative note for platinum, the diesel engine's share of new passenger car sales fell marginally to 52 per cent.

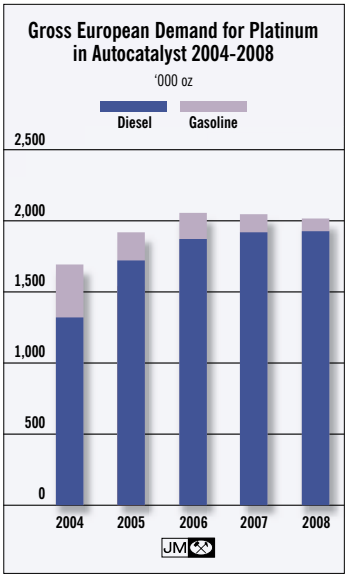
Gross Platinum Demand: Autocatalyst
'000 oz

	2007	2008
Europe	2,055	2,020
Japan	610	595
North America	850	560
China	175	185
Rest of the World	455	445
Total	**4,145**	**3,805**

JM

Some platinum was purchased for car company strategic stocks in the second half of 2008. However, this was outweighed by a decline in working stocks of catalysts, further depressing demand.

Platinum use in the gasoline sector declined to below 100,000 oz. Auto makers had already replaced platinum with palladium in catalyst formulations on most vehicles where this was possible. Little scope thus remained for further substitution and platinum demand simply fell in line with the drop in vehicle production.



A slowdown in the European automotive sector ensured that autocatalyst platinum demand in this region fell for the first time ever in 2008.

In the diesel sector, the use of platinum-based diesel particulate filters (DPFs) on new vehicles provided staunch support for demand. Between 40 and 50 per cent of all light duty diesel vehicles sold in Europe during 2008 were fitted with DPFs. This was a significant increase from 2007 as auto makers aimed to benefit from German financial incentives ahead of the new Euro 5 emissions rules. The implementation of these from late 2009 will further increase DPF fitment.

Platinum demand for diesel vehicles was trimmed by the wider use of platinum/palladium oxidation catalysts in place of platinum-only designs. The price differential between these metals increased the incentive for car makers to introduce such catalysts onto more vehicle models. (More information on this topic can be found in the special feature on page 39.)

Platinum demand from the heavy duty (HD) diesel sector increased in 2008. A looming Europe-wide recession might have been expected to drive vehicle demand lower in this market. Many orders were indeed cancelled but some fleet operators brought forward purchases to avoid the additional cost of aftertreatment imposed by the heavy duty Euro V emissions legislation taking effect in 2009. As a result, production of HD vehicles in Europe rose marginally, maintaining platinum demand at close to 50,000 oz.

Japan

Japanese passenger car production in 2008 was 9.9 million units, little changed from the previous year, as the major auto makers preferentially cut production overseas rather than in Japan itself. However, the continuing slow move towards palladium three-way catalysts in place of platinum formulations meant that

demand for platinum fell by 15,000 oz to 595,000 oz.

On vehicles destined for export to developing markets (which typically apply earlier emissions standards), Japanese car makers often fit previous generation catalyst formulations. Many of these are platinum-based and exports to Asia, Africa and South America thus support platinum demand.

In the heavy duty sector, vehicle production in Japan in 2008 was similar to output in 2007. With an increasing proportion of new vehicles fitted with aftertreatment, this sector accounted for 140,000 oz of platinum demand, slightly more than in 2007.

North America

Light duty automotive production fell sharply in North America (Canada and the USA) during 2008. Vehicle output deteriorated throughout the year and fell by roughly 2.6 million units, to 10.8 million vehicles.

The severe economic downturn in North America blunted consumer spending as many jobs were lost. With banks and other financial organisations severely restricting both lending to consumers and leasing, new vehicle sales were particularly badly affected.

The weak economy also impacted upon the mix of vehicles sold as consumers increasingly moved to smaller models. High oil prices earlier in the year had already begun to deter customers from buying the largest vehicles. Manufacturers therefore cut production of light and medium trucks by a weighty 29 per cent, significantly more than the 5.5 per cent cut in car output. With truck catalysts typically larger and containing more precious metal, this trend drove down the average platinum loading per vehicle.

As expected, the auto makers continued to make progress on thrifting platinum or replacing it with palladium in those gasoline catalysts where it remained in use, driving platinum use lower still. Platinum is still used in a number of catalysts but, with few diesel passenger vehicles either made or sold locally, demand is outweighed by the usage of palladium.

The heavy duty diesel market contributed roughly 170,000 oz of demand, less than in 2007. The haulage industry was not immune to the effects of the US recession and many firms cancelled vehicle orders.

Overall, annual gross autocatalyst platinum demand in North America fell by 34.1 per cent to 560,000 oz.

China

The Chinese passenger vehicle market recorded a tenth successive year of record sales in 2008 and autocatalyst demand for platinum rose by 5.7 per cent to 185,000 oz. Although the pace of growth slowed, over 5.3 million units were sold, 6.4 per cent more than in 2007, with most manufactured domestically.

New emissions legislation was enacted within China during 2008 in the form of Euro 4 equivalent rules in Beijing, Shanghai and Guangzhou and Euro 3 equivalent rules in the rest of the country. Manufacturers fitted new, higher-loaded catalyst formulations in order to meet these rules. Although the majority of catalysts fitted to vehicles use palladium/rhodium technology, some manufacturers continue to use platinum-based formulations – particularly on light commercial vehicles – and platinum demand climbed higher.

Rest of the World

Many markets in the Rest of the World region performed well in 2008. Production grew in countries including Argentina, Brazil, India and Russia. When combined with the trend in almost every market toward the implementation of tighter emissions standards, this drove platinum demand higher in many countries.

However, there were weak spots such as in South Korea where poor domestic sales and falling exports of diesel vehicles to Europe forced platinum demand lower. Overall, platinum demand in the Rest of the World region fell by 10,000 oz to 445,000 oz.

Autocatalyst Recovery

1.01 million ounces of platinum were recovered from spent autocatalysts in 2008, 7.5 per cent more than in the previous year.

In North America, consumers delayed purchasing new vehicles, resulting in lower numbers of old vehicles being scrapped, and the number of catalysts recovered fell. However, high metal prices provided an economic incentive for recyclers to process stocks of scrap catalysts collected in earlier years. Overall, the weight of platinum recovered from end-of-life autocatalysts in North America climbed by 5,000 oz to

Although the strong platinum price in early 2008 drove high levels of recycling of second-hand jewellery in China and in Japan, as the price fell this activity rapidly decreased in intensity.

Platinum Demand: Autocatalyst Recovery '000 oz		
	2007	2008
Europe	(215)	(245)
Japan	(35)	(60)
North America	(605)	(610)
China	(10)	(15)
Rest of the World	(70)	(75)
Total	**(935)**	**(1,005)**

610,000 oz in 2008.

In Europe, the first two thirds of 2008 saw record rates of recycling of end-of-life autocatalysts. High metal prices encouraged the processing of catalysts which had been hoarded by collectors, boosting recycling rates. Collection rates soared too as competition for spent catalysts increased. However, when metal prices and profit margins fell later in the year, some collectors were forced from the market. The volume of catalysts reprocessed fell dramatically to leave the overall weight of platinum recovered only 30,000 oz higher than in the previous year at 245,000 oz.

In other regions, recycling rates climbed slightly higher, to 15,000 oz in China, 60,000 oz in Japan and 75,000 oz in the Rest of the World region.

JEWELLERY

Net global jewellery demand fell by 90,000 oz to 1.37 million ounces in 2008. Record platinum prices in the first half of the year inhibited demand and boosted recycling in Asia. The price slump in the second half brought a sharp increase in Chinese purchasing. The economic gloom constrained sales in Europe and North America.

Europe

Net jewellery demand in the European market decreased by 2.5 per cent to 195,000 oz in 2008. The high platinum price and its exceptional volatility in the first half of 2008 negatively affected jewellery sales. Manufacturers were forced to re-price jewellery almost on a daily basis, deterring retailers from restocking.

In the UK, platinum consumption fell despite support from the large, relatively price-insensitive bridal market. The onset of a recession hit sales of other types of platinum jewellery as consumers became less willing to spend on discretionary purchases.

With demand in the UK declining, Switzerland became the largest European market in terms of platinum demand. Although, a high metal price

Jewellery manufacturing volumes were particularly strong in China towards the end of 2008.

depressed demand for platinum jewellery, the number of platinum watches produced climbed to 20,500 from 18,000 pieces in 2007. Towards the end of 2008, even this sector was affected by economic conditions, with orders and manufacturing volumes falling sharply.

Japan

Japanese retail sales of platinum jewellery were hurt by the high metal price in early 2008. This, when combined with the effects of a weak domestic economy, made platinum jewellery a less attractive purchase for many consumers.

In the final months of the year, when the platinum price fell, some manufacturers and retailers were able to reduce their prices. Those who did so were rewarded with sharply increased sales, which saw consumer purchases recover to close to 2007 levels. Sales of kihei chain, which has a pseudo-investment

Platinum Demand: Jewellery '000 oz						
	Gross[1]		Recycling[2]		Net[3]	
	2007	2008	2007	2008	2007	2008
Europe	200	200	0	(5)	200	195
Japan	540	535	(360)	(480)	180	55
North America	225	200	(5)	(5)	220	195
China	1,070	1,060	(290)	(210)	780	850
Rest of the World	75	70	0	0	75	70
Total	**2,110**	**2,065**	**(655)**	**(700)**	**1,455**	**1,365**

NOTES TO TABLE

[1] Gross demand is equivalent to the sum of platinum jewellery manufacturing volumes and changes in unfabricated metal stocks within the industry.

[2] Recycling represents the amount of old stock and old jewellery recycled whether the metal is re-used within the jewellery industry or sold back to the market.

[3] Net demand (our headline figure) is the sum of these figures and therefore represents the industry's net requirement for new metal.

character due to its low retail mark-up, were particularly strong. Gross demand – a combination of the amount of jewellery manufactured in Japan and any changes in unfabricated metal stocks – was therefore little changed from the previous year at 535,000 oz.

We have previously commented on the growth of recycling of second-hand platinum jewellery within Japan. Very large volumes of platinum jewellery were sold during the 1970s, 1980s and 1990s. The rising platinum price in recent years and a listless economy have driven some consumers to sell this old jewellery for cash, encouraging the development of an increasingly efficient collection infrastructure.

When prices climbed to near-record Yen levels in early 2008, extremely large volumes of old jewellery – at times, more metal than was required in domestic jewellery manufacturing – were returned and recycled. However, as prices fell, consumers sold back less jewellery and recycling rates slowed dramatically. Despite this, we estimate that recovery of platinum from jewellery scrap in Japan grew from 360,000 oz in 2007 to 480,000 oz in 2008.

With recycling increasing, net demand for platinum for jewellery manufacturing in Japan decreased from 180,000 oz in 2007 to 55,000 oz in 2008.

North America

The poor state of the economy drove net platinum demand from the North American jewellery industry 11.4 per cent lower to 195,000 oz in 2008. Weak consumer sentiment made North Americans less willing to spend on luxury items and jewellery purchases fell. Despite the high metal price, there was no significant return of scrap jewellery from the general public.

In the bridal market, platinum retained its popularity for women's rings and demand remained relatively healthy. However, the pressure on wedding budgets meant that other metals continued to capture market share from platinum for men's wedding bands.

In the first six months of 2008, platinum was nearly double the price it had been a year previously and credit limits only allowed manufacturers and retailers to purchase half as much stock in weight terms as before. As platinum pieces were sold, retailers commonly replaced them with white gold, further depressing platinum demand. While the fall in the platinum price in the second half of the year reduced this pressure on the market, it did not feed through into retail prices before the end of the year and consumer purchasing remained weak.

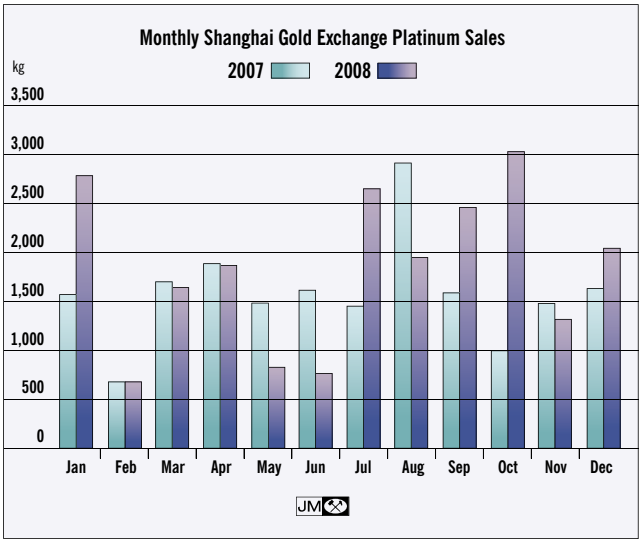
China

As we have previously reported, the high platinum price in the first half of 2008 had a large impact on the Chinese jewellery market. Manufacturers and retailers reduced their stock levels and consumers were less able or less willing to purchase jewellery. Gross purchases of metal by the industry fell below 2007 levels during these six months. Just as importantly, large volumes of jewellery were returned by consumers and by retailers and wholesalers. The flow of these large amounts of recycled metal back to the market caused net purchases of new metal by the jewellery industry to fall even more sharply than the drop in gross demand.

Once the platinum price started to fall, in mid-2008, the position quickly changed. The flow of secondary metal decreased greatly and, from August onwards, manufacturers began to increase their purchases of primary metal in order to achieve the production levels needed to meet increased retailer demand.

In the closing months of 2008, manufacturers, wholesalers and retailers alike took the opportunity to replenish depleted stocks of metal and of finished products. This was reflected in very strong purchasing of platinum by the jewellery trade on the Shanghai Gold Exchange during the second half of the year.

Purchases of platinum on the Shanghai Gold Exchange rose strongly in the second half of 2008 as the jewellery industry responded to the lower price.



Sales of physical platinum investment products in Japan were enormously strong in the final quarter of 2008.

Finally, the lower metal price enabled stores to reduce the retail price of platinum from historic highs of around 600 RMB/g. Retailers also increased the quantity of platinum jewellery on show in their stores, largely at the expense of white gold. Although these changes only occurred in late 2008, consumer purchasing of platinum strengthened in response to the lower retail prices and the greater variety of platinum jewellery on display.

We estimate that Chinese gross demand – the sum of the weight of platinum used in jewellery fabrication and any changes in unfabricated metal stocks within the industry – decreased to 1.06 million ounces in 2008. The amount of recycled metal used by the jewellery industry fell to 210,000 oz from 290,000 oz in the previous year. As a result, net platinum demand climbed 9.0 per cent in 2008 to a total of 850,000 oz.

Rest of the World

Net jewellery demand in the Rest of the World region fell by 5,000 oz to 70,000 oz during 2008. A growing proportion of production in this region takes place in India for domestic consumption. Although the Indian home market remains small, this is growing, particularly in markets such as Chennai where there have been substantial marketing efforts. The domestic market accounted for 20,000 oz of demand for new metal in 2008, offsetting the effects of falling exports of platinum jewellery to North America.

INVESTMENT

Net physical investment demand for platinum increased by 255,000 oz in 2008 to 425,000 oz.

Japanese investors purchased a net 275,000 oz of platinum in the form of large bars in 2008, compared to a net disinvestment of 60,000 oz in 2007. Initially, sales by investors back to the market continued in 2008, outweighing purchases and resulting in net disinvestment during the first six months of the year.

However, investor behaviour changed when the platinum price fell in mid-year. With the price of platinum falling, the Yen strengthening and equity investments losing much of their allure, purchasing by individual investors increased sharply in the final quarter, leading to exceptionally strong demand.

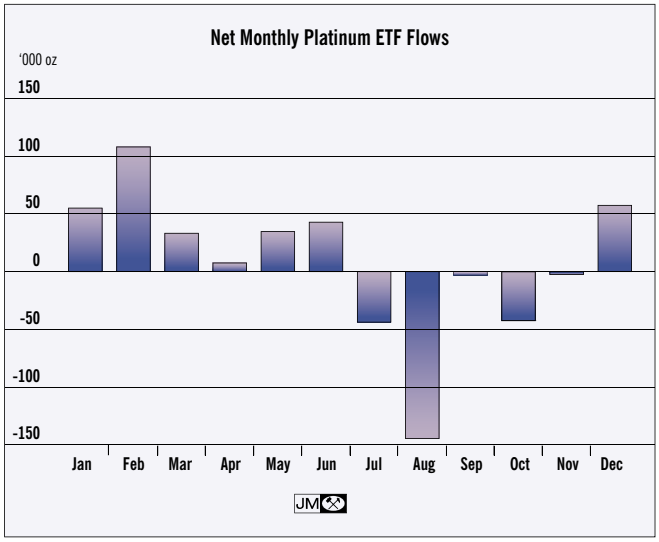
Platinum Demand: Investment
'000 oz

	2007	2008
Europe	195	105
Japan	(60)	275
North America	30	40
China	0	0
Rest of the World	5	5
Total	**170**	**425**

JM

In contrast, net purchases of platinum through Exchange Traded Funds fell by almost half to 105,000 oz in 2008 even though these funds were operational for their first full calendar year during this period. In the London fund, investment activity throughout the year showed a very strong correlation to movements in the metal price. Investors bought substantial amounts of platinum as the price rose strongly. However, as the price fell back, large amounts of metal were sold by investors keen to release cash. In contrast, investment flows in the

Investors bought very large quantities of platinum through ETFs in the first quarter of 2008 but sold much of this metal back as the price fell later in the year.



Swiss fund were significantly less volatile. Combined positions peaked at 485,000 oz during July but only 300,000 oz of platinum remained in the various ETFs at the end of the year, with net annual demand reaching only 105,000 oz.

The very high volatility of the platinum price also had an effect on sales of platinum coins. The US Mint, for example, was forced to raise prices once, lower prices twice and suspend sales of platinum coins altogether on a further two occasions during the year. However, investors and collectors were undeterred and the 2008 platinum American Eagle coin sold out during its year of minting, an unusual occurrence. As a result, demand climbed to 40,000 oz.

Platinum demand from the petroleum refining sector climbed to 245,000 oz despite a falling oil price in the second half of 2008.

CHEMICAL

The chemical sector accounted for 395,000 oz of platinum demand in 2008, 25,000 oz less than in 2007. Demand from the manufacture of silicones rose by 5,000 oz but less metal was purchased for use in heterogeneous catalysts.

In the silicone sector (where the platinum catalyst is captured in the silicones used in pressure release adhesives), thrifting has started to affect platinum demand. Although demand for silicones themselves remained strong for most of the year, a number of manufacturers have introduced curing solutions with a lower platinum content and some are looking at platinum-free ultraviolet technology. The net result of these two trends in 2008 was a small increase in platinum demand. Although the fall in the price of platinum and a lack of capital for investment may slow adoption of ultraviolet curing technology, the market share of the lower platinum content catalysts is increasing and platinum demand for this application has now peaked.

Platinum Demand: Chemical
'000 oz

	2007	2008
Europe	110	105
Japan	55	55
North America	95	95
China	70	60
Rest of the World	90	80
Total	**420**	**395**

JM

In the process catalyst arena, demand for platinum slipped lower. Manufacturing capacity for chemicals such as paraxylene grew in much of Asia in 2008. However, global demand for such commodity chemicals fell later in the year and the petrochemical and plastics industry cut its product stocks. Production was cut back severely, meaning that less platinum was required for top-up catalyst charges. Of note, however, was the cancellation of a number of projects due to the poor economic outlook, something that will limit platinum demand in the medium term.

Demand for nitric acid grew in 2008 although by a slower rate than in the previous year. Demand for platinum catalytic burner gauzes therefore differed little from 2007 levels.

PETROLEUM REFINING

The petroleum refining sector purchased a net 245,000 oz of platinum during 2008, 40,000 oz more than in 2007, despite the plunging oil price. The petroleum refining industry typically runs its operations at high throughput and maintains low product inventories in order to maximise its profitability. With petroleum demand falling only slightly, there has thus been only a modest effect on refinery operating rates.

In fact, there was new capital investment in the industry with facilities constructed in India, Japan and the Middle East in 2008, supporting platinum demand. Looking further into the future, European rules on the use of next generation biofuels seem set to drive further platinum demand in the longer term.

Platinum Demand: Petroleum Refining
'000 oz

	2007	2008
Europe	25	35
Japan	5	10
North America	30	25
China	10	10
Rest of the World	135	165
Total	**205**	**245**

JM

ELECTRICAL

Platinum demand from the global electrical sector fell by 11.8 per cent in 2008 to 225,000 oz, with lower net purchases of metal by the hard disk industry largely responsible. Demand for platinum for use in other electronic components fell too.

Platinum Demand: Electrical
'000 oz

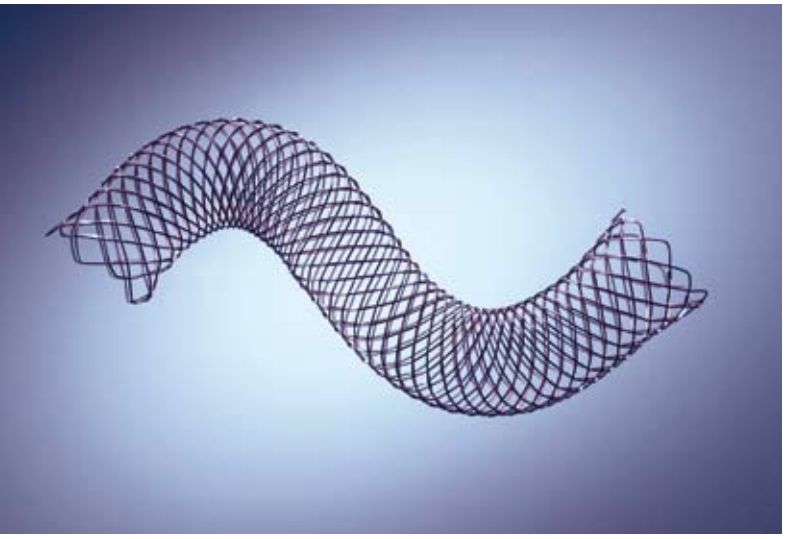
	2007	2008
Europe	15	15
Japan	35	30
North America	55	30
China	20	30
Rest of the World	130	120
Total	**255**	**225**

JM

Despite a difficult end to the year, production of computer hard disk drives grew in 2008. Rising areal storage density (the amount of information that can be saved per unit area of a hard disk) also increased. This allowed manufacturers to maintain the average number of disks per electronic device while still improving performance. As a result, platinum consumption increased by a similar rate to the growth in computer production.

However, demand for platinum varied substantially during 2008. With sales of consumer electronics slowing rapidly in the final quarter of the year, their production was also cut. Destocking, whether of sputtering targets, hard disk drives or complete computers, became a widespread feature of the supply chain. This combination of falling industry stocks and weak consumer purchasing had a strong negative impact on platinum purchases by disk manufacturers in the closing months of 2008 (and in early 2009). Platinum demand therefore fell despite the increase in the total weight of metal actually coated onto the hard disks produced during the year.

The introduction of new products such as this stent helped to drive biomedical demand for platinum higher in 2008.



GLASS

Platinum Demand: Glass
'000 oz

	2007	2008
Europe	15	(5)
Japan	85	80
North America	25	(5)
China	180	125
Rest of the World	165	195
Total	**470**	**390**

JM

Demand for platinum from the glass industry decreased by 80,000 oz to 390,000 oz in 2008. Most demand from this sector is for the construction of new facilities and a slowdown in industrial demand for fibre glass delayed the construction of a number of factories. The closure of CRT glass plants in China also reduced demand there.

In Europe and North America, platinum demand from the glass sector was once again negative with the closure of factories, due to the relocation of manufacturing capacity to other regions, releasing some metal back to the market.

In Asia, demand was strongly positive, although lower than in 2007. Despite the deceleration of Chinese economic growth, demand for fibre glass increased and manufacturers installed new production capacity.

The global flat screen (LCD and plasma) television market grew strongly during 2008 and producers installed new flat glass manufacturing capacity in Japan and elsewhere in Asia. However, the closure of a number of cathode-ray tube (CRT) television glass facilities in China returned some platinum to the market last year, driving demand lower.

OTHER

Demand for platinum for other applications grew by 5,000 oz in 2008 to 500,000 oz. Platinum demand for use in biomedical components and aircraft turbine blades increased. However, dental sector use of platinum fell. Platinum is used as a component in high-gold content dental alloys in North America and the rise in the gold price drove a move towards the use of other alloys which do not contain platinum.

Platinum Demand: Other
'000 oz

	2007	2008
Europe	185	185
Japan	45	45
North America	215	215
China	15	20
Rest of the World	35	35
Total	**495**	**500**

JM

PALLADIUM

Net global demand for palladium increased by 15,000 oz in 2008 to a total of 6.85 million ounces. Gross demand from the autocatalyst sector fell to 4.38 million ounces due to slowing vehicle production in North America. Net purchases of palladium by the electronics sector rose to 1.33 million ounces but chemical sector demand fell to 350,000 oz as the economic slowdown took hold. Palladium usage in the dental sector remained steady at 630,000 oz while physical investment demand reached 400,000 oz of metal, 54 per cent up on the 2007 figure.

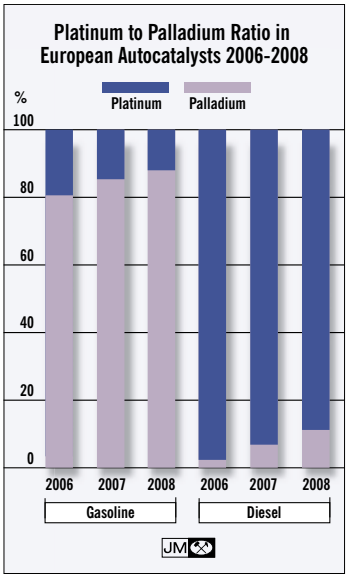
The increasing use of palladium in diesel filters provided some support for autocatalyst palladium demand in Europe.

AUTOCATALYST

Gross demand for palladium from the autocatalyst sector fell by 165,000 oz in 2008 to an annual total of 4.38 million ounces. Global vehicle sales slowed throughout the year and a steep drop in North American light duty vehicle output cut gross palladium demand in this region by 350,000 oz compared to 2007. Continued penetration of palladium into the diesel catalyst sector in Europe provided good support for overall demand, as did growing vehicle production and tighter emissions rules in countries such as China and Russia.

Europe

Palladium use on gasoline vehicles decreased in 2008 in Europe but total demand grew in this region due to increased use in the diesel sector.



Gross demand for palladium from the European autocatalyst industry climbed by 3.3 per cent to 950,000 oz in 2008, despite a 6 per cent fall in European light duty vehicle production to an annual total of 19.3 million units.

This fall in vehicle production was broadly matched by a decrease in the use of palladium demand on gasoline vehicles. As we have previously noted, very little scope remains for replacement of platinum by palladium in three-way catalysts on gasoline vehicles within Europe. Nonetheless, a small amount of switching of catalyst formulations was seen during 2008, adding marginally to palladium demand. The Euro 5 emissions rules due to be applied to new light duty vehicle models in late 2009 (and to all new cars in early 2011) also provided a boost to palladium demand as manufacturers fitted new, higher-loaded catalysts to a range of vehicles in advance of their introduction.

Changes in the diesel sector, however, were more significant in terms of palladium demand. Auto makers continued to replace many platinum-only diesel oxidation catalyst formulations with platinum/palladium analogues. A growing amount of palladium is also being used in diesel particulate filters alongside platinum – partly to provide thermal stability to the catalytic particles on the filter. These trends drove palladium demand in the European diesel vehicle market to close to 250,000 oz in 2008. (Further information on the use of palladium in diesel catalysts can be found in our special feature on page 39.)

Japan

Japanese auto makers bought 30,000 oz more palladium in 2008 – 850,000 oz in total – than in 2007. Light duty vehicle production in Japan slipped only marginally to 11.1 million units, although both domestic and export sales weakened at the end of the year.

Gross Palladium Demand: Autocatalyst
'000 oz

	2007	2008
Europe	920	950
Japan	820	850
North America	1,695	1,345
China	325	385
Rest of the World	785	850
Total	4,545	4,380

JM

A large proportion of the vehicles manufactured in Japan are sold in other countries. While exports grew by two per cent during 2008, the final quarter was very weak with vehicle sales to the most important export markets – North America and Western Europe – falling quickly. The decline in sales had little impact on 2008 production but has continued and is set to lead to lower domestic production this year.

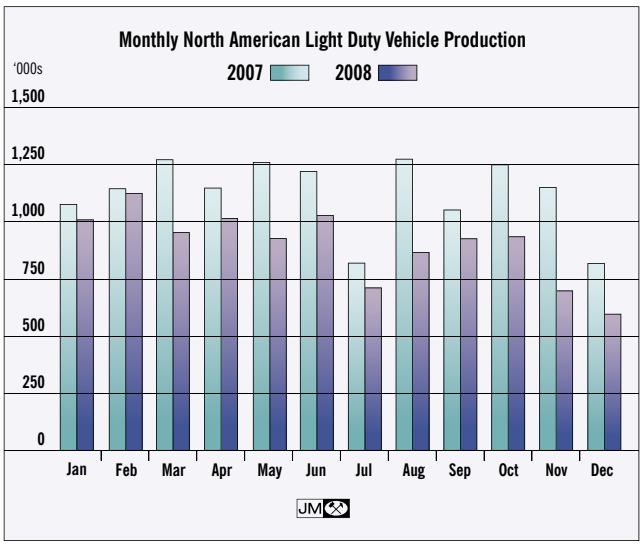
In Japan, there have been no new emissions regulations for some time. Despite this, auto makers have continued to improve the environmental performance of their vehicles in order to keep pace with developments in Europe and North America. Many cars now meet the voluntary J-ULEV standard. Although the precious metal loadings of some catalysts have been increased to achieve lower emissions, this has been accompanied by thrifting of other catalyst formulations. Average catalyst metal loadings in the domestic market have thus remained relatively static.

However, as we have previously reported, the Japanese car makers tend to use a large proportion of platinum on their export vehicles in comparison with other manufacturers. They have therefore increasingly replaced platinum/rhodium catalysts with palladium/rhodium catalysts on many of their locally-sold vehicles in order to balance their usage of the different metals and to control costs. High rhodium prices have also encouraged the thrifting of rhodium and its partial replacement by larger amounts of palladium, adding some strength to palladium demand in this country.

North America

North American purchases of palladium for use by the autocatalyst sector fell dramatically – by 20.6 per cent or 350,000 oz – to 1.35 million ounces in 2008, the lowest figure since 2003.

Although a slowdown in the US economy had initially been predicted to cut North American vehicle sales by more than ten per cent last year, the reality was substantially worse. While sales were somewhat weak in the first half of the year, a rapidly weakening economy saw sales decline further each month, with vehicle purchases in December falling a hefty 36 per cent below December 2007 levels. With inventories of unsold vehicles rising, the major auto makers cut production sharply in the second half of the year with some factories experiencing long shutdowns in the final quarter, leading to a decrease in demand for catalytic converters and for palladium.



North American light duty vehicle output worsened throughout the year as the economic gloom deepened in that region.

Historically-high oil prices also had an effect in early 2008 as consumers purchased more economical smaller vehicles instead of the largest sports utility vehicles (SUVs). A combination of an increasingly feeble economy and a lack of available credit for consumers also negatively affected demand for larger, more expensive vehicles. Both SUVs and light trucks are typically fitted with larger autocatalysts with a higher precious metal content than smaller vehicles. The decrease in the market share of such vehicles therefore drove down the average metal content per vehicle, further cutting palladium consumption.

Palladium demand did derive some slight support from the continuing trend to replace platinum with palladium in three-way catalysts. While this has been underway for some time, it continued during 2008, helping support palladium use at the expense of platinum. However, we believe that this process is now essentially complete.

China

Gross palladium purchases by Chinese vehicle manufacturers increased from 325,000 oz to 385,000 oz in 2008. Although domestic passenger car production grew by 5.9 per cent in 2008, this was the slowest rate of growth for a number of years. Moreover, the pattern of vehicle sales during 2008 was unusual: consumer

A fall in consumer confidence and a lack of availability of credit depressed vehicle sales in North America during 2008.

purchasing was soft around the time of the Beijing Olympics and weakened again later in the year before the Chinese government cut sales taxes in order to reinforce demand.

New emissions legislation was enacted throughout China in mid-2008. Every light duty vehicle manufactured for sale in China should now meet either Euro 3 or Euro 4-equivalent legislation. This tightening of emissions standards has driven an increase in the palladium loading of a typical catalyst and added to palladium demand.

Rest of the World

Demand for palladium for autocatalysts in the Rest of the World region climbed by 65,000 oz to a total of 850,000 oz in 2008. In Brazil, vehicle sales increased strongly as the economy expanded. With auto makers changing some catalyst formulations to meet the Proconve L-5 emissions rules due to come into force in 2009 in Brazil, palladium demand there rose healthily.

In Russia, annual vehicle production soared by roughly ten per cent to 1.7 million units despite a sharp downturn at the end of the year. With new emissions legislation also coming into force in Russia in 2008, palladium usage increased significantly. Mexican automotive palladium demand climbed too, due to an increase in vehicle production in 2008 following the relocation of some manufacturing from the USA to Mexico.

Autocatalyst Recovery

The weight of palladium recovered from end-of-life catalytic converters grew by 15.3 per cent to 1.17 million ounces in 2008. The record platinum group metal prices of the first half of 2008 – particularly that of rhodium – made the recovery and recycling of catalytic converters from end-of-life vehicles highly economically attractive in every region.

Palladium Demand: Autocatalyst Recovery
'000 oz

	2007	2008
Europe	(300)	(365)
Japan	(35)	(65)
North America	(590)	(625)
China	(20)	(30)
Rest of the World	(70)	(85)
Total	**(1,015)**	**(1,170)**

JM

The weight of palladium recovered from spent autocatalysts in North America climbed to 625,000 oz in 2008. Sales of new vehicles were depressed by the economic climate and scrappage rates for vehicles fell as a consequence. However, the average palladium content of a scrapped autocatalyst continued to grow, reflecting heavy use of palladium in the North American automotive market at the end of the last decade. This, when combined with the processing of stocks of spent catalysts which recyclers had already built up, outweighed the effect of lower numbers of vehicles being scrapped.

High commodity prices during the first half of 2008 drove record autocatalyst recycling volumes in every region.

In Europe, palladium recycling volumes also increased in 2008, to a record 365,000 oz. As in North America, the peak period for usage of palladium in the autocatalyst sector was from 1999 to 2001 and the average palladium loading of an end-of-life catalyst has continued to increase. As with platinum, recycling rates were extraordinarily strong in the first half of the year as high prices drove the recycling industry to minimise stocks and increase its throughput. When metal prices eventually fell, recycling volumes rapidly dwindled as collectors became more reluctant to sell their stocks of scrap catalysts, leaving annual palladium recycling volumes only 65,000 oz higher than one year previously.

In Japan, a large proportion of vehicles which are deregistered is exported for re-use elsewhere in the world. As a result, volumes of metal recovered from autocatalysts remain relatively low at 65,000 oz. Combined palladium recovery from China and the Rest of the World region was 115,000 oz.

JEWELLERY

Net demand for palladium from the jewellery industry climbed by 19.6 per cent to 855,000 oz in 2008. High platinum and gold prices drove manufacturers to produce more palladium jewellery in China and recycling rates fell, driving net annual demand there 30 per cent higher to 650,000 oz. In Europe and in North America, the steady improvement in the uptake of palladium by manufacturers and consumers continued and demand grew in both regions.

Palladium Demand: Jewellery
'000 oz

	Gross		Recycling		Net	
	2007	2008	2007	2008	2007	2008
Europe	40	45	0	0	40	45
Japan	125	115	(30)	(40)	95	75
North America	55	60	0	0	55	60
China	705	740	(205)	(90)	500	650
Rest of the World	25	25	0	0	25	25
Total	**950**	**985**	**(235)**	**(130)**	**715**	**855**

JM

See notes to table on page 26.

China

The volume of palladium jewellery manufactured in 2008 initially showed healthy growth from the previous year. The dizzying rise in the prices of platinum and gold – as well as the highly volatile behaviour of their prices – reduced profit margins on jewellery made from either of these metals throughout the trade. As a result, a number of manufacturers switched some of their production capacity to the manufacture of palladium in the first half of the year, driving demand higher than it had been one year previously.

In fact, production volumes of palladium jewellery remained strong throughout the first three quarters of the year. They fell only when manufacturing was switched back into platinum as the platinum price, having dropped by more than half, reached some level of stability in the final quarter. Additionally, we believe that many manufacturers and wholesalers increased their working stocks of palladium metal and jewellery during 2008, adding further to demand.

Palladium jewellery is popular with many consumers in the West and North-East of China.

However, the retail picture for palladium jewellery remains very mixed. It is virtually absent from many first tier cities but has a much stronger presence and market share in second and third tier cities, particularly as plain metal jewellery rather than gem-set pieces (although this latter sector is growing). Its popularity is also geographically-varied with provinces in the West and North-East of China being the largest markets. It is therefore worth noting that the earthquake in May in Szechuan – perhaps the largest market for palladium jewellery – had a negative impact on demand.

Part of the reason for the slow development of the palladium jewellery market may be due to the pricing structure for this metal. Unlike gold and platinum, the retail price for palladium jewellery is typically several times the cost of the metal itself and some retailers will neither exchange nor buy-back worn palladium jewellery. It is thus not seen as a store of value by consumers in the same way that gold and platinum often are. The sharp fall in the metal price in the second half of last year depressed both the resale value of palladium jewellery and the volumes of old jewellery exchanged. Should the current low resale value persist, this could affect consumer sentiment and have a negative impact on future retail sales.

As we had previously forecast, the flow of recycled metal from unsold palladium jewellery stock within the industry back into jewellery manufacturing also fell last year. Most stock seen at retailers is now in the form of Pd990 (a 99 per cent pure alloy) or even Pd999 (a purer 99.9 per cent alloy) and very little of the old stock of Pd950 now remains to be recycled.

With jewellery manufacturing volumes climbing and recycling decreasing (as shown in the table on page 35), net palladium demand increased by 30 per cent to 650,000 oz in 2008. Implied imports of palladium into China were significantly higher than this figure. It should be noted, however, that some of this imported palladium was subsequently re-exported. We also believe that in the region of 150,000 oz of this metal was not sold for use in industrial or jewellery applications but was instead purchased for short-term speculative purposes. Although this metal may yet be used within the jewellery industry, we do not include this metal in our figure for Chinese jewellery demand and treat it as a movement in market stocks until such time as it unequivocally enters the jewellery trade.

Other Regions

Net jewellery sector demand for palladium also rose in Europe and North America, to 45,000 oz and 60,000 oz respectively, while it decreased to 75,000 oz in Japan.

In Europe and North America, palladium's profile as a jewellery metal continued to grow. Product availability, although still limited, continued to improve. Retailers responded to the high prices of more traditional jewellery metals by introducing palladium into their stores in order to meet attractive price points for consumers. Sales of men's wedding bands in palladium have grown in both regions but fewer women's rings are currently made in this material.

High platinum and gold prices also encouraged a greater number of manufacturers in both regions to start working with this metal and to add it to their product ranges. At the same time, new casting alloys have improved product quality and simplified the manufacturing process.

European jewellery sector demand for palladium was also boosted by strong sales of palladium watches in 2008. We expect further growth in demand within Europe when a hallmark for palladium jewellery is introduced within the UK in late 2009.

In Japan, by contrast, almost no palladium jewellery is manufactured or sold domestically. Palladium demand there is entirely dependent therefore on its use in platinum and white gold alloys. 2008 saw very high levels of consumer scrap jewellery, including platinum, being sold to collectors and refiners. The amount of palladium recovered – typically 10-15 per cent of the total metal content of a piece of jewellery – climbed accordingly. Manufacturing volumes of jewellery were a little lower than in the previous year as a result and net demand fell from 95,000 oz to 75,000 oz. We expect this figure to increase in 2009 if jewellery recycling rates remain at their current low levels.

CHEMICAL

The chemical industry purchased a net 350,000 oz of palladium in 2008. This represented a decrease of 6.7 per cent from 2007, reflecting both an expected slowdown in construction of new plant capacity and the weak performance of the global economy in the final quarter of the year.

As we reported in our Platinum 2008 Interim Review, demand for palladium in the nitric acid industry was strong in the first half of 2008. Palladium catchment gauzes are used in many low to medium pressure nitric acid plants to capture platinum lost from the catalytic burner gauzes. However, as the platinum price fell in the second half of the year, the economic incentive to fit new palladium catchment gauzes decreased. Additionally, as demand for nitric acid itself softened, fewer plants were operated at full capacity, allowing less frequent changes of catalyst. Overall, palladium demand fell slightly.

In other subsectors of the chemical industry, palladium demand was relatively strong throughout much of last year. Extra production capacity for chemicals such as purified terephthalic acid (PTA) and hydrogen peroxide was constructed in China and in the Rest of the World region, contributing substantial demand for palladium. However, with fewer new plants constructed in Asia than in the previous year, demand fell marginally.

Later in the year, as demand for many of these commodity chemicals fell, industry participants worked to reduce stocks of them, leading to substantially lower manufacturing volumes. This trend of destocking continued in early 2009 and with no short-term requirement for new

Palladium Demand: Chemical
'000 oz

	2007	2008
Europe	95	100
Japan	25	20
North America	75	55
China	80	55
Rest of the World	100	120
Total	**375**	**350**

production capacity, demand is likely to fall this year. The lack of credit available to finance the construction of new projects is also likely to delay growth in this sector in the medium term and therefore temper any growth in metal demand over that timescale.

DENTAL

Demand for palladium for dental applications was steady in 2008 at a global total of 630,000 oz. The two key dental markets for palladium are Japan and North America. Demand changed little in either of these locations as a lower metal price helped defend the market share of palladium-based treatments against newer ceramic technology.

Palladium Demand: Dental
'000 oz

	2007	2008
Europe	70	65
Japan	275	275
North America	265	270
China	5	5
Rest of the World	15	15
Total	**630**	**630**

JM

The long-term trend in Japan remains for a decrease in palladium demand. New non-pgm treatments are increasingly competing with the use of the palladium-containing Kinpala alloy. However, the steep decline in the palladium price in the second half of 2008 drove a fall in the amount of scrap alloy recycled. We estimate that the fall in gross manufacturing demand was balanced by this decrease in recycling during the year. Net demand therefore remained static at 275,000 oz in 2008.

In North America, palladium is also primarily used in restorative dental treatments such as the capping of teeth. While the economic slowdown has depressed the number of visits to dentists, it has had little impact so far on this type of dental treatment. Indeed, demand rose by 5,000 oz to 270,000 oz as the high price of gold drove a move towards the use of lower-gold, higher-palladium content dental alloys.

ELECTRONICS

Electronics sector demand for palladium climbed by 6.9 per cent to 1.33 million ounces during 2008. The use of palladium pastes in multi-layer ceramic capacitors (MLCC) continues to be the most important application and a small rise in demand here was the largest single factor in the increase in overall palladium usage.

Palladium Demand: Electronics
'000 oz

	2007	2008
Europe	160	165
Japan	270	250
North America	140	155
China	325	365
Rest of the World	345	390
Total	**1,240**	**1,325**

JM

Sales of consumer electronics goods performed well in the first nine months of 2008 before worsening as the global economy slowed. The increasing complexity of consumer electronics also boosted the number of passive components – such as MLCC – per device. However, the effects of the economic downturn were felt towards the end of the year. Once consumers started to restrict their spending, they not only bought fewer electronic products but also began to purchase cheaper, lower specification devices instead of the more advanced options available. With these typically containing fewer capacitors and hence less precious metal, palladium demand was depressed in the final quarter of 2008, a trend that has continued into 2009.

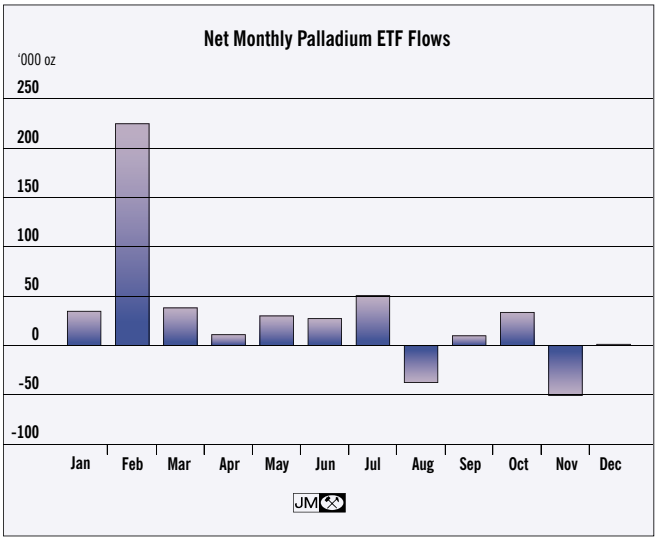
The fall in automotive output also hit palladium demand in late 2008. Cars now feature increasingly complex electronic systems for applications as diverse as engine control and in-car entertainment. However, a decrease in the number of vehicles manufactured in the more mature markets of North America and Europe led to a decline in demand for palladium-

Despite slowing demand at the end of the year, more palladium was used in multi-layer ceramic capacitors in 2008 than in 2007.

containing electronic components.

There was though, little change in the share of the MLCC market taken by palladium technology. While this has decreased during recent years, many manufacturers still use palladium pastes in higher specification products and palladium-based MLCC still represent some 10-15 per cent of the market.

Finally, palladium competes with gold in some electronics applications. The wide price differential between these two metals might have been expected to boost palladium use in electronic connectors, for example. In this application, layers of palladium can be used in place of some of the gold content, thereby reducing the overall cost of the component. However, the electronics industry exhibits a degree of conservatism, which meant that little production was switched to using palladium. In fact, with the production of connectors falling in 2008, palladium demand for this application was only marginally higher than a year previously.



Investors purchased a net 400,000 oz of palladium through the European Exchange Traded Funds during 2008 with relatively little disinvestment occuring.

INVESTMENT

Net demand for physical palladium investment products grew by more than half to 400,000 oz in 2008, from 260,000 oz in 2007. Purchases of coins and bars accounted for 30,000 oz of demand, more than in the previous year when there had been net disinvestment. However, the buying of metal through the two European Exchange Traded Funds (ETFs) was more important, being responsible for 370,000 oz of this total.

Palladium Demand: Investment
'000 oz

	2007	2008
Europe	280	370
Japan	0	0
North America	(20)	30
China	0	0
Rest of the World	0	0
Total	**260**	**400**

JM

All of the precious metals, including palladium, experienced significant price volatility during 2008. On several occasions in the year this restricted sales of gold and platinum coins as the various mints were unable to update prices frequently enough. Growing economic uncertainty in the second half of the year drove record sales of gold coins to the general public too. With the flow of precious metal coins to collectors and investors unable to meet demand, some purchasing overflowed into the palladium market. As with the other metals, a lack of availability of coin blanks restricted consumer sales. Nevertheless, demand for coins and bars grew from a net disinvestment of 20,000 oz in 2007 to a net investment of 30,000 oz last year.

This was less significant than the volumes of metal purchased through Exchange Traded Funds. A mixture of fund investors and private individuals bought large amounts of palladium in the first quarter of 2008 as the price followed that of platinum higher. While investors sold significant quantities of platinum from the ETFs in the second half of the year as the global economy weakened, there was little change in the amount of metal held in the two palladium ETFs, suggesting that some of these investors have a longer-term attitude towards their investments. Total net palladium demand through the two ETFs climbed from 280,000 oz in 2007 to 370,000 oz last year.

OTHER

Palladium demand for other applications fell by 5,000 oz to 80,000 oz in 2008. Applications such as stationary source emission control and petroleum refining generated marginally more palladium demand than in 2007. However, there were falls in net palladium purchases for a number of other minor industrial end-uses, driving overall demand lower.

Palladium Demand: Other
'000 oz

	2007	2008
Europe	20	20
Japan	10	10
North America	30	25
China	10	10
Rest of the World	15	15
Total	**85**	**80**

JM

PALLADIUM USE IN DIESEL OXIDATION CATALYSTS

Automotive catalytic converters were first developed in the 1970s and were initially fitted to gasoline-fuelled automobiles in North America from 1975 in order to reduce the emissions of pollutants from these vehicles.

The first catalysts used a simple formulation of platinum deposited on aluminium oxide which in turn was coated onto a support material so that it could be placed in the exhaust stream of the vehicle. These designs were essentially two-way oxidation catalysts, so-called because they reduce tailpipe emissions of both carbon monoxide and hydrocarbons by oxidising them to carbon dioxide and water.

Later, researchers developed the now commonplace three-way catalysts (for gasoline vehicles) in order to meet tighter emissions legislation. In a three-way catalyst (TWC), carbon monoxide and unburnt hydrocarbons are oxidised at the same time as NOx emissions (a mixture of oxides of nitrogen) are reduced to water and nitrogen. Originally, TWCs used platinum and rhodium as the catalytically-active components. Palladium analogues of these platinum catalysts were developed later and have since become the dominant technology on light duty gasoline vehicles in most regions.

Volkswagen was the first company to fit platinum-based diesel oxidation catalysts – which were similar to the first gasoline two-way catalysts – to its diesel cars in 1989. In 1993, emissions rules were applied to new diesel passenger cars sold in the European Union and these catalysts began to be fitted as standard on new vehicles.

HOW DOES A DIESEL OXIDATION CATALYST WORK?

A diesel oxidation catalyst (DOC) functions by oxidising carbon monoxide and any unburnt hydrocarbons over a platinum group metal. Normally these reactions would only take place at very high temperatures but the use of a catalyst allows them to proceed at much lower temperatures. (In the oxygen-rich environment of a diesel engine exhaust, the reduction of NOx is hard to perform and there is little or no three-way activity.)

At ambient temperature, the catalyst will not oxidise either carbon monoxide or the unburnt hydrocarbons. However, as the temperature of the catalyst rises – when it is heated by hot exhaust gases almost immediately after the engine has started – both oxidation reactions begin to take place more quickly. The point at which this occurs is called the light-off temperature. Above this point, conversion efficiencies rapidly reach a steady state. Much of the development of DOCs has targeted the reduction of this light-off temperature in order to improve a vehicle's environmental performance, particularly when the catalyst is cold, soon after a vehicle's engine is started.

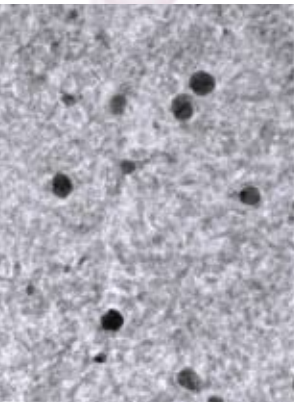
However, it is widely known that this catalytic performance will gradually worsen throughout the vehicle's lifetime. As the DOC ages, a variety of sulphur compounds derived from the diesel fuel can build up on its surface and poison its performance. Exposure to high operational temperatures also damages the catalyst's performance as the catalytically-active nanoscale platinum particles coalesce and their aggregate surface area decreases (a process known as sintering). With less of the precious metal's surface area exposed to the exhaust gases, the conversion efficiency falls too.

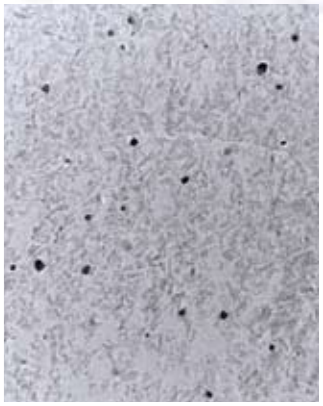
Development work has therefore been targeted at improving not only the "fresh" performance of platinum-based catalysts but also their "aged" performance. This has been achieved by optimising the size of the platinum particles in the catalyst and by strengthening the interaction between these particles and the base metal oxide materials used to support them.

WHY WAS PALLADIUM USED IN GASOLINE CATALYSTS BUT NOT IN DIESEL CATALYSTS?

The operating requirements for diesel catalysts are typically very different from those for three-way catalysts. Platinum has historically been favoured for use in diesel aftertreatment because the exhaust stream of a diesel engine is a highly oxidising environment and, under these conditions, palladium is readily converted to the less catalytically-active palladium oxide, whereas platinum remains in its metallic form. By comparison, in the more reducing environment of a gasoline engine's exhaust, palladium exists as the more catalytically-active palladium metal. As a result, palladium is generally a less active catalyst under diesel conditions than it would be in a gasoline vehicle.

The exhaust from a diesel engine is much cooler than that from a





The addition of palladium to a platinum diesel catalyst (above right) improves the thermal stability of the catalyst when compared to the platinum-only formulation (above left).

gasoline engine and this also has an effect. Both gasoline and diesel fuels can contain significant amounts of organic sulphur compounds which combust in the engine to form various gaseous sulphur species. These rapidly poison the performance of palladium catalysts. While platinum-based catalysts are also poisoned by these sulphur species, they are more tolerant to their presence.

In the higher temperature gasoline environment, desulphation often occurs spontaneously: in other words, the sulphates formed on the catalytic sites desorb in hot conditions and much of the catalyst's performance is restored. Unfortunately, in the cooler diesel environment this spontaneous desorption rarely occurs and palladium-based catalysts suffer deactivation by sulphur poisoning.

MOTIVATION FOR RESEARCH INTO THE INTRODUCTION OF PALLADIUM

Palladium is, compared to platinum, a less active catalytic material for these oxidation reactions. On its own in a diesel catalyst, it will often exist in its less active oxide form. It was therefore historically not the first choice of active metal for a scientist to use when developing a new catalyst. Fortunately for palladium demand, however, it has been known for some time that the addition of palladium to platinum in a supported catalyst can stabilise the catalyst, when it is heated, by forming bimetallic particles.

At the highest temperatures experienced by a diesel catalyst, platinum often sinters. As in a three-way catalyst, this means that the nanoscale platinum particles start to move around the support and merge to form larger particle aggregates with an associated loss of efficiency in the catalyst. The addition of palladium can stabilise the size of the precious metal particles when a catalyst is heated and thus ensure that the performance of the diesel catalyst is maintained at a high level for much longer.

Researchers have therefore attempted to use palladium alongside platinum in DOCs for a number of years to provide additional thermal stability. If this were achieved, the lifetime performance of a catalyst could be improved sufficiently to allow the use of a lower loading of platinum. Additionally, if the price of palladium were below that of platinum, the auto makers would potentially be able to improve the catalyst's performance in the real world and reduce costs at the same time.

OBSTACLES TO THE USE OF PALLADIUM IN DIESEL OXIDATION CATALYSTS

However, there were two major obstacles to the use of palladium in this way: one economic and one technical. The economic obstacle proved to be only temporary: while palladium was more expensive than platinum, the replacement of any platinum by palladium in a diesel catalyst was economically unattractive. However, since 2002 palladium has consistently been less expensive than platinum and its use has therefore been much more attractive to the car makers in purely economic terms.

The technical problem was more difficult to overcome. Palladium's catalytic activity is readily poisoned by sulphur and diesel fuel can contain significant amounts of sulphur-containing compounds. During the 1990s, for instance, diesel fuel in Europe could contain as much as 500 ppm of sulphur. However, the permitted level of sulphur has been steadily reduced and in 2005 the maximum sulphur content of European on-road diesel fuel was cut to 50 ppm. In February 2009 this fell again to only 10 ppm.

With sulphur levels falling this far, it became feasible to attempt to use palladium alongside platinum in diesel oxidation catalysts. Although research work had been ongoing for some time, the first public announcement of the development of such a platinum/palladium catalyst was made in 2004 and the very first commercial catalysts were fitted to vehicles during 2005.

The increased use of diesel particulate filters (DPFs) on European vehicles has also helped palladium make inroads into the light duty diesel sector. The soot which is retained in these filters needs to be removed regularly to avoid the build-up of high back

pressure in the exhaust system. This is achieved by temporarily altering the engine's performance in order to raise the temperature of the exhaust gas to the point at which carbon is removed, a process known as regeneration of the filter. These high temperature regeneration events also increase the temperature of the DOC and, with careful design of the catalyst, allow sulphur to be removed periodically from the DOC's surface. As a result, sulphur build-up on DOCs is less problematic if a particulate filter is also fitted to the vehicle. The high temperatures experienced by the catalyst during this regeneration process mean that the thermal stability of the catalyst becomes more important where a filter is fitted, making the use of platinum/palladium technology more attractive.

LIMITATIONS OF PALLADIUM USE IN DIESEL EMISSION CONTROL

Platinum/palladium diesel catalyst formulations are now widely in use in Europe but there remain some limitations to their use, even where low sulphur fuel is available, meaning that platinum-only catalysts are still employed on many diesel vehicles.

Firstly, palladium is not an equally effective catalyst for each of the oxidation reactions it is required to perform. It is not particularly effective at converting some of the hydrocarbons present in diesel exhaust gas while platinum is a better catalyst for this reaction. However, palladium is an effective catalyst for the carbon monoxide oxidation reaction, particularly at high concentrations of this gas. In contrast, platinum's performance in this particular catalytic reaction is temporarily poisoned by high carbon monoxide concentration (i.e. it becomes less effective the more of the gas there is).

Secondly, even in those applications where palladium has a place, there is likely to be an upper limit to the ratio of palladium to platinum in the catalyst. The two metals do not normally exist as separate catalytic sites but rather as a mixture of alloys. While the presence of palladium can provide much-needed thermal stability in a catalyst, the use of some platinum remains important in providing high catalytic activity for some of the oxidation reactions.

Finally, the role of a diesel oxidation catalyst has become progressively more complex as emissions legislation has tightened. Where simple oxidation of hydrocarbons and carbon monoxide was the role of the DOC, a limited range of catalytic formulations was employed. In current systems, a DOC can also be required to convert NO to NO_2 or to burn large quantities of fuel to heat the exhaust system quickly and it can be combined with a range of other types of aftertreatment. With a wider range of possible roles for the DOC, no single catalyst formulation can be universally applied.

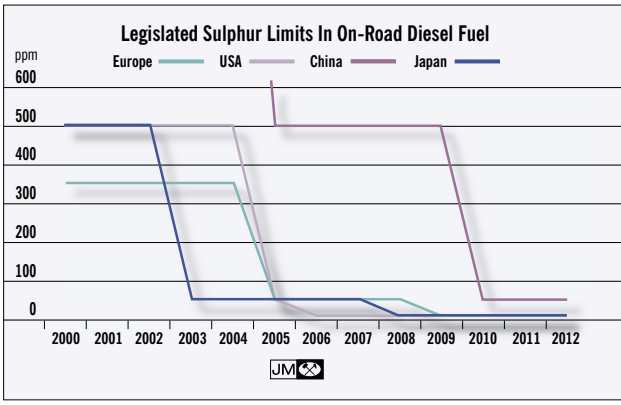
FUTURE DEVELOPMENTS IN THE USE OF PALLADIUM

While the platinum price fell heavily in late 2008, the palladium price fell too and a considerable price differential remains between the two metals. As a result, we expect palladium to make further inroads into the diesel sector as platinum/palladium formulations are introduced on an increasing proportion of European vehicles.

There is a considerable amount of ongoing research looking at increasing the use of palladium in place of some of the platinum in diesel oxidation catalysts and even in diesel particulate filters. A typical oxidation catalyst formulation currently in use might have a platinum:palladium ratio of 2:1 in weight terms (or about 1.2:1 in atomic terms). The launch of catalysts containing equal amounts of platinum and palladium seems now to be inevitable and further development beyond this ratio may be possible in some cases, although it may not prove possible to apply such technology universally.

The market share of platinum/palladium catalysts has also increased in the last few years, adding to palladium demand and helping to restrict the rapid growth in platinum demand which would otherwise have occurred. With the global market for diesel vehicles expected to expand over the medium term, good prospects exist for enhanced demand for both metals in the future too.

The maximum permitted sulphur content of on-road diesel fuel varies between different markets but is decreasing everywhere.



OTHER PLATINUM GROUP METALS

Net rhodium demand decreased to 689,000 oz in 2008. Rhodium supplies also fell, to 695,000 oz. Ruthenium demand slipped to 669,000 oz as net purchases by the electronics industry contracted. Demand for iridium fell to 102,000 oz. Supplies of both iridium and ruthenium decreased too.

RHODIUM

Net global rhodium demand fell by 18.4 per cent to 689,000 oz in 2008, largely due to the slowdown in the automotive industry and reduced demand for rhodium from glass producers. More metal was recovered from spent autocatalysts. Supplies of rhodium decreased by 15.7 per cent as South African producers failed to maintain output. Overall, the rhodium market was in a small surplus of 6,000 oz during 2008.

Autocatalyst Demand

Gross automotive demand for rhodium in 2008 was 14.3 per cent lower than in 2007, at 760,000 oz, the first decrease in rhodium demand since 2001.

Gross rhodium usage fell heavily – to 194,000 oz – in North America last year. The effects of falling vehicle production were exacerbated by a decrease in the average size of new vehicles sold and a trend towards lower rhodium catalyst loadings. Although the rhodium price reached its peak in mid-2008, it had already been at elevated levels for some time. This had driven considerable research and development efforts into rhodium thrifting (the reduction of rhodium content without worsening catalyst performance) which have now taken effect.

In Europe and Japan, gross rhodium demand also decreased. European vehicle production fell (although by a lower percentage than the fall in North American output) but the forthcoming introduction of Euro 5 emissions rules for light duty vehicles supported rhodium use to an extent. Vehicle manufacturing volumes in Japan changed little from 2007 levels but some thrifting took place, cutting Japanese rhodium demand by 14,000 oz.

In the Rest of the World region, gross rhodium demand fell to 144,000 oz. Production increased in many countries including Brazil, India and Russia. However, as in other regions, auto makers were able to thrift the rhodium from some catalyst formulations, driving gross rhodium usage lower. Rhodium use increased to 77,000 oz in China where rising production and new emissions legislation supported demand.

205,000 oz of rhodium were recovered from end-of-life catalysts in 2008, more than in 2007. The sharp rise in the rhodium price in early 2008 encouraged recyclers to process as many catalysts as possible, leading to higher recycling volumes in all regions.

Rhodium Supply and Demand
'000 oz

	2007	2008
Supply		
South Africa	696	574
Russia	90	85
North America	20	18
Others	18	18
Total Supply	**824**	**695**
Demand		
Autocatalyst: gross	887	760
recovery	(192)	(205)
Chemical	63	68
Electrical	3	3
Glass	59	38
Other	24	25
Total Demand	**844**	**689**
Movements in Stocks	**(20)**	**6**

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Other Demand

Glass industry demand for rhodium fell by 21,000 oz to 38,000 oz in 2008. While the economic slowdown weakened flat panel glass demand in late 2008, extra production capacity was installed in Asia during the year. However, the high rhodium price drove widespread dealloying throughout the glass industry. Reducing the rhodium content of the alloys used in this industry shortens their working life but the costs of more frequent replacement of parts were outweighed by the decrease in total metal costs. Glass sector demand was driven lower still by the release of rhodium from a number of cathode ray tube glass factories that closed in China in 2008.

In the chemical sector, rhodium demand rose slightly to 68,000 oz, due to the installation of new oxo-alcohol manufacturing capacity (for alcohols used as plasticisers or solvents) in China and the Rest of the World region. Rhodium use in electrical and other applications was stable at 28,000 oz.

Supplies

Supplies of rhodium fell heavily – by 15.7 per cent – to 695,000 oz during 2008. Over 80 per cent of supplies come from South Africa and lower production at many mines drove metal sales sharply lower to 574,000 oz.

This was despite the addition of capacity from newer mines producing rhodium-rich UG2 ore. Russian rhodium sales also fell, by 5,000 oz, to 85,000 oz.

RUTHENIUM & IRIDIUM

Net ruthenium demand in 2008 fell by 36.8 per cent to 669,000 oz, driven lower by reduced new metal purchases by the electronics industry and the chemical sector. Iridium demand declined marginally to 102,000 oz. Supplies of both metals fell but remained adequate to meet demand.

Demand

Net ruthenium demand fell for the second successive year, decreasing by 389,000 oz to 669,000 oz in 2008. While production of perpendicular magnetic recording (PMR) hard disks increased, more metal was recovered from the hard disk manufacturing process and net demand fell heavily. The use of ruthenium both in plasma display panels and in chip resistors fell.

Net demand for ruthenium from the hard disk sector fell to below 200,000 oz in 2008. The market share of PMR hard disks rose rapidly throughout 2008 and by the end of the year almost all disks manufactured used this technology. Despite this increase in the number of PMR disks, thrifting of their average ruthenium content restrained growth in the amount of metal consumed.

However, the major change in hard disk demand was related to movements in industry working stocks. In 2007, sputtering target and hard disk manufacturers purchased large quantities of ruthenium for working stocks. Since then, however, the average recycling time for spent targets has shrunk greatly, returning substantial amounts of ruthenium to the market and driving net demand lower.

Ruthenium Demand by Application
'000 oz

	2007	2008
Chemical	151	139
Electrochemical	62	60
Electrical	776	414
Other	69	56
Total Demand	1,058	**669**

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Ruthenium is used in photo-imageable thick film pastes used in the manufacture of plasma display panels (PDP). Production of flat screen televisions using PDP technology rose by 26 per cent in 2008 despite a slowdown in sales in late 2008. More importantly, though, the increasing use of lower ruthenium or even ruthenium-free pastes cut metal demand from this application substantially.

Ruthenium use in thick film chip resistors also fell. The number of these components manufactured climbed during 2008 but an ongoing trend towards miniaturisation drove the average ruthenium content of each resistor marginally lower.

Ruthenium demand from the chemical and electrochemical sectors fell by 14,000 oz to a combined 199,000 oz. Use in the chlor-alkali process was flat but purchases for process catalysis dropped by 12,000 oz. Ruthenium demand from other applications decreased by 18.8 per cent to 56,000 oz.

Iridium demand dipped from 104,000 oz in 2007 to 102,000 oz in 2008. We have restated demand for both years to reflect higher recycling rates of iridium crucibles than we had previously accounted for.

Fewer iridium crucibles were manufactured for crystal-growing in 2008 than in the previous year. These crystals are used in telecommunications and medical imaging, and the slowdown in the North American economy cut demand both for these crystals and the crucibles in which they are grown.

Iridium Demand by Application
'000 oz

	2007	2008
Chemical	23	21
Electrochemical	24	24
Electrical	25	15
Other	32	42
Total Demand	104	**102**

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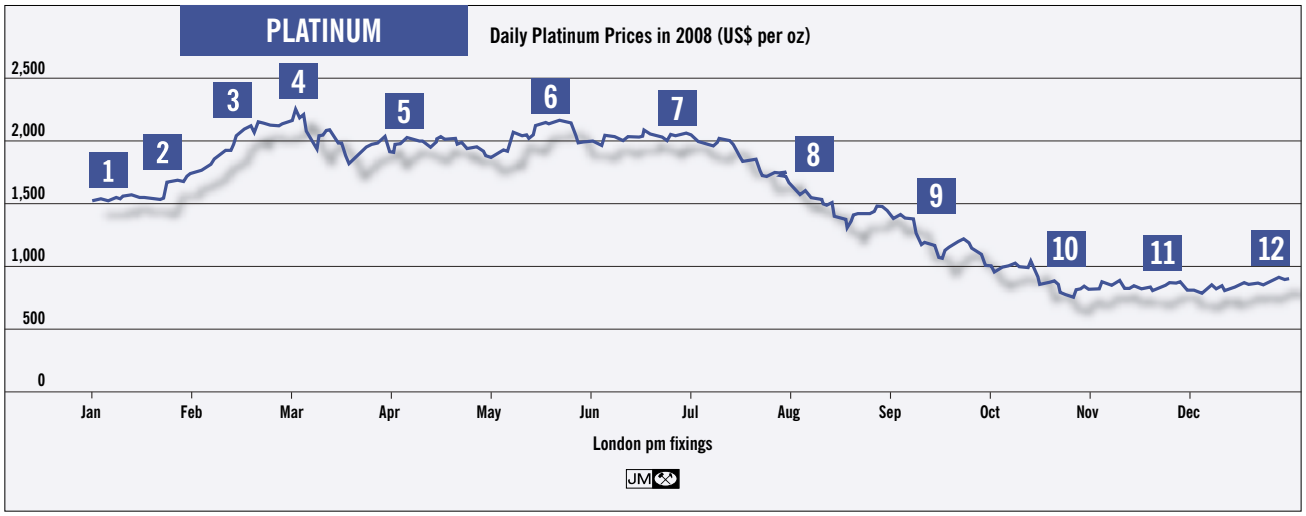
Demand for iridium for use in spark plugs and aero engine ignitors was flat in 2008 at 25,000 oz. Iridium plugs continue to increase their share of the higher end of the automotive market but demand was restrained by a fall in vehicle output in the main producing regions.

Chemical and electrochemical demand for iridium fell to 45,000 oz. Environmental legislation and efforts to improve energy efficiency are driving a transition from mercury technology to membrane cells in the chlor-alkali process, thereby increasing iridium demand. However, chemical sector demand fell in 2008.

Supplies

Supplies of ruthenium and iridium fell in 2008. Most mine production of both metals is from South Africa and electricity supply problems, smelter outages and a range of other issues forced supplies sharply lower. Even so, we believe that supplies were comfortably able to meet demand.

PRICES & FUTURES MARKETS



Supply disruption and strong investor interest drove platinum to record highs in the first half of 2008 before a collapse in confidence in the global economy sent the price crashing lower in the second half of the year.

2008 was an extraordinary year for the platinum market. The price started January at $1,530 and ended the year at $899. However, it did climb to an all-time record high of $2,276 in March, demonstrating the enormous volatility throughout almost the entire year. In fact, the year can readily be split into two halves: for the first six months, supply disruptions in South Africa, good end-user purchasing and strong fund interest boosted the platinum price to record levels; in the second half of the year, a resurgent US Dollar, global economic worries and plunging vehicle sales drove the price lower, to levels not seen since 2005.

1 The platinum price had climbed steadily during 2007, driven by a weak US Dollar and strong commodity prices and this momentum continued into 2008. The first fix of the year was $1,530, a little below the December 2007 record high of $1,544.

Average PGM Prices in $ per oz

	2007	2008	Change
Platinum	1,303.70	1,576.20	21%
Palladium	354.85	351.90	(1%)
Rhodium	6,190.55	6,563.90	6%
Ruthenium	579.60	322.55	(44%)
Iridium	446.95	450.05	1%

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

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The dollar continued its slide and platinum reached a new record of $1,555 on the 9th of **January**. There were many more record prices to come in the following months. Even at this early point of the year, worries over losses at the major international banks were causing volatility in commodity prices: alternative investments became more attractive than equities to many funds but every fall on the stock markets drove sales of commodities to cover losses elsewhere. In January, this mix of activity was largely positive for the platinum price, although it did introduce very high intra-day volatility.

The prospects of a cut in US interest rates depressed the dollar on the 14th and very healthy buying of platinum on the Shanghai Gold Exchange (SGE) sent the price to $1,589. A sharp drop in share prices drove sales of gold and other metals and the price slipped to $1,522 – the lowest price during the first half of 2008 – on the 22nd of January.

When US interest rates were cut by three quarters of a per cent later that day, this supported the price. On the 23rd, Anglo Platinum announced the short-term closure of its Amandelbult mine due to flooding, driving the price rapidly higher, to $1,591 on the 24th.

2 The most important moment in the first half of 2008 came on the 25th of January when the electricity supply problems, which had been occurring in South Africa since late 2007, intensified. With power outages increasing in number and becoming impossible to forecast, the mining industry stopped almost all of its activities. With the market already tight, platinum leapt higher in response to $1,681 that day.

3 Mining restarted in South Africa in late January but the price continued to rise. Investors saw an opportunity and quickly started to build large positions through the two European Exchange Traded Funds (ETFs) – over 105,000 oz of metal was bought in one month.

The price rose to $1,716 on the 29th before Eskom,

the South African power utility, announced that it could supply 90 per cent of the mines' power requirements. The price stabilised but, on the 31st, Eskom was forced to admit that it could not achieve even this target and the price started to climb again.

Platinum moved over $1,800 on the 6th of **February** despite a fall in physical purchasing in response to the rising price. It was further boosted by unfounded rumours that Russian exports could not meet contractual obligations. Japanese futures investors then took charge and propelled the price higher still. On the 11th, Anglo Platinum reduced its production forecast, generating yet more fund buying, and platinum shot to $2,010 on the 14th.

Each dip in the price was met with good physical buying and a rising gold price helped to drive platinum onwards. Just as importantly, the temporary closure of Anglo Platinum's Polokwane smelter on the 15th of February cut metal supply further. ETF buying continued and platinum leapt to $2,180 on the 21st.

4 Platinum continued to climb in early **March**. Gold approached $1,000, the dollar remained weak and large amounts of forward purchasing drove platinum to an all-time high of $2,276 on the 4th of March. This marked the highest point for the price during 2008.

5 Investors now took some of their profits, selling platinum and driving the price lower. ETF purchasing slowed and physical demand softened in response to the higher prices. However, uncertainty over both the South African electricity situation and the US economy generated very high volatility.

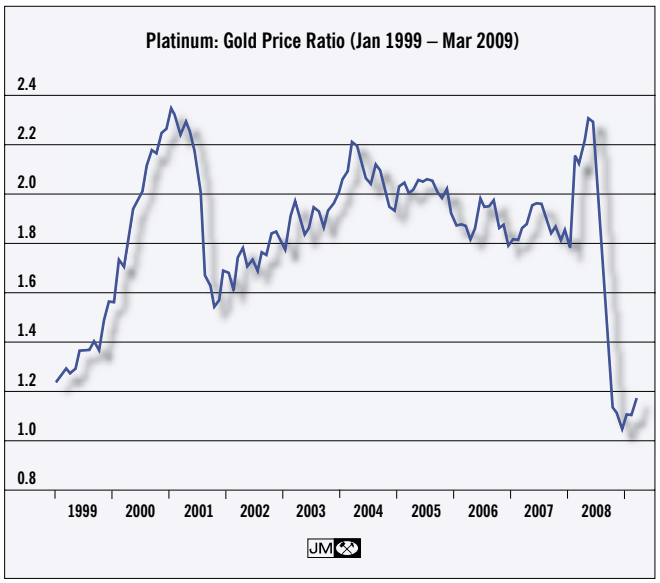
Funds started to liquidate some of their long positions, driven by Eskom's premature claim that it could provide 95 per cent of the mining companies' power needs. The price lurched $300 lower in just two days to $1,947 on the 10th of March. However, a weaker dollar and a strong investor appetite for gold pushed that metal over $1,000, helping platinum back over $2,000 the next day.

This pattern continued with investor sales repeatedly driving platinum below $2,000 and strong physical buying sending it back higher. Platinum did fall as far as $1,823 – its monthly low – on the 20th of March before finding good support from industrial purchasing.

Platinum fell $102 between the final fix of March and the first fix of **April** to $1,938 as funds sold-off gold, platinum and palladium to cover losses in the equity markets. Slowly, though, the volatility decreased and the price settled to $1,855 on the 2nd of **May**.

6 Excitement quickly returned to the platinum market in early May. Concerns remained over the ability of the South African platinum producers to maintain their output with a reduced electricity supply, prompting good physical purchasing and driving the price higher. On the 7th, the launch of an Exchange Traded Note (ETN) encouraged heavy fund buying, with platinum shooting up to $2,082 on the 9th. The price paused here but a range of stimuli – including a rising gold price and the spectre of further power cuts in South Africa – reinvigorated the market. Platinum peaked at $2,192 on the 22nd of May before buying interest diminished.

7 In **June**, attention turned to the worsening global economic situation and investors started to worry about demand for commodities including the platinum group metals. Fund sales of long positions forced the price lower but whenever the price dipped below



While platinum traded at roughly twice the price of gold for more than 5 years, the prices of these two metals converged in late 2008.

Platinum Prices in 2008
London am and pm fixings, $ per oz

	High	Low	Average
January	1,731.00	1,522.00	1,583.95
February	2,180.00	1,741.00	1,997.40
March	2,276.00	1,823.00	2,052.40
April	2,065.00	1,918.00	1,989.10
May	2,192.00	1,855.00	2,054.60
June	2,103.00	1,974.00	2,039.45
July	2,075.00	1,726.00	1,910.20
August	1,717.00	1,313.00	1,490.20
September	1,451.00	1,004.00	1,224.20
October	1,040.00	756.00	913.40
November	880.00	797.00	841.30
December	920.00	788.00	840.10
Annual	**2,276.00**	**756.00**	**1,576.20**

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$2,000, technical traders and "bargain-hunters" drove it higher. Although news of the worsening slowdown in the North American automotive market and in some European markets began to emerge, nothing seemed able to move the price far in either direction.

8 This stability was, though, purely an illusion: the platinum price weakened at the start of **July** as the scale of the problems in the global financial sector started to become apparent. Lonmin announced the temporary closure of its No.1 smelter at Marikana but any impact this might have had on the price was outweighed by weak North American vehicle production. Platinum fell to $1,986 on the 7th of July.

A falling dollar helped the platinum price to bounce back to $2,040 on the 11th but sales of 25,000 oz of metal by ETF investors reversed the tide. Both selling on TOCOM and the announcement by General Motors of hefty cuts in its planned vehicle production hit platinum, which dropped to $1,956 on the 16th.

With the technical support at the $2,000 level removed, the platinum price crashed lower. There was turmoil in the financial markets with investors liquidating many long positions in favour of cash, helping the dollar – in its role as a safe haven investment – to strengthen. Net long positions on the futures exchanges dropped by half during July, sending the price spiralling down to end the month at $1,758.

The dollar continued to strengthen and the selling from funds and other investors persisted. TOCOM opened limit down on a number of successive days early in **August**, keeping the pressure on the price which slipped below $1,600 on the 4th despite strong physical purchasing in Tokyo and Shanghai.

A one-day strike in the South African mining industry on the 6th pushed platinum back over $1,600 but negative investor sentiment was now dominant. Other commodity prices crumpled and platinum followed: ETF redemptions and sales of futures positions and physical metal applied further pressure, and the price collapsed to a monthly low of $1,313 on the 19th.

9 The release of poor US economic data on the 20th of August halted the dollar's rise briefly and allowed the price to recover some ground. Short covering in oil on the 21st drove many commodities higher with platinum peaking at $1,494 on the 28th.

Once again the automotive market intervened: Toyota cut its sales forecasts and the price slipped lower again as the investment community continued its selling. Simultaneously, physical purchasing decreased sharply as production cuts from the auto makers led to lower requirements for platinum from this sector.

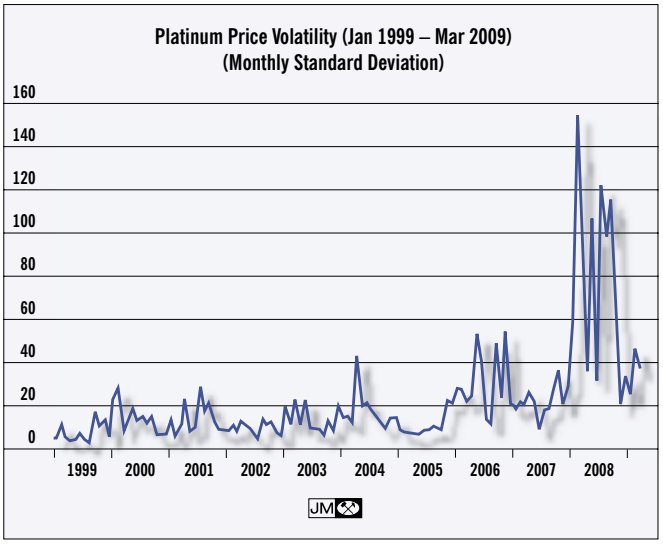
On the 3rd of **September**, US hedge fund Ospraie announced that the losses suffered at its flagship commodities fund meant that this would close. Platinum dropped to $1,330 on TOCOM early the following day before strong purchasing on SGE drove the price back as high as $1,423 later that day.

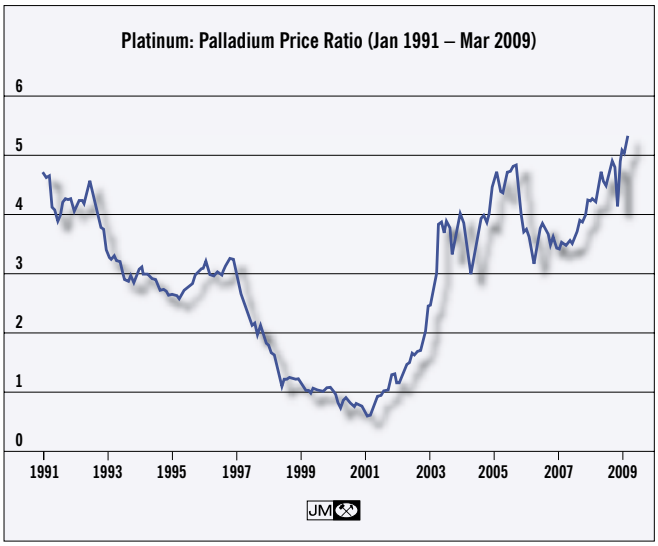
Further investor sales drove the price lower before Lehman Brothers filed for bankruptcy protection on the 11th. This sent shockwaves through the market. Almost every asset was driven sharply downwards and platinum collapsed to $1,073 on the 17th before the pressure relented.

US Treasury proposals on dealing with so-called toxic debts then provoked wild outbreaks of optimism. The resignation of South African President Thabo Mbeki also boosted the platinum price which reached momentary stability at $1,225 on the 23rd.

10 Concern over the US Treasury's rescue plan developed as it was initially rejected by US legislators. The financial markets reacted negatively and the platinum price simply crumbled to $985 on the 2nd of **October**, the first time it had been under $1,000 since late 2005. With Chinese buyers absent due to a national holiday, platinum hit a low of $959 on the 3rd. When they returned on the

The volatility of the platinum price has risen in the last decade and, despite decreasing recently, remains at historically high levels.





The ratio of the platinum and palladium prices continued to grow steadily in 2008.

6th, an astounding 431 kg of metal changed hands on SGE and the price bounced back over $1,000, reaching a high of $1,032 on the 14th before running into resistance. However, European vehicle sales softened, eroding investors' confidence in platinum. The price slipped below $1,000 on the 15th: it did not return above this level again in 2008.

Strong Asian physical buying could not prevent the price retreating further in the face of substantial sales of metal by funds and sharply decreased physical purchases of platinum, especially by the automotive industry. Expectation of a rate cut by the European Central Bank firmed the dollar and more cuts in car production were accompanied by the sale of 45,000 oz of metal from the London ETF. Platinum crashed to its low for the year of $756 on the 27th of October.

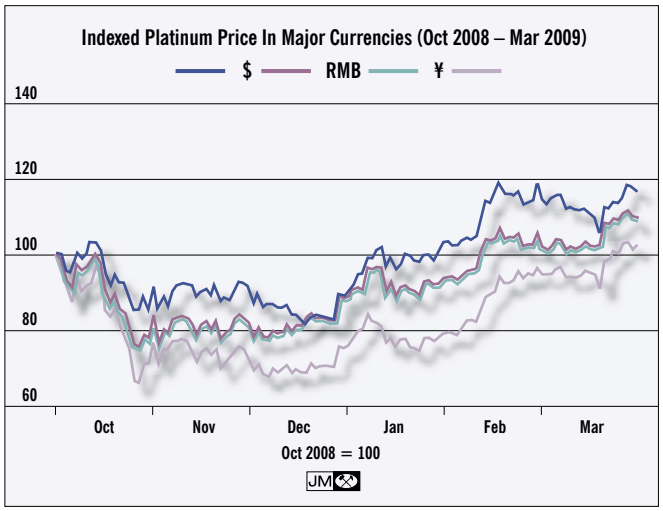
11 On the 28th of October, Aquarius signalled the first response of the South African producers to the low metal price when it shut a shaft at its Marikana operations. The dollar weakened and platinum rebounded over $800. NYMEX net long speculative positions started to grow again on a possible resumption of electricity cuts in South Africa. The platinum price finally recovered a degree of stability and established itself in a range between $800 and $900, amidst very healthy buying of platinum by investors in Japan and industrial and jewellery users in China.

However, fundamentals still played little part: when Anglo Platinum announced the temporary closure of its Polokwane smelter for the second time in a year, this could only drive the price to $870 at the second fix on the 5th of **November**. Likewise, a warning from General Motors that it could run out of cash in the first half of 2009 could only push platinum down to $849 on the 7th. As asset prices everywhere fluctuated, platinum remained volatile but largely range-bound until terrible US unemployment data was released on the 5th of **December**. Almost every commodity fell and platinum plummeted to $788 that day.

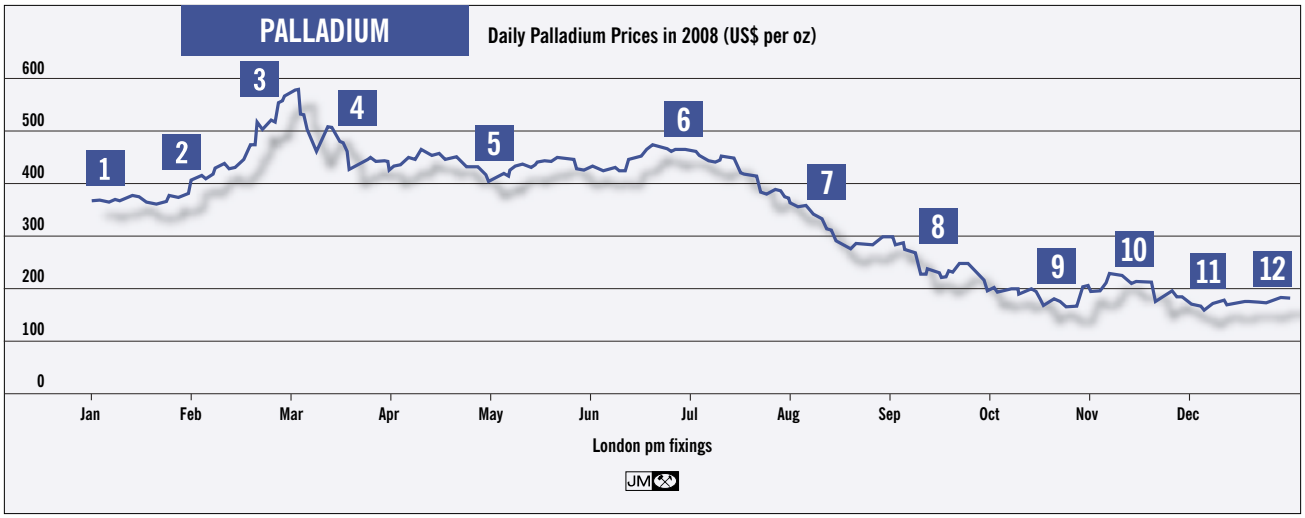
12 The remainder of 2008 was positive for platinum. The US Government announced an enormous public works programme and commodity prices soared, with platinum reaching $842 on the 8th of December, supported by Aquarius Platinum's temporary closure of its Everest mine.

Now the focus shifted to the health of the automotive industry. Slowing car sales depressed the platinum price even as gold inched higher. Progress on discussions about a bail-out for the "Big Three" provided some support but platinum fell back to $801 on the 12th when the US Senate rejected the proposal. This was the first time that the platinum price had fallen below that of gold for over ten years.

Currency movements came to the rescue: the dollar plunged on speculation that US interest rates might be cut to zero and platinum climbed to $874 on the 18th of December. A strong gold price then kept platinum close to this level, with a final fix before Christmas of $856. Amidst thin conditions, a rising oil price dragged platinum to a year-end $899, a long way below its highs earlier in the year.



The fall in the platinum price in Yen and Chinese Renminbi in late 2008 encouraged very strong physical purchasing and supported the metal price.



The palladium price rose strongly in the first half of 2008 but collapsed in the second half of the year as investors sold large amounts of metal.

2008 saw remarkable volatility in the palladium market: the price began the year at $370 and climbed to $588 in March, its highest point since 2001. Strong gold and platinum prices in the first half of 2008 supported palladium as did robust physical demand. However, investor sales hit the price later in the year. With vehicle sales slow in many regions, physical demand diminished too and the price ended the year at $183.50.

1 Palladium started 2008 at $370, just below its 2007 high, but with little momentum. Although the palladium price crept higher, pulled along by a buoyant platinum price and a rising dollar, it remained in a range of $360-$380 for the first two weeks of **January**. Good volumes of metal changed hands on the fixes on the 14th, propelling palladium to a mid-month peak of $382 before profit-taking appeared. Falls in a number of stock markets around the world drove commodity sales by funds to cover their losses and palladium softened to a monthly low of $363 on the 22nd.

2 A large cut in US interest rates depressed the dollar on the 22nd and 23rd of January, boosting precious metal prices. Palladium drove through the $380 mark on the 25th on news of the suspension of mining and mineral processing in South Africa in response to the uncertain supply of electricity.

As the platinum price hit a succession of records, palladium kept rising. Investor buying pulled palladium to $402 on the 1st of **February** – the first time it had been at this level since May 2006. However, the price kept following platinum's lead and moving inexorably higher. It reached the $420 mark on the 4th and established a new six-year high as it climbed to $443 on the 11th before meeting significant resistance.

3 Palladium drifted sideways for several days before rising above $450 in the spot market in New York on the 15th of February. ETF buying interest, which was already significant, suddenly accelerated. Investors purchased over 130,000 oz of metal through these funds in the last two weeks of February alone. The price leapt in response, reaching $484 and briefly cresting $500 on NYMEX before heavy fund profit-taking reappeared. The price dipped to $469 but, with the dollar weak and gold and platinum prices buoyant, investor money flooded into palladium too. The price rushed to $568 on the 29th of February – a monthly rise of over 40 per cent – and $588, its high for the year, on the 4th of **March** as platinum peaked too. Palladium crawled to $595 on the spot market later that day but was finally driven lower by profit-taking.

4 Palladium now fell rapidly, as the selling pressure intensified, shedding ten per cent of its value in one day when it dropped to $532 at the afternoon fix in London on the 5th of March. It continued to fall even as gold rose towards the psychologically-important $1,000 level. It crashed downwards through the $500 mark on the 7th as investors sold-off some positions and briefly came to rest at $463 on the 10th, more than twenty per cent below where it had been one week previously.

The dollar then weakened and gold reached $1,000 an ounce for the first time ever on the 13th of March.

This provided considerable strength to the palladium price which rebounded to $514 the same day before more fund sales forced it back down to a monthly low of $425 on the 20th of March.

5 Net long speculative positions on NYMEX fell below a million ounces for the first time in 2008 and ETF purchasing slowed. While the price was still highly volatile by ordinary standards, the level of volatility decreased steadily and palladium traded only between $415 and $470 for the whole of **April** without exhibiting any clear direction.

However, the release of poor US automotive sales figures at the start of **May** hit palladium and the price slumped to a monthly low of $406 on the 1st. However, consumer purchasing remained strong and the price climbed once more, following platinum and gold. On the 8th, Lonmin and Stillwater both released production data showing decreased palladium output, adding further strength to the price. Palladium finally peaked at $455 on the 22nd. However, gold fell back below $900 and dragged other precious metals lower. Fears over a slowing global economy intensified and palladium slipped to $421 on the 5th of **June**.

6 The palladium price initially followed platinum higher in June but the key moment came on the 12th when comments that Russian state palladium stocks could effectively be depleted within the next five years were reported. Investors reacted immediately and the price hit $450 on the 13th. Technical buying helped palladium outpace platinum and it forced its way to a peak of $475 on the 20th of June, before dropping into a range of $460-$470 by the end of the month.

Palladium Prices in 2008
London am and pm fixings, $ per oz

	High	Low	Average
January	388.00	363.00	374.30
February	568.00	402.00	467.65
March	588.00	425.00	490.25
April	469.00	417.00	446.60
May	455.00	406.00	435.90
June	475.00	421.00	449.30
July	468.00	376.00	427.25
August	375.00	274.00	316.00
September	304.00	199.00	248.85
October	207.00	168.00	190.85
November	233.00	179.00	207.10
December	184.00	164.00	176.15
Annual	**588.00**	**164.00**	**351.90**

JM

7 Now, though, the price weakened dramatically. Slowing automotive production in North America was confirmed in early **July** and palladium tested the support at $450, slipping below that level on the 7th. Investor sales of metal accelerated and net long speculative positions on NYMEX halved during the month even as ETF positions grew. On the 15th, a wide range of commodities was sold to cover margin calls elsewhere. Palladium was hit again by very substantial long liquidation on the 23rd and 24th. This outweighed healthy physical purchasing and drove palladium to $376 on the 30th of July before the selling slowed.

Physical buying decreased in intensity as the car makers entered their traditional holiday season. Short positions on NYMEX increased and continued fund sales of metal were not matched by end user purchasing. Gold hit an eight-month low on the 12th of **August** and palladium fell to a low of $310 that day.

Further dollar strength, sales of metal in Asia and stop-loss selling in Europe all came on the 15th, forcing palladium nine per cent lower between two fixings. Investment bank selling added the final touch and palladium hit a new low of $274 on the 19th.

8 Palladium finally found some respite at this level and with many of the "weak longs" having left the market, low levels of physical purchasing were just enough to push the price to $304 on the 1st of **September**.

However, investors were now focusing on the emerging chaos in the world's financial markets and on slowing global automotive production. With funds looking to release cash – particularly US Dollars – and move their investments into safer areas, palladium was hit hard. The dollar reached a one-year high against the Euro on the 9th of September and a wave of fund sales followed, with palladium being flung to a paltry $218 on the 11th before it could find good buying interest and begin to grind its way higher. Encouraged by the optimism that accompanied the US Government's proposed bail-out plan for the banking system, it finally re-emerged above $250, fixing at $253 on the 23rd.

9 The price settled close to $250 as the American bail-out plan was discussed in late September. However, when US legislators finally rejected the plan on the 29th, palladium collapsed to end the month at only $199.

The new lower palladium price encouraged buying from investors and end users in early **October**. Palladium quickly bounced back over $200 but worries over the global economy and weakening industrial demand restrained the price. The dollar gradually strengthened and increased the pressure on commodities. The release of poor European automotive

production data finally overcame the inertia in the price and palladium fell to $168 on the 24th of October, despite the closure of North American Palladium's Lac des Iles mine in response to the low prices.

10 Again, the low palladium price encouraged strong buying. The price shot back over $200 on the 29th of October. Purchasing of metal through the ETFs provided further vigour to the price ahead of the US Presidential election, giving palladium just enough impetus to send it to a monthly high of $233 on the 6th of **November**.

However, reality intervened again: Toyota cut its production forecasts and the announcement of enormous losses at the major US vehicle manufacturers drew all the energy from the palladium market. The price inched lower to $227 on the 10th of November, and then started to slide faster as the US Dollar firmed. ETF investors turned sellers on the 11th and 12th and drove palladium down to $211 on the 13th. Negative sentiment regarding the automotive sector prompted investor sales on the 19th and palladium plunged to a monthly low of $179 on the following day.

11 There was almost no support for palladium until gold came to the rescue on the 21st of November when a $50 rise in its price finally provided some stability to the palladium price. The US financial authorities intervened in the bank markets by helping to rescue the ailing Citigroup. This lessened the sense of panic in the market and weakened the dollar, sending palladium briefly over $200 on the 25th before investors took what profits they could find. However, a constant flow of negative news on the US economy fractured the little confidence remaining and palladium retreated again to its annual low of $164 on the 5th of **December**.

12 In early December, a US Government proposal to stimulate its economy by investing very large amounts of capital in infrastructure projects soothed the markets and drove the dollar downwards. Gold rose as a result and palladium followed gingerly, moving to $178 on the 8th and into a range of $175-$180. It briefly fell through the bottom of this range on the 12th following the US Senate's rejection of the rescue plan for the Detroit car makers. However, the dollar softened on speculation of interest rate cuts in the USA and palladium recovered somewhat, rising to end the year at $183.50.

OTHER PGM

The rhodium price was buffeted by interruptions to South African metal supply in the first half of 2008 and by worsening economic sentiment and weak automotive sales in the second half. This drove a dizzying price rise from $6,850 at the start of 2008 to a record high Johnson Matthey Base Price of $10,100 in June. However, the price turned sharply lower and plummeted to end December at $1,250.

Rhodium started 2008 at $6,850, a little below its 1990 record high of $7,000. Constant end user buying applied upward pressure on the price, which hit a record $7,025 on the 9th of **January**.

On the 25th of January, the disruption caused by the South African electricity crisis hit rhodium. With consumer buying strong, rhodium rose over $2,000 in less than a month to $9,080 on the 20th of **February**. Lingering worries over South African supplies drove the price to a high of $9,425 on the 7th of **March** before buying dissipated. The price fell to $8,925 on the 2nd of **April** but purchasing returned – seemingly from industrial users buying metal instead of borrowing it – and easily outweighed the small numbers of offers of metal, pushing the price to $9,900 on the 28th of **May**.

The price fell back to $9,525 in early **June**, driven by forward rhodium sales from the new Blue Ridge mine in South Africa. However, investors were now targeting new highs and rhodium finally broke the $10,000 barrier on the 17th and peaked at $10,100 on the 19th of June.

Now, though, the price turned around quickly: a slowdown in North American vehicle production and rumours of speculator and auto company sales of rhodium drove the price down to $8,000 on the 4th of **August**. With South African rhodium supplies stronger than in early 2008, there was little support: dealers were unwilling to hold long positions and buyers vanished. Rhodium plummeted, passing $7,000 on the 13th and finally stopping at $3,850 on the 21st of August, less than half of its value at the start of the month.

Some end user buying reappeared and drove the price sharply back to $6,200 on the 27th of August before stability returned to the market. However, slowing global vehicle production affected rhodium again in early **September** with the price falling by $1,000 in a single day to $4,900 on the 3rd of the month. Rumours of further selling by hedge funds or by car

companies dogged the market and rhodium ended the third quarter weakly at $4,350.

The rhodium price plunged again in **October**. Low levels of buying from end users could not match sustained selling and the price slipped to $3,300 on the 6th. Buyers remained scarce and the price fell further to a sickly $1,450 on the 6th of **November** before the temporary closure of Anglo Platinum's Polokwane smelter injected some life into the market. Rhodium bounced to $1,600 the next day but selling resurfaced and it hit a yearly low of $1,000 on the 25th of November, over ninety per cent below its mid-2008 peak.

Rhodium finally changed direction in **December** when gentle purchasing and a spell of market exuberance dragged the price to a year-end $1,250.

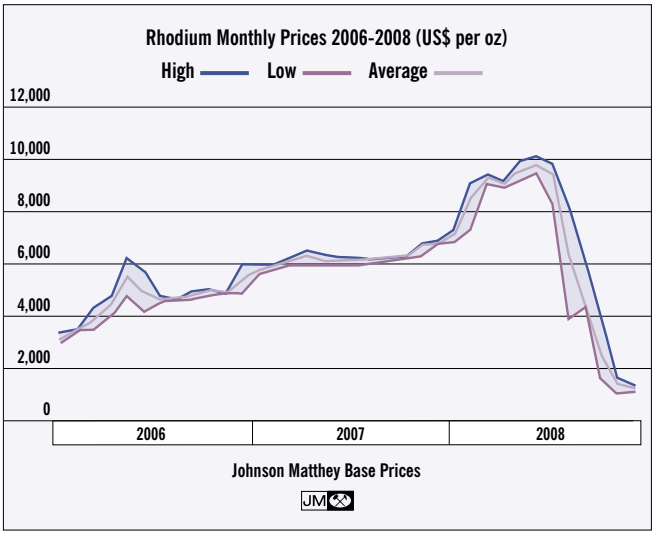
The ruthenium price slipped lower throughout almost all of 2008, trading at an average price of $322.55, 44.3 per cent lower than a year before.

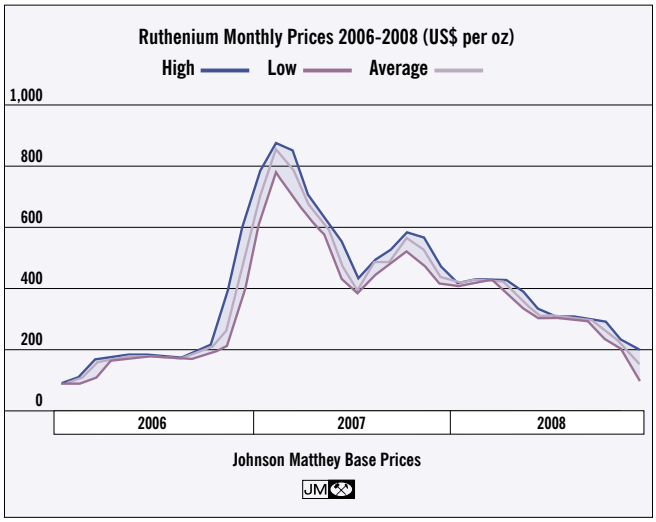
Ruthenium started 2008 positively at $415 and, although the first movement was downwards to $405 in early **January**, a small amount of speculator investment and end user purchasing drove the price to a high of $425 in **February**. Ruthenium remained at this level until early **April**. Large amounts of recycled metal were now returning from the hard disk industry, outweighing slow physical demand and the price was consequently driven lower to $300 by the end of **June**.

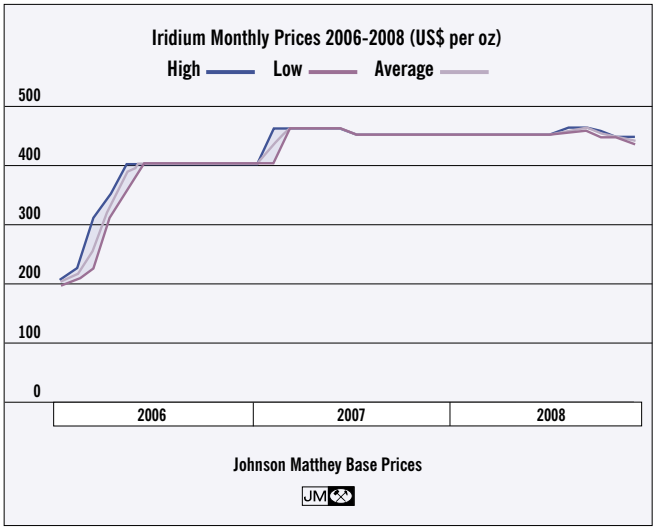
Some buying returned and the ruthenium price stabilised close to this level. However, as the global economic outlook worsened, demand from the hard disk sector slowed and the price fell once more. Ruthenium took regular steps lower and fell to $230 at the end of **October** and $200 at the end of **November**. The continued mismatch between demand and combined primary and secondary supply drove the price lower still and ruthenium ended the year at $100, where it had last been in February 2006.

Iridium was the quietest of the platinum group metals, trading at an average price of $450.05 during 2008, marginally higher than one year previously.

Iridium remained stationary at $450 for the first half of the year before climbing marginally higher on steady industrial buying. It reached a high of $460 in mid-**August** but the economic malaise that was affecting other commodities began to affect iridium too. With industrial demand weakening, the price softened in the final quarter to end 2008 at $435.

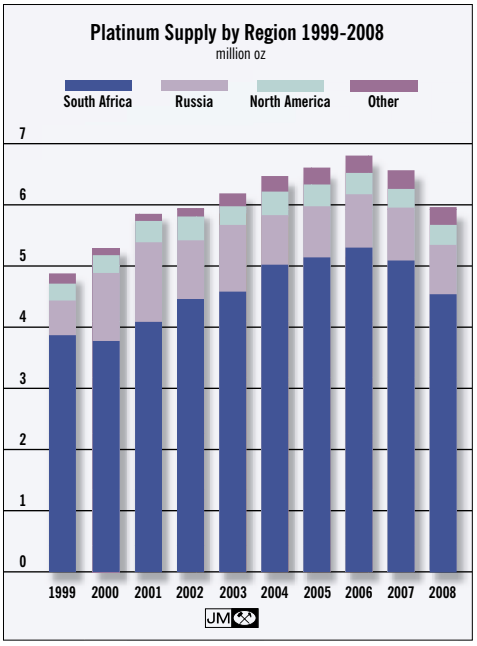


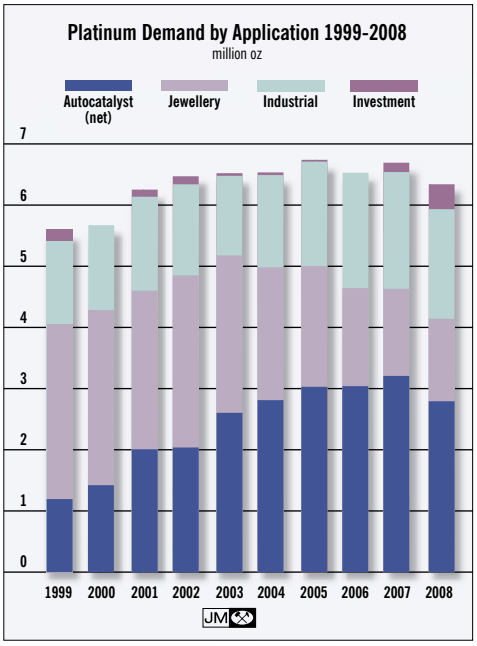




Platinum Supply and Demand

	'000 oz	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Supply[1]	South Africa	3,900	3,800	4,100	4,450	4,630	5,010	5,115	5,295	5,070	4,530
	Russia[8]	540	1,100	1,300	980	1,050	845	890	920	915	820
	North America	270	285	360	390	295	385	365	345	325	325
	Others	160	105	100	150	225	250	270	270	290	295
	Total Supply	**4,870**	**5,290**	**5,860**	**5,970**	**6,200**	**6,490**	**6,640**	**6,830**	**6,600**	**5,970**
Demand by Application[2]	Autocatalyst: gross[3]	1,610	1,890	2,520	2,590	3,270	3,490	3,795	3,905	4,145	3,805
	recovery[4]	(420)	(470)	(530)	(565)	(645)	(690)	(770)	(860)	(935)	(1,005)
	Chemical	320	295	290	325	320	325	325	395	420	395
	Electrical	370	455	385	315	260	300	360	360	255	225
	Glass	200	255	290	235	210	290	360	405	470	390
	Investment[7]	180	(60)	90	80	15	45	15	(40)	170	425
	Jewellery	2,880	2,830	2,590	2,820	2,510	2,160	1,965	1,640	1,455	1,365
	Petroleum	115	110	130	130	120	150	170	180	205	245
	Other	335	375	465	540	470	470	475	490	495	500
	Total Demand	**5,590**	**5,680**	**6,230**	**6,470**	**6,530**	**6,540**	**6,695**	**6,475**	**6,680**	**6,345**
	Movements in Stocks[5]	**(720)**	**(390)**	**(370)**	**(500)**	**(330)**	**(50)**	**(55)**	**355**	**(80)**	**(375)**
	Average price (US$)[6]	**377**	**545**	**529**	**540**	**691**	**846**	**897**	**1,143**	**1,304**	**1,576**



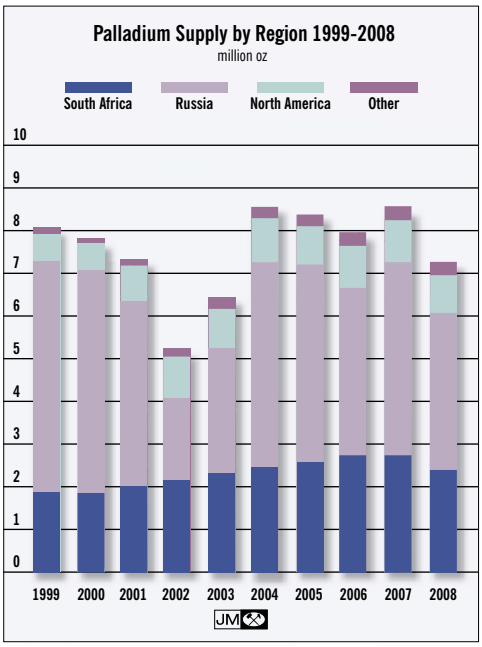


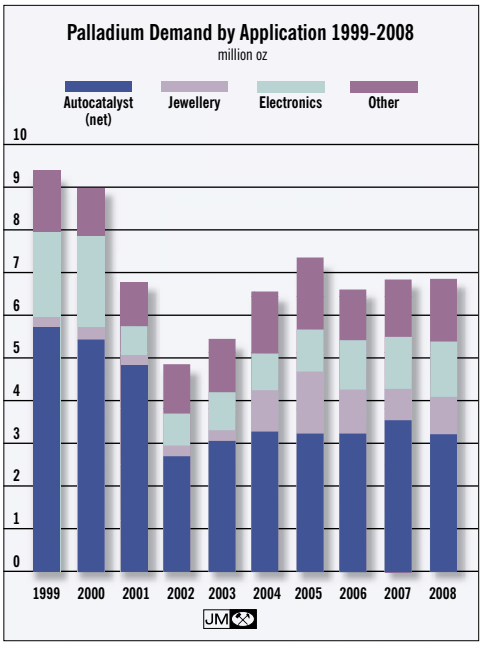
Platinum Demand by Application: Regions

	'000 oz	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Europe	Autocatalyst: gross	560	680	1,060	1,210	1,455	1,680	1,960	2,060	2,055	2,020
	recovery	(30)	(40)	(70)	(90)	(115)	(145)	(170)	(190)	(215)	(245)
	Chemical	80	100	105	115	105	115	100	100	110	105
	Electrical	70	80	65	40	35	40	40	25	15	15
	Glass	20	20	10	10	10	5	10	10	15	(5)
	Investment	5	0	0	0	0	0	0	0	195	105
	Jewellery	185	190	170	160	190	195	195	195	200	195
	Petroleum	15	15	15	15	15	15	15	20	25	35
	Other	90	105	155	190	185	190	175	175	185	185
	Total	995	1,150	1,510	1,650	1,880	2,095	2,325	2,395	2,585	2,410
Japan	Autocatalyst: gross	250	290	340	430	500	615	600	605	610	595
	recovery	(60)	(60)	(55)	(55)	(60)	(55)	(35)	(35)	(35)	(60)
	Chemical	20	20	25	30	40	40	50	50	55	55
	Electrical	75	90	80	55	40	50	65	55	35	30
	Glass	65	65	85	60	85	90	95	100	85	80
	Investment	110	(95)	45	40	(10)	15	(15)	(65)	(60)	275
	Jewellery	1,320	1,060	750	780	660	560	510	360	180	55
	Petroleum	5	5	5	5	5	5	5	5	5	10
	Other	35	35	35	55	40	40	45	40	45	45
	Total	1,820	1,410	1,310	1,400	1,300	1,360	1.320	1,115	920	1,085
North America	Autocatalyst: gross	535	620	795	570	885	800	820	705	850	560
	recovery	(315)	(350)	(370)	(380)	(420)	(435)	(505)	(575)	(605)	(610)
	Chemical	95	100	100	100	95	90	100	100	95	95
	Electrical	120	145	120	100	85	90	95	75	55	30
	Glass	25	50	35	30	(30)	(10)	5	10	25	(5)
	Investment	60	35	45	40	25	25	25	20	30	40
	Jewellery	330	380	280	310	310	290	275	245	220	195
	Petroleum	40	35	40	45	40	35	35	35	30	25
	Other	190	210	250	265	215	205	220	225	215	215
	Total	1,080	1,225	1,295	1,080	1,205	1,090	1,070	840	915	545
China[9]	Autocatalyst: gross	5	10	15	35	60	75	120	155	175	185
	recovery	0	0	0	0	0	0	0	0	(10)	(15)
	Chemical	15	20	10	10	10	10	10	65	70	60
	Electrical	20	20	15	15	15	20	25	45	20	30
	Glass	25	35	65	40	30	60	70	50	180	125
	Investment	5	0	0	0	0	0	5	0	0	0
	Jewellery	950	1,100	1,300	1,480	1,200	1,010	875	760	780	850
	Petroleum	10	15	15	5	5	5	5	10	10	10
	Other	5	5	5	5	5	5	10	10	15	20
	Total	1,035	1,205	1,425	1,590	1,325	1,185	1,120	1,095	1,240	1,265
Rest of the World[8,9]	Autocatalyst: gross	260	290	310	345	370	320	295	380	455	445
	recovery	(15)	(20)	(35)	(40)	(50)	(55)	(60)	(60)	(70)	(75)
	Chemical	110	55	50	70	70	70	65	80	90	80
	Electrical	85	120	105	105	85	100	135	160	130	120
	Glass	65	85	95	95	115	145	180	235	165	195
	Investment	0	0	0	0	0	5	0	5	5	5
	Jewellery	95	100	90	90	150	105	110	80	75	70
	Petroleum	45	40	55	60	55	90	110	110	135	165
	Other	15	20	20	25	25	30	25	40	35	35
	Total	660	690	690	750	820	810	860	1,030	1,020	1,040

Palladium Supply and Demand

	'000 oz	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Supply[1]	South Africa	1,870	1,860	2,010	2,160	2,320	2,480	2,605	2,775	2,765	2,430
	Russia[8]	5,400	5,200	4,340	1,930	2,950	4,800	4,620	3,920	4,540	3,660
	North America	630	635	850	990	935	1,035	910	985	990	910
	Others	160	105	120	170	245	265	270	270	285	310
	Total Supply	**8,060**	**7,800**	**7,320**	**5,250**	**6,450**	**8,580**	**8,405**	**7,950**	**8,580**	**7,310**
Demand by Application[2]	Autocatalyst: gross[3]	5,880	5,640	5,090	3,050	3,450	3,790	3,865	4,015	4,545	4,380
	recovery[4]	(195)	(230)	(280)	(370)	(410)	(530)	(625)	(805)	(1,015)	(1,170)
	Chemical	240	255	250	255	265	310	415	440	375	350
	Dental	1,110	820	725	785	825	850	815	620	630	630
	Electronics	1,990	2,160	670	760	900	920	970	1,205	1,240	1,325
	Jewellery	235	255	240	270	260	930	1,430	995	715	855
	Investment[7]	0	0	0	0	30	200	220	50	260	400
	Other[7]	110	60	65	90	110	90	265	85	85	80
	Total Demand	**9,370**	**8,960**	**6,760**	**4,840**	**5,430**	**6,560**	**7,355**	**6,605**	**6,835**	**6,850**
	Movements in Stocks[5]	**(1,310)**	**(1,160)**	**560**	**410**	**1,020**	**2,020**	**1,050**	**1,345**	**1,745**	**460**
	Average price (US$)[6]	**358**	**681**	**603**	**337**	**201**	**230**	**201**	**320**	**355**	**352**





Palladium Demand by Application: Regions

	'000 oz	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Europe	Autocatalyst: gross	1,530	1,900	1,730	1,370	1,220	1,105	975	890	920	950
	recovery	(10)	(15)	(30)	(45)	(70)	(110)	(165)	(225)	(300)	(365)
	Chemical	65	95	65	70	65	70	155	175	95	100
	Dental	180	100	50	55	70	80	75	75	70	65
	Electronics	255	265	35	85	85	115	80	105	160	165
	Jewellery	50	45	35	35	35	35	35	40	40	45
	Investment	0	0	0	0	0	0	0	0	280	370
	Other	25	20	20	15	20	25	20	25	20	20
	Total	2,095	2,410	1,905	1,585	1,425	1,320	1,175	1,085	1,285	1,350
Japan	Autocatalyst: gross	600	510	505	520	550	635	660	795	820	850
	recovery	(55)	(50)	(40)	(40)	(40)	(40)	(30)	(30)	(35)	(65)
	Chemical	20	20	20	20	25	25	25	25	25	20
	Dental	545	470	475	505	515	520	475	270	275	275
	Electronics	980	990	260	140	225	235	265	275	270	250
	Jewellery	105	150	140	165	160	155	145	130	95	75
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	10	15	10	10	5	10	10	10	10	10
	Total	2,205	2,105	1,370	1,320	1,440	1,540	1,550	1,475	1,460	1,415
North America	Autocatalyst: gross	3,490	2,805	2,375	640	1,205	1,445	1,430	1,415	1,695	1,345
	recovery	(125)	(155)	(200)	(260)	(270)	(345)	(390)	(500)	(590)	(625)
	Chemical	75	65	75	75	70	85	85	80	75	55
	Dental	350	230	190	215	225	235	250	260	265	270
	Electronics	405	485	250	210	215	185	195	190	140	155
	Jewellery	10	10	10	10	10	10	20	40	55	60
	Investment	0	0	0	0	30	200	220	50	(20)	30
	Other	50	5	15	45	65	30	215	30	30	25
	Total	4,255	3,445	2,715	935	1,550	1,845	2,025	1,565	1,650	1,315
China[9]	Autocatalyst: gross	0	15	40	55	90	105	170	220	325	385
	recovery	0	0	0	0	0	0	0	0	(20)	(30)
	Chemical	30	30	30	40	40	50	55	65	80	55
	Dental	0	0	0	0	5	5	5	5	5	5
	Electronics	150	175	100	75	240	275	275	315	325	365
	Jewellery	40	20	25	30	25	700	1,200	760	500	650
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	5	5	5	5	5	10	5	10	10	10
	Total	225	245	200	205	405	1,145	1,710	1,375	1,225	1,440
Rest of the World[8,9]	Autocatalyst: gross	260	410	440	465	385	500	630	695	785	850
	recovery	(5)	(10)	(10)	(25)	(30)	(35)	(40)	(50)	(70)	(85)
	Chemical	50	45	60	50	65	80	95	95	100	120
	Dental	35	20	10	10	10	10	10	10	15	15
	Electronics	200	245	25	250	135	110	155	320	345	390
	Jewellery	30	30	30	30	30	30	30	25	25	25
	Investment	0	0	0	0	0	0	0	0	0	0
	Other	20	15	15	15	15	15	15	10	15	15
	Total	590	755	570	795	610	710	895	1,105	1,215	1,330

Rhodium Supply and Demand

	'000 oz	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Supply[1]	South Africa	410	457	452	490	544	587	627	666	696	574
	Russia[8]	65	290	125	90	140	100	90	100	90	85
	North America	18	17	23	25	26	17	20	17	20	18
	Others	8	3	4	10	14	16	17	19	18	18
	Total Supply	**501**	**767**	**604**	**615**	**724**	**720**	**754**	**802**	**824**	**695**
Demand by Application[2]	Autocatalyst: gross[3]	509	793	566	599	660	758	829	863	887	760
	recovery[4]	(65)	(79)	(88)	(99)	(124)	(140)	(137)	(171)	(192)	(205)
	Chemical	34	39	44	39	39	43	48	49	63	68
	Electrical	6	7	6	6	6	8	10	9	3	3
	Glass	35	42	41	37	26	46	57	65	59	38
	Other	9	10	10	10	13	14	20	23	24	25
	Total Demand	**528**	**812**	**579**	**592**	**620**	**729**	**827**	**838**	**844**	**689**
	Movements in Stocks[5]	**(27)**	**(45)**	**25**	**23**	**104**	**(9)**	**(73)**	**(36)**	**(20)**	**6**
	Average price (US$)[6]	**907**	**1,998**	**1,604**	**838**	**530**	**986**	**2,056**	**4,552**	**6,191**	**6,564**

NOTES TO TABLES

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

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

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

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

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

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

CHANGES TO TABLES

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

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

[9]**Demand** for platinum and palladium in China has been separated from demand in the Rest of the World region for the whole of the 1999-2008 period.

GLOSSARY

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

NOTE ON PRICES

All prices are quoted per oz unless otherwise stated.

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

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