



PLATINUM 2012

Interim Review



Johnson Matthey

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Background image: Iridium crucibles in which single crystal sapphire, used in light-emitting diodes (LEDs), is grown.

PLATINUM 2012

Interim Review

by **Jonathan Butler**

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EXECUTIVE SUMMARY

The platinum market is forecast to move into a deficit of 400,000 oz in 2012. Severe disruption to platinum group metal (pgm) mining is expected to reduce supplies from South Africa by over 600,000 oz. With demand firm at 8.07 million ounces and a decline in recycling, the balance of the platinum market will look very different to last year.



Platinum supplies are expected to decline by 10% to 5.84 million ounces this year. We forecast a fall in sales of platinum from South Africa to an eleven-year low of 4.25 million ounces as a result of labour stoppages and the closure of marginal operations. Output from other producing regions will remain broadly flat overall.

Gross platinum demand in autocatalysts is predicted to soften by 1% to 3.07 million ounces. Falling vehicle production in Europe, together with a slight decline in the market share of diesel cars, will be mostly offset by higher demand for platinum from Japanese and Indian manufacturers and greater use of platinum in heavy duty emissions aftertreatment.



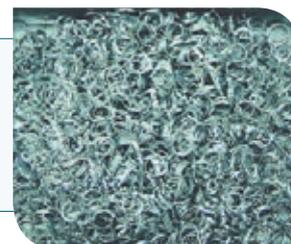
Demand for platinum in the jewellery sector is expected to rise to a three-year high of 2.73 million ounces. Gross demand from the trade in China is forecast to reach 1.92 million ounces driven by lower average platinum prices and an increase in the manufacturing of platinum jewellery to build stock in newly-opened retail stores.

Industrial demand for platinum is forecast to fall by 13% to 1.79 million ounces in 2012. In the glass manufacturing sector, new purchasing will be netted off by the return of platinum from old facilities and the drawing down of inventory bought last year. Electrical demand is also expected to soften but we anticipate growth in purchasing of platinum for non-road emissions control.



Physical investment demand for platinum is expected to remain positive, at 490,000 oz. Investment in physically-backed exchange traded funds (ETFs) has largely followed the price during 2012, with periods of rising price tending to attract heavy net investment. Purchasing in the Japanese large bar market and in the coin sector will further supplement demand.

We forecast an 11% fall in platinum recycling, to 1.83 million ounces in 2012. Platinum recovery from spent autocatalysts is expected to decline as softer average pgm prices this year have encouraged collectors to hold on to exhaust catalysts from end-of-life vehicles. We also anticipate lower jewellery scrap recycling following a strong year in 2011.





The palladium market is forecast to move from a surplus in 2011 to a deficit this year of 915,000 oz. Supplies are expected to contract, mainly due to lower sales of Russian state stocks, and we anticipate reduced palladium recycling. Gross demand is predicted to rise to 9.73 million ounces, driven by a return to positive net physical investment and higher autocatalyst purchasing.

Supplies of palladium are predicted to decline by 11% to 6.57 million ounces, a nine-year low.

We forecast that sales of Russian state stocks will decrease by over half a million ounces compared with last year. Falling average grades in Russia are expected to result in a decrease in newly-refined palladium output. Lower supplies are also expected from South Africa due to recent disruption to mining operations.



Purchasing of palladium by the autocatalyst sector is expected to rise by 7% to a new high of 6.48 million ounces. Demand for palladium is forecast to benefit from growth in global vehicle production, with the strongest performance in the principally gasoline markets of Japan and the USA, as well as continuing substitution of platinum in diesel aftertreatment formulations.

We forecast a softening of industrial demand for palladium, of 3%, to 2.41 million ounces. In electrical applications, a long-term trend towards using cheaper base metal alternatives to palladium in all but niche and high-end applications continues to drive demand lower. However, a wave of chemical plant construction in China will stimulate purchasing of palladium for new catalyst charges.



Gross demand for palladium in jewellery is predicted to dampen by 11% to 450,000 oz. Purchasing of palladium by the Chinese jewellery sector is expected to decline once again as the metal continues to suffer from a lack of positioning and effective marketing, as well as competition from low-fineness gold alloys.

This year is set to mark the return to positive physical palladium investment demand, in contrast to the net liquidation seen in 2011. For the year as a whole, a change in investor sentiment towards palladium ETFs is expected to result in 385,000 oz of net physical investment demand, a swing of 950,000 oz compared with last year.

The rhodium market is forecast to be in a deficit of 43,000 oz this year, the first since 2007. Stronger purchasing for autocatalysts and physical investment will drive up gross demand, while lower mined output from South Africa will lead to a decline in supplies. Lower recovery of rhodium from spent autocatalysts is forecast as intake of end-of-life exhaust systems at refineries declines in response to lower pgm prices.



SUMMARY

PLATINUM

- We forecast that the platinum market will move into a deficit of 400,000 oz in 2012.
- Global supplies of platinum are predicted to drop by 10% to 5.84 million ounces this year due to labour disruption and mine closures in South Africa.
- Autocatalyst demand for platinum is forecast to fall by 1% to 3.07 million ounces. Weakness in the European diesel car market will be mostly offset by growth elsewhere.
- Industrial demand is expected to moderate by 13% to 1.79 million ounces due to lower purchasing by glass and hard disk drive manufacturers.
- Gross purchases by the jewellery sector are predicted to rise to a three-year high of 2.73 million ounces as a result of strong demand in China.
- Physical investment demand for platinum is forecast to be 490,000 oz, slightly higher than in 2011.

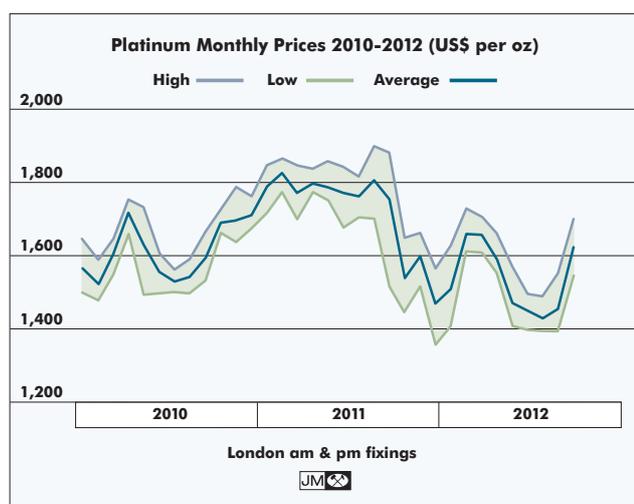
A substantial reduction in supplies, as well as lower volumes of autocatalyst recycling, will make a considerable difference to the platinum market balance in 2012. We forecast a 605,000 oz fall in sales of platinum from South Africa, following a period of unprecedented disruption to mine operations, and a price-related drop in total platinum recycling of 215,000 oz. As gross demand is predicted to remain flat year-on-year, with growth in the jewellery and investment sectors roughly balanced by lower industrial purchasing, we forecast that the platinum market will move into a 400,000 oz deficit in 2012, from a surplus of 430,000 oz in 2011.

We expect platinum supplies from South Africa to fall to an eleven-year low of 4.25 million ounces in 2012. Our full-year forecast includes production losses due to strikes and stoppages to the end of September, but does not make allowances for disruption thereafter. Mine output in South Africa has been constrained by the decision of some junior producers to shutter less profitable operations in the light

of subdued demand, weak prices and rising production costs. The operating environment deteriorated in August and September with the deeply unsettling news of violence and intimidation near Lonmin's Marikana operations amid competition between rival factions of the established National Union of Mineworkers (NUM) and the breakaway Associated Mineworkers and Construction Union (AMCU). A wage agreement ended the strike at Lonmin after six weeks. With disorder spreading to other mines in South Africa, Anglo American Platinum suspended its Rustenburg operations in order to protect the workforce from intimidation. Subsequent losses resulted from illegal strikes, which continue at the time of writing. Eventual supplies may be lower than we forecast if there are further strikes and stoppages. The mines have less capacity to supplement supplies with refined inventory, which might further constrain sales to the market.

In other producing regions, we forecast that platinum supplies will remain broadly flat. Slightly lower output from Russia is anticipated in line with a changing ore mix and declining grade. In North America, output will be maintained at a steady level following a ramp-up last year. Although we expect some additional output from Zimbabwe, global supplies of platinum are set to decline by 10% to 5.84 million ounces.

We expect autocatalyst demand for platinum to weaken by 1% to 3.07 million ounces in 2012. European light vehicle production is predicted to fall by over a million units as the eurozone experiences recession, austerity measures and low consumer confidence. The market share of diesel cars is forecast to drop to just under 50% as fewer vehicles are sold in the previously strong diesel markets of France and Italy. Offsetting most of this decline in Europe, we forecast higher demand for platinum in gasoline exhaust aftertreatment as Japanese manufacturers recover from last year's natural disasters, and strong growth in diesel car production in India.



Platinum prices were dragged down by perceptions of oversupply and weak demand for much of 2012. The price moved sharply upwards following the South African supply disruption of August and September.

As a consequence of subsiding demand in glass and electrical applications, we predict that industrial purchasing of platinum will soften by 13% this year to 1.79 million ounces. In the glass sector, despite new capacity being installed for the production of liquid crystal display glass and glass fibre, returns of platinum from decommissioned facilities and the drawing down of inventory purchased last year will result in a decline in demand from the exceptional level of 2011. Partly offsetting this trend, we forecast that this, the first full year of non-road emissions legislation being implemented in the major markets of Europe, Japan and North America, will see platinum demand more than double in non-road applications.

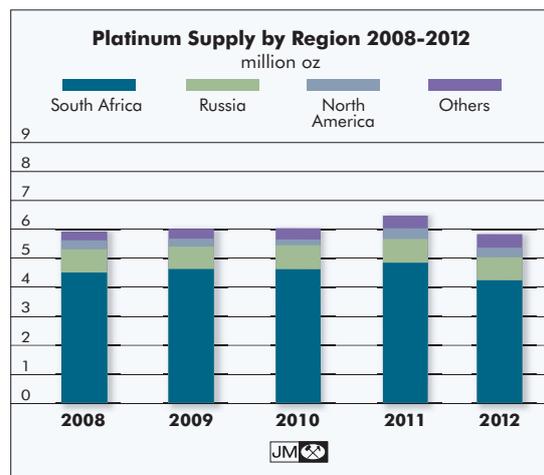
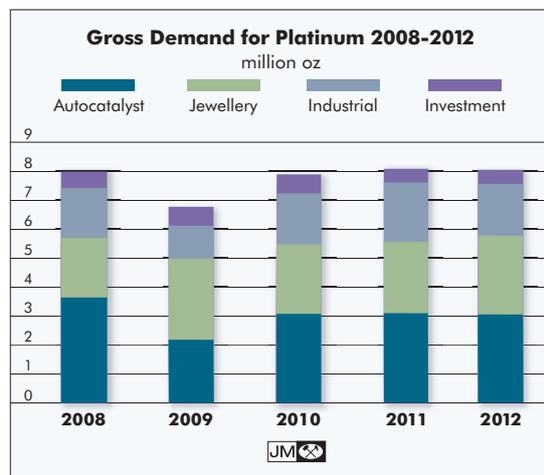
Lower average dollar and RMB platinum prices during the first eight months of 2012, compared with the same period last year, helped give momentum to the Chinese jewellery sector. Purchasing of platinum on the Shanghai Gold Exchange and through Hong Kong traders ran at a three-year high in the first eight months of this year. Unlike in previous years, however, there does not appear to have been a significant element of speculative purchasing of metal. Almost all of the platinum purchased in the first three quarters of 2012 went into manufacturing platinum jewellery pieces to meet growing wholesale and retail demand, driven to a large extent by the opening of new fully-stocked sales outlets. Higher prices in the fourth quarter could slow demand to some degree. For the year as a whole we forecast gross Chinese jewellery demand will rise by 14% to 1.92 million ounces.

Identifiable physical investment demand for platinum is forecast to remain positive, at 490,000 oz this year. The pattern of investment in physically-backed exchange traded funds (ETFs) has largely followed the price during 2012, with periods of rising price tending to attract net investment, but with liquidation accompanying falling prices.

Softer average pgm prices in the first nine months of 2012 led to a downturn in intake of end-of-life vehicle catalysts at refineries. We forecast that this will result in a 16% fall in platinum recovery from the autocatalyst sector this year, to 1.04 million ounces. Lower precious metal prices, including gold, are also forecast to impinge upon the volume of recycling of platinum jewellery, particularly in Japan.

The platinum price was depressed during the year to mid-August by perceptions of weak demand, a poor economic outlook and overcapacity in South Africa. It required a shock, in the form of the serious Lonmin industrial dispute in the third quarter, to cause the price to move more sharply upwards. Despite the output lost from this and other disruption, the market remained highly liquid.

Platinum Supply and Demand			
'000 oz			
Supply	2010	2011	2012
South Africa	4,635	4,855	4,250
Russia	825	835	790
Others	590	790	800
Total Supply	6,050	6,480	5,840
Gross Demand			
Autocatalyst	3,075	3,105	3,070
Jewellery	2,420	2,480	2,725
Industrial	1,755	2,050	1,785
Investment	655	460	490
Total Gross Demand	7,905	8,095	8,070
Recycling	(1,830)	(2,045)	(1,830)
Total Net Demand	6,075	6,050	6,240
Movements in Stocks	(25)	430	(400)



PALLADIUM

- The palladium market is forecast to switch from a 1.26 million ounce surplus last year to a 915,000 oz deficit in 2012.
- Supplies of palladium are predicted to drop by 790,000 oz to 6.57 million ounces as a result of reduced mine output from South Africa and Russia and lower sales of Russian state stocks.
- We forecast 7% growth in gross demand for palladium in autocatalysts, to a record 6.48 million ounces. A return to positive ETF inflows this year of 385,000 oz will account for a 950,000 oz swing in investment demand.
- We anticipate a 3% softening of gross industrial demand, to 2.41 million ounces, while gross jewellery demand is expected to fall by 11% to 450,000 oz.

The palladium market is forecast to swing by over 2 million ounces from surplus to deficit this year due to contracting supplies, stronger gross demand and less recycling. The biggest factors in this move will be a return to positive net investment in the ETF market, lower sales of palladium from Russia and South Africa, and soaring demand in autocatalyst applications.

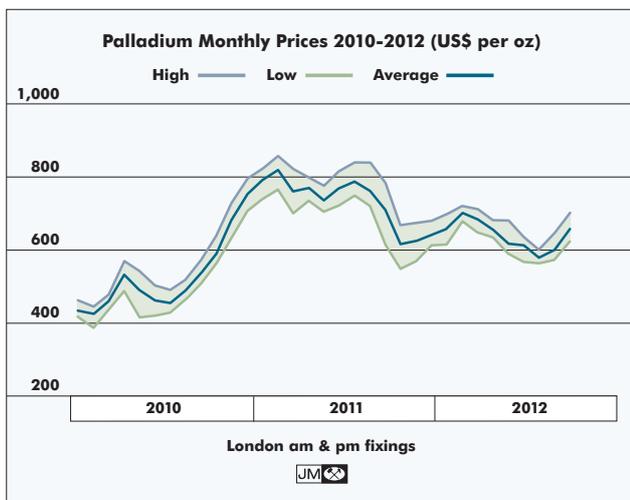
Globally, we forecast an 11% decline in palladium supplies in 2012 to 6.57 million ounces, the lowest since 2003. Newly-refined supplies of palladium are forecast to fall, and we continue to expect considerably lower sales of Russian state stocks compared with recent years.

Supplies of palladium from South Africa are forecast to fall in line with reduced output of platinum this year. Owing to labour stoppages and the closure of operations in the country, we predict palladium sales in 2012 will amount to 2.40 million ounces, 6% lower than in the previous year. In Russia, commensurate with Norilsk Nickel's 2012 guidance, we anticipate that refined output will fall by 4% to 2.60 million ounces. We expect that supplies from Russian

mining operations will be supplemented by the sale of government-controlled stockpiles of palladium, amounting to an estimated 250,000 oz this year. This represents over half a million ounces less than in 2011. We remain of the view that the sale of material this year will represent most of the remaining state inventory. Supplies from Zimbabwe are expected to continue to rise, while output in North America and other regions will remain flat.

Strong growth in gasoline vehicle production and greater use of palladium in diesel emissions control is expected to result in 7% growth in palladium demand in autocatalysts, reaching a new record high level of 6.48 million ounces. Gross demand growth is set to be highest in North America where, driven by double-digit sales increases, vehicle production is forecast to rise at a rate of 14%. This is more than twice the growth rate in China, until recently the world's fastest-growing car market. Palladium demand has also benefitted from a rebound during 2012 in Japanese manufacturers' output both in Japan and at plants overseas, particularly in North America and China. Demand will be supported by the Rest of the World region, with strong growth in output in Mexico and Russia. Only Europe is forecast to see a contraction in autocatalyst demand for palladium this year, with lower vehicle production and sales.

Industrial demand for palladium is forecast to soften by 3% this year to 2.41 million ounces. While a wave of construction of new chemical plants in China will drive purchasing of palladium for new catalyst charges, the electrical sector is expected to see falling demand. A long-term trend towards replacing palladium-containing components with cheaper base metal alternatives in all but niche and high-end applications continues to drive palladium use lower. The development of ever-smaller components, requiring less metal, is also eroding palladium demand even as the number of components per device increases. We see some growth,



Palladium prices were relatively subdued in 2012 and saw little sustained upside from South African supply concerns in the third quarter.

from a low level, in the use of palladium in non-road emissions control. Palladium is typically used together with platinum in diesel oxidation catalysts (DOCs) and particulate filters.

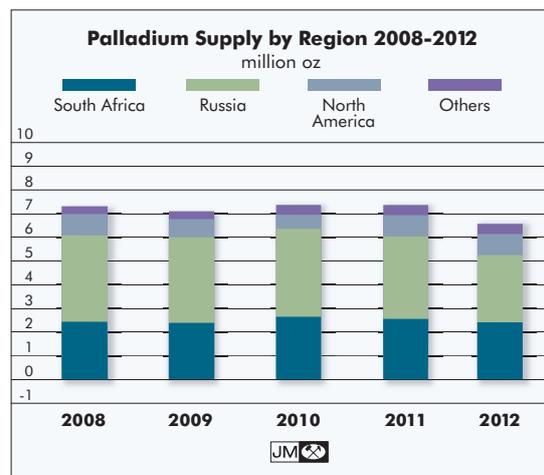
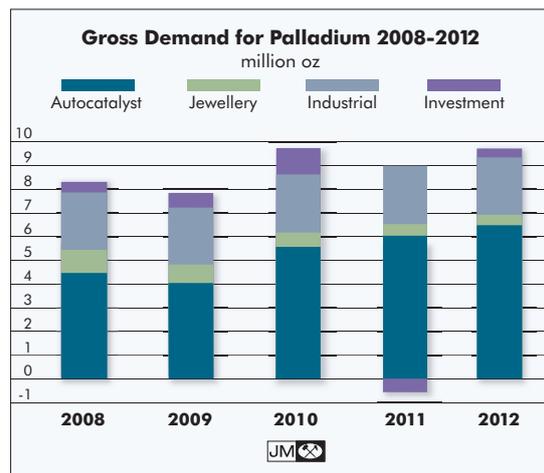
Following the liquidation of well over half a million ounces of palladium from ETF holdings in 2011, more positive investor sentiment is expected to result in net investment of 385,000 oz in 2012. After a steep sell-off late last year, investors returned to the market, perhaps aware of the tighter fundamentals resulting from declining Russian state stock sales and rising autocatalyst demand. In contrast to previous investor behaviour, and to that seen concurrently in the platinum investment market, palladium ETF positions continued to grow as the price declined for much of the first half of the year. Price increases in August also saw further purchasing in ETFs, although there was some liquidation in September.

Gross demand for palladium from the jewellery sector in 2012 is forecast to dampen again, by 11% to 450,000 oz. The metal continues to suffer from a lack of positioning and effective marketing in China, the biggest market, where we forecast gross demand will decline by 21% to 240,000 oz. There has been some growth in the purchasing of palladium for the manufacturing of men's wedding bands in Europe, albeit from a low base.

Recycling of palladium is forecast to soften this year by 4% to 2.24 million ounces. This is in line with collectors holding on to autocatalyst scrap in anticipation of improved prices. Growth in the pool of vehicles available for recycling, with higher average loadings of palladium on their catalysts, points to a longer-term increase in recovery of the metal from spent converters. Palladium jewellery recycling is also expected to decline, due to lower returns of jewellery scrap in China. However, the Chinese trade has reported a large increase in the amount of old palladium jewellery being returned by consumers as a percentage of gross demand. The volume of palladium recovered from electrical devices is expected to rise to a new high of 520,000 oz as more end-of-life products are recycled.

Palladium prices were relatively subdued in the first nine months of 2012 and even the South African supply concerns in the third quarter provided little sustained upside to the price. Although a market deficit emanating from reduced Russian stock sales and robust autocatalyst demand has been widely anticipated and contributed to positive investor sentiment, the price has not seen a sustained rally. The large above-ground stockpile in the investment and jewellery sectors perhaps helped assuage fears of genuine supply shortfalls in the palladium market.

Palladium Supply and Demand '000 oz			
Supply	2010	2011	2012
South Africa	2,640	2,560	2,400
Russia	3,720	3,480	2,850
Others	995	1,320	1,320
Total Supply	7,355	7,360	6,570
Gross Demand			
Autocatalyst	5,580	6,030	6,480
Jewellery	595	505	450
Industrial	2,465	2,480	2,410
Investment	1,095	(565)	385
Total Gross Demand	9,735	8,450	9,725
Recycling	(1,850)	(2,345)	(2,240)
Total Net Demand	7,885	6,105	7,485
Movements in Stocks	(530)	1,255	(915)



OTHER PGM

- The rhodium market is forecast to be in a 43,000 oz deficit in 2012, the first in five years, due to falling supplies and lower recycling, but rising gross demand.
- Rhodium supplies are expected to fall in line with South African mining output. Volumes of rhodium recovered from spent autocatalysts are also expected to soften.
- As a result of growth in autocatalyst and investment purchasing, gross rhodium demand is expected to rise by 7% to 973,000 oz, the highest since 2007.
- We anticipate weaker purchasing for ruthenium and iridium, mainly as a result of lower demand in chemical and electrical applications respectively.

Rhodium

The rhodium market is forecast to move into a deficit this year, the first since 2007, due to a combination of strengthening gross demand, a decline in mined output and lower recycling of spent autocatalysts.

We anticipate that, in line with the other pgms, supplies from South Africa in 2012 will fall by 10% to 580,000 oz as a result of labour disruptions and mine closures. Declining output in Russia will be broadly offset by very modest rises elsewhere but overall, supplies to the market globally will fall by 8% to 703,000 oz.

Gross demand for rhodium is forecast to increase by 7% to 973,000 oz this year because of stronger autocatalyst demand and a substantial increase in physical investment purchasing. Rhodium demand has benefitted from higher worldwide vehicle production this year following a relatively muted 2011 when output by Japanese vehicle manufacturers, the largest users of rhodium, was severely constrained by the Great East Japan Earthquake and its aftermath. The first eight months of 2012 saw a 40% year-on-year increase in vehicle production in

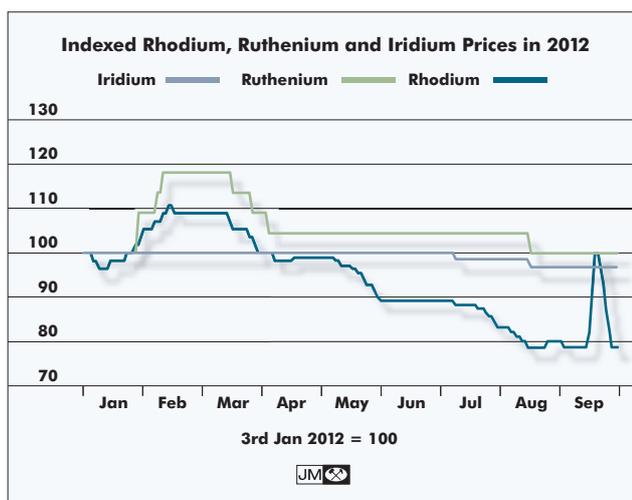
Japan, and substantial increases in production at car plants in North America and China, as Japanese companies caught up with lost output. This is expected to help lead to a 9% increase in demand for rhodium in vehicle emissions control, to 778,000 oz, offsetting a long-term trend towards thrifing. With tighter emissions limits on the horizon in many jurisdictions, and rhodium prices at multi-year lows, some automakers are beginning to look again at rhodium loadings, with a view to making further use of rhodium's catalytic activity in the conversion of nitrogen oxides (NOx) to less harmful products. For more information, see our special feature on page 16.

Purchasing of rhodium by the chemical sector is forecast to climb as new acetic acid and oxo-alcohol manufacturing plants are brought on-stream, particularly in China, requiring new process catalyst charges. However, sales to the glass industry are expected to fall to less than half of their 2011 level. Although new glass fibre and liquid crystal display (LCD) manufacturing capacity has been constructed in China in 2012, this has been offset by lower purchases elsewhere and the return of rhodium from decommissioned plants.

We anticipate that the physical investment demand sector, counted in our 'Other' category, will see the strongest rate of growth in purchasing this year. The physically-backed rhodium ETF saw substantial net investment in the first nine months of 2012 and is forecast to continue this trend for the remainder of the year. Demand will also be supplemented by the sale of small rhodium investment bars.

Recycling of rhodium from end-of-life vehicle catalysts is forecast to decline by 19% to 227,000 oz in accordance with a fall in the supply of spent autocatalysts as subdued pgm prices lead collectors to hang on to scrap.

Rhodium's price performance for much of the year has been remarkable only for the way it edged lower under the weight of offers in the open market and the perception of poor fundamentals. By early September it was trading at \$1,100, the lowest level in three years. A short covering rally



Rhodium prices slid for much of 2012, wiping out earlier gains. There was little movement in either ruthenium or iridium prices.

that accompanied emerging worries on the supply side sent rhodium briefly back to \$1,400, the price where it had begun the year.

Ruthenium

Demand for ruthenium is forecast to decrease by 20% to 770,000 oz in 2012, mainly as a result of lower purchasing in chemical applications.

Following exceptional levels of ruthenium catalyst demand for use in ammonia plants globally in 2011, we anticipate a drop in purchases to more normal levels, at 101,000 oz, this year. Purchasing of ruthenium by the electrical sector is expected to soften in line with lower manufacturing of hard disk drives.

Worldwide demand for ruthenium in the electrochemical sector is expected to remain broadly flat this year. However, purchasing in China will soften following a multi-year expansion and upgrade from old mercury and diaphragm technology to membrane cells utilising ruthenium-iridium coated electrodes. Purchasing of ruthenium for chlor-alkali plants in North America is expected to increase as an upswing in the construction sector stimulates demand for polyvinyl chloride (PVC) as a building material.

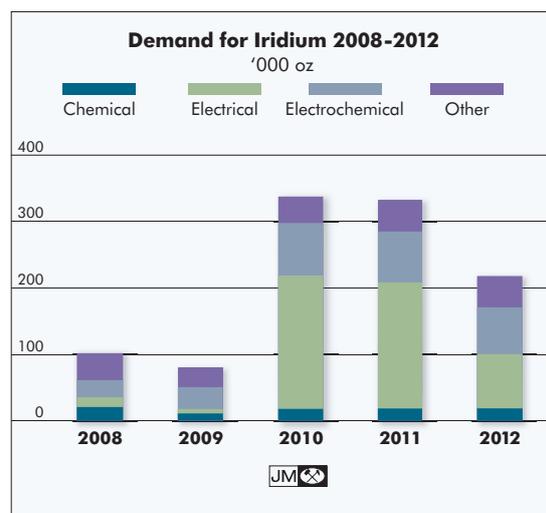
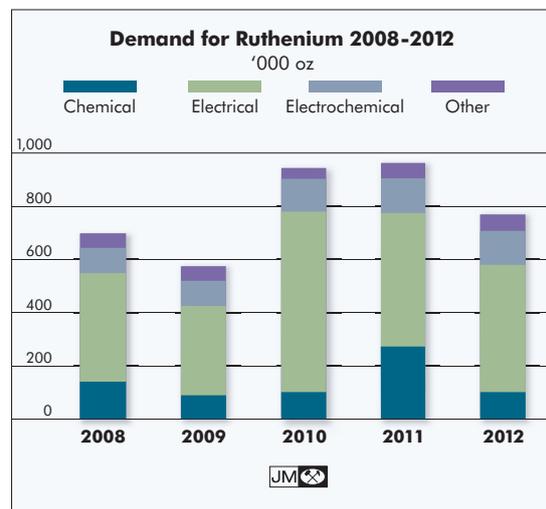
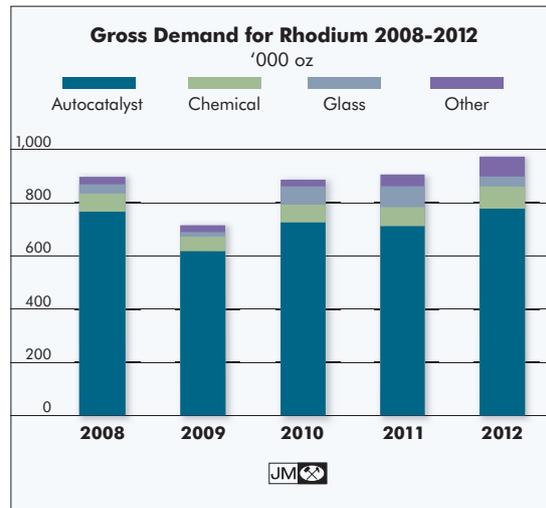
Newly-refined supplies of ruthenium are forecast to decline as a result of disruption to pgm mining in South Africa, but the fall in demand will keep the market balanced. Ruthenium prices in the first nine months of 2012 were subdued, rising then falling by only \$20 in the period, ending at \$110.

Iridium

Demand for iridium is predicted to fall by 35% in 2012 to 218,000 oz as a remarkable wave of previous iridium crucible purchasing by manufacturers of crystal substrates dramatically reduces.

Iridium crucibles are used to grow single crystal sapphire, used to manufacture light-emitting diodes (LEDs), and are counted in our 'Electrical' category. Demand for backlit LED TVs, which has driven the growth of crystal-growing capacity in the last two years, has fallen significantly in 2012. Partly offsetting this, we forecast limited growth in other electrical applications but overall, electrical demand is set to decline.

Mined output of iridium is forecast to decrease in line with the other pgms this year. Reflecting lower purchasing, but thinly traded, the iridium price came off its record highs. By the end of September, it remained at an elevated level in historical terms of \$1,050.



OUTLOOK

- Labour-related disruption, a slow ramp-up of output at previously closed operations and possible rationalisation of the industry are likely to affect pgm supplies from South Africa into 2013.
- Gross demand for platinum and palladium is forecast to hold up well in the next twelve months as a result of solid autocatalyst and industrial purchasing.
- We anticipate growth in rhodium purchasing in autocatalyst and industrial applications in 2013, which will help to keep the market tight.
- Growth in recycling of pgms from the depressed levels seen in 2012 can be expected next year if prices see a sustained recovery. This has the potential to materially impact the market balance for each metal.

OVERVIEW

Severe disruption to pgm mining in South Africa combined with firm demand has shifted the balance of the platinum market in 2012, turning the surplus which we forecast in our last Review into a significant deficit. In 2013, platinum demand is expected to hold up well but supplies might continue to be affected by labour disruption and its aftermath, as well as possible restructuring of the industry. The palladium market is predicted to experience a similar trend of solid demand but uncertain supplies next year.

Problems in South African supply have intensified during 2012 and seem unlikely to be fully resolved in the near term. The apparent effectiveness of illegal and unorthodox strikes, albeit at a considerable cost to human life, in bringing about wage rises on top of those previously agreed through the normal channels has increased the pressure on industry margins and may well lead to suspension or closure of mines. In the longer term, the country's capacity to increase output may be more limited as a result of the recent disruption and any subsequent rationalisation.

Several South African producers were already considering restructuring low-margin operations in the light of weak prices and high costs before the recent wave of stoppages. Wage settlements at some mines have stoked mining cost inflation and intensified the threat to profitability. Although the rand pgm basket price tracked upwards amid supply concerns in the third quarter, some mines continued to operate at a loss and few were generating sufficient returns to support long-term investment in production capacity. With continuing cost increases, it seems highly likely that the future of many mining operations will come under close scrutiny in the months ahead, with the possibility of closures and consolidation. At this point, the outlook for South African supplies in 2013 is extremely uncertain but it is difficult to expect an increase in South African output of any great magnitude from the 4.25 million ounces we are forecasting for this year.

Although the supply side is likely to dominate the pgm markets in the next few months, we predict that demand will remain fairly solid due to a combination of technology changes in the autocatalyst sector in advance of future legislation, and stronger purchasing for several cyclical industrial applications. Demand growth will be limited by a less than sanguine global economic outlook, particularly in developed countries. The outlook for the eurozone remains uncertain, with austerity measures and high unemployment weighing on consumer confidence in many European markets. After a bounce back from the effects of 2011's Great East Japan Earthquake, economic growth is likely to moderate in Japan. The US economy, buoyed by the launch of a third round of monetary easing in September 2012, is likely to continue to see steady growth overall, however there is likely to be a period of uncertainty following the presidential election as fiscal stimuli expire early next year.

Although the rate of China's economic growth has slowed, the government has scope to avoid a hard landing by implementing stimulus measures, as it did from 2008 to 2009. Economic growth in other developing markets, which have been key drivers of pgm demand in recent years, could be below potential in the face of inflationary pressure in 2013.

PLATINUM

Supplies of platinum are unlikely to rise substantially in 2013. Depending on prices, supplies could be supplemented by substantial returns of metal to the market from open-loop recycling. Gross demand is expected to see modest growth overall, with a solid performance from autocatalyst and industrial applications.

Global supplies of platinum are forecast to remain subdued in 2013. The tense labour situation and the possible closure of marginal operations pose threats to supply, while those operations which have experienced illegal strikes are likely to take time to return to normal production levels. The three

biggest producers in South Africa had all cut their spending plans for 2013 before the wave of strikes hit the sector and the losses and uncertainty generated by the disruption have only added to financial pressures. There may be some growth in underlying production from Zimbabwe where, despite continuing political uncertainty, the Unki mine is set to ramp up output.

In the automotive sector, vehicle manufacturing in Europe in 2013 is forecast to see another difficult year. With the previously strong markets of France and Germany expected to experience low growth and Italy in recession, vehicle sales are likely to continue to be dampened, and there could be further erosion in the market share of diesel cars as consumers opt for cheaper gasoline vehicles. Despite muted vehicle production, platinum demand should be sustained as manufacturers roll out Euro 6-compliant vehicles ahead of the introduction of new light duty legislation from 2014. In relation to this, platinum demand will benefit from greater adoption of lean NOx traps (LNTs) for fuel-efficient light duty diesel and lean burn gasoline vehicles. A number of carmakers have already unveiled new diesel models which offer high fuel efficiency and employ a platinum-containing diesel oxidation catalyst (DOC), diesel particulate filter (DPF) as well as a LNT to meet the new emissions limits. In the heavy duty market, the decision of some manufacturers this year to delay the launch of new engines that meet heavy duty Euro VI legislation means that we anticipate some upside to platinum demand in 2013, the first year of the regulations.

Autocatalyst demand growth in Europe will be tempered somewhat by lower purchasing in other regions. Japan, which experienced a post-disaster 'bounce' in 2012 as vehicle manufacturers made up for lost production, will return to more normal output levels next year. Japanese carmakers in North America recaptured market share this year, but are likely to reduce platinum purchasing as output stabilises and thifting of platinum in gasoline autocatalysts takes place.

Prospects for industrial demand in 2013 are slightly improved on the previous year, as we anticipate a return to higher purchasing in a number of applications characterised by cyclical demand. The glass industry, after experiencing new buying being offset by returns from decommissioned plants, is expected to return to net growth. Demand for glass fibre in the construction sector will drive growth in sales of platinum to manufacturing plants, particularly in Asia. We anticipate lower returns of platinum from older marble melt technology glass fibre facilities. Recent contraction of that type of manufacturing has reduced capacity to adequate levels. A rise in purchasing

of platinum by the chemical industry is forecast, particularly in China and India, as expansion takes place to meet demand from increasingly wealthy populations. A surge in construction in Brazil, hosts of the next football World Cup and Olympic Games, is also expected to drive strong purchasing of process catalysts used in the manufacture of polymers and advanced materials. We anticipate higher purchasing of platinum by the electrical sector, after a period of subdued demand, driven by anticipated uptake of high-capacity drives for server farms and a new generation of hard drive-containing notebook computers. The non-road emissions control sector will continue to drive demand for platinum in our 'Other' category following the introduction of pgm-based aftertreatment as required by legislation in several major markets.

The opening of fully-stocked retail outlets in shopping malls and chain stores has kept Chinese platinum jewellery manufacturers busy this year and we expect this to continue as a number of Hong Kong-based jewellery brands are planning to expand retail operations in second and third-tier cities on the mainland. The growth of an appetite for jewellery in the increasingly affluent populations of these cities will be a crucial determinant of the level of demand for platinum jewellery, but the volatility of the platinum price, competition from gold, and the general level of consumer confidence will also be factors. We anticipate further growth in demand for platinum in the manufacture of jewellery in India, particularly in men's chains and bracelets. Men's platinum jewellery is the fastest-growing segment of that market and also tends to sell the heaviest pieces. Platinum jewellery in general continues to grow in popularity in India assisted by prominent marketing campaigns.

Current indications are that interest rates will remain at low levels in the major developed markets into 2013. This, together with the possibility that supply concerns could result in higher prices, leads us to the view that physically-backed platinum investment demand will remain positive in the next six months, although the precise level of this demand will be determined by price volatility.

Collectors accumulated autocatalyst scrap during 2012 in anticipation of better prices, which has created an overhang of inventory. Recycling could be a key factor in the platinum market balance in 2013 if prices see a material and sustained improvement, driving higher throughput of spent catalyst substrates to refineries. Higher recycling could also be stimulated by collectors needing to realise cash flow. The rising pool of available vehicles, together with higher catalyst loadings and more efficient networks for collection and

refining, point to higher autocatalyst recycling, though in the short term the actual volume of material recovered will remain driven by prices. A significant element in recycling of platinum jewellery in China will be an increasingly affluent population willing to trade up to weightier, more expensive pieces – thus growing both gross demand and recycling volumes.

PALLADIUM

Supplies of palladium are expected to fall in 2013 with lower output from Russia and the diminishing likelihood of significantly higher output from South Africa. We forecast another year of solid autocatalyst and industrial demand, and higher returns from end-of-life vehicle recycling.

Recent declining Russian output together with a slow ramp-up following disruption in South Africa, and continuing threats to the commercial viability of certain operations in that country, leads us to forecast that global supplies of palladium will fall in 2013. We anticipate higher recovery of the metal from autocatalyst recycling next year, helping provide a useful secondary source of palladium which will supplement falling primary supplies.

We predict another rise in purchasing by the autocatalyst sector from the expected record level of 2012, due to higher vehicle production in some markets as well as greater use of palladium in emissions control. Although the prospects for higher vehicle output from Europe will remain muted as some countries experience recession, we forecast higher demand for palladium in light duty formulations, driven by gasoline car output and continued substitution of platinum with palladium in diesel vehicles.

Autocatalyst demand in Japan is set to fall back from its post-disaster rebound, but elsewhere we forecast growth. In North America, consumers are expected to continue to take advantage of cheap credit to buy new cars, stimulating both vehicle production and palladium demand in three-way catalysts (TWCs). Higher vehicle production in China and India will also boost purchasing.

Growth in industrial demand for palladium is expected to be driven by the expansion of chemical manufacturing capacity, particularly in Asia, to meet growing demand for consumer products. However, palladium use is once again forecast to soften in applications where it faces long-term competition from cheaper alternatives, particularly in the electrical and dental sectors.

Gross palladium purchasing by the jewellery sector is likely to be robust in Europe and North America where it has

gained a niche in men's jewellery including wedding rings. In China, it is likely to continue to see diminishing demand as it struggles in the face of competition from alternative metals targeted at similar price points in the market, including low-finesse white gold alloys.

In the physical investment sector, if perception of lower than planned output from South Africa leads to price increases, it could encourage further exchange traded fund (ETF) inflows but also some profit-taking. Overall, palladium investment demand is forecast to remain positive.

OTHER PGM

Supplies of rhodium will depend on the performance of South African producers in 2013. Rhodium demand and autocatalyst recycling are forecast to rise.

With near-flat output expected in all other producing regions, decisions on the future of platinum mining operations in South Africa will impact the shape of the rhodium market next year. We anticipate a return to growth in rhodium recycling in line with higher throughput of end-of-life vehicles from collectors.

On the demand side, we anticipate modestly higher purchasing of rhodium for use principally in gasoline autocatalysts. There may be a softening of purchases of rhodium by Japanese manufacturers as vehicle production moderates from the exceptional growth seen during 2012.

Sales of rhodium for industrial applications have the potential to increase next year due to the changing dynamics of cyclical demand areas. If expansion of liquid crystal display glass and glass fibre manufacturing capacity continues as projected while the pace of returns of old platinum-rhodium fabrications slows down, demand for rhodium will rise in 2013.

In physical investment, the growth story of 2011 and 2012, we anticipate another year of positive demand, supported by low interest rates and perceptions of a tighter market.

Ruthenium demand is forecast to see a return to growth in 2013 following a year in which purchasing dropped.

Chemical purchasing is expected to dip next year as spent process catalysts are sold back to the market, offsetting new and top-up demand. However, we anticipate higher demand in the electrical sector. Electrochemical applications are predicted to remain solid.

Purchasing of iridium is forecast to remain roughly flat as increased demand for the metal in process catalysts is offset by lower purchasing of iridium crucibles and for electrochemical applications.

SUPPLIES, MINING & EXPLORATION

- Global pgm supplies are forecast to fall in 2012 as a result of lower mine output from South Africa.
- South African platinum supplies are predicted to drop by 12% to 4.25 million ounces due to labour disruption and the closure of marginal operations.
- Palladium supplies are expected to be augmented by the sale of 250,000 oz of Russian state stocks.
- Only Zimbabwe is anticipated to see growth in platinum and palladium output, as ramp-up of production at the new Unki mine continues.

SOUTH AFRICA

Supplies of platinum from South Africa are forecast to fall by 12% to 4.25 million ounces in 2012, as a result of safety stoppages, illegal strikes and the closure of some low margin operations. Shipments of palladium and rhodium, which unlike platinum did not see large refined inventory sales last year, are predicted to decline in 2012 by 6% and 10%, to 2.40 million ounces and 580,000 oz, respectively. The operating environment for South African producers deteriorated during 2012, as a consequence of high and rising costs, inadequate prices, softening demand, labour unrest and, for some, a high level of safety stoppages.

Our full-year forecast includes production losses due to strikes and stoppages to the end of September 2012. The extent to which fourth quarter production will be affected is not yet clear. At the time of writing, Lonmin's Marikana operations had returned to work, but Anglo American Platinum's Rustenburg mines were still experiencing high levels of absenteeism. Should stoppages persist, supplies are likely to fall below the level forecast in this report. In the following text, unless otherwise stated, all comparisons are with the first half of 2011.

Anglo American Platinum

Underlying production at Amplats' own mines and joint ventures (JVs) increased by 1% the first half of 2012 to 1.18 million ounces of platinum. However, refined platinum output decreased by 13% to 1.03 million ounces due to operational difficulties which delayed the restart of the Rustenburg converter plant following annual maintenance.

PGM Supplies: South Africa '000 oz			
Supply	2010	2011	2012
Platinum	4,635	4,855	4,250
Palladium	2,640	2,560	2,400
Rhodium	632	641	580

Just under 15,000 oz of platinum were lost as a result of safety stoppages at Amplats' own mines in the first half of this year, compared with almost 50,000 oz lost in the same period in 2011. Mines in the Rustenburg area recorded improved performances in the first half. However, the picture was more mixed at other sections.

The company's JV and associate mines fared less well, with a combination of fatal accidents and industrial action interrupting production in the first half. The Modikwa mine, a JV with African Rainbow Minerals (ARM), lost 11,000 oz after a prolonged wage strike and safety stoppages following two fatalities. Production also decreased at the Bafokeng Rasimone Platinum mine due to safety stoppages and a shortage of rock drill operators. A change in mine layout at Amplat's Kroondal JV mine with Aquarius Platinum affected output in the first half, as did a number of incidents of unlawful strike action that continued into the third quarter. In a further indication of the difficulties on the supply side, the Marikana JV with Aquarius was placed on care and maintenance in June as a result of the low pgm price environment.

Amplats' operations were affected by a suspension of the Rustenburg mines in mid-September as the company moved to protect its workforce from intimidation. Low attendance following the reopening of the operations and an illegal strike seems likely to dent underlying production in the second half, but at the time of writing the extent of this is unclear.

Impala Platinum

Impala's first half operations were severely impacted by a six-week illegal strike at the Rustenburg lease area. A slow build up following the disruption also contributed to a decline in tonnes milled and the loss of 150,000 oz of platinum production. Throughput of Merensky ore declined during the strike but the UG2 open cast operation was unaffected. The Two Rivers JV mine with ARM performed well in the first half with a 5% increase in tonnes milled, resulting in an increase in platinum production in concentrate to 73,000 oz. Following previous delays in the company's vertical shaft sinking

programme, production began from the first of three new deep-level mines, 20 shaft, in the first half of this year.

Facing renewed labour unrest in September, Implats announced it was granting a further wage increase. Operations have at the time of writing remained unaffected by illegal strike action in the second half.

Lonmin

Lonmin recorded an improved operational performance at its Marikana division in the first six months of 2012. Overall, the section reported a 12% increase in production of platinum in concentrate in the first half to 365,000 oz. An increase in tonnes milled at Karee, the largest of the underground operations, resulted from an uninterrupted first half following an unofficial strike that had affected production in the same period in 2011.

In August 2012, a bitter dispute between the NUM and the newer AMCU union erupted into a series of violent clashes between protesting miners and the South African Police Service. With the Marikana operations suspended for six weeks, Lonmin revised its platinum production guidance downwards to between 685,000 oz to 700,000 oz and warned of an increase in costs.

Under pressure from low profitability, in July Lonmin announced it was deferring capital spending on its new Hossy and Saffy vertical shafts and the new, third generation K4 shaft. These shafts had been the focus of the company's objective to grow output from the Marikana division to 950,000 oz of platinum per year and move to lower cost operations. With a further deterioration in conditions as a result of labour unrest at Marikana, the company announced in September that it was putting K4 on care and maintenance.

Northam

Despite challenging mining conditions, the volume of material milled at Northam's Zondereinde operations increased by 4% to 940,000 tonnes in the first half of 2012. Together with an increase in combined Merensky and UG2 head grade, this resulted in an 11% increase in production of platinum in concentrate, to 82,000 oz. A smelter run-out in April, which necessitated a furnace rebuild, led to a decline in the purchasing of metal in concentrate.

At Zondereinde, work on deepening and opening additional panels of Merensky Reef continues to progress. There has also been steady progress in development of the new Booyendal mine on the eastern Bushveld including the decline system

and construction of the concentrator plant. Subject to the availability of power from Eskom, which has been delayed as a consequence of a land dispute, the mine is due to begin production in the second half of 2013.

Other Producers

At Xstrata's Eland mine, production of platinum in concentrate fell in the first half as a result of suspension of the open pit operations and limited production from the underground mine development. Xstrata is currently undertaking a strategic review of the Eland project plan, with the aim of optimising the development of the mineral resource, while minimising near-term funding requirements.

Production of platinum in concentrate at Eastern Platinum's Crocodile River mine increased slightly to 25,000 oz in the first half, mainly as a result of better productivity at the Zandfontein section. The company suspended stoping operations at Zandfontein in June and announced a twelve to eighteen month development programme to reduce costs and improve efficiencies. Previously, in May, the company decided to suspend funding for the ongoing development of the Mareesburg open pit mine and construction of the Kennedy's Vale Concentrator Plant, citing low metal prices and high costs.

As a result of low rand basket prices, geological problems and unstable labour relations, Aquarius Platinum placed its Everest mine on care and maintenance in June 2012. The company now has only one producing mine in South Africa, the Kroondal mine, which operates under a pool and share agreement with Amplats.

RUSSIA

We forecast that supplies of platinum from Russia will decline this year to 790,000 oz. Newly-mined palladium supplies are expected to fall by 4% to 2.60 million ounces, while supplies of rhodium are set to be 3% lower than in 2011, at 70,000 oz. Our view of palladium supplies from Russian state stocks remains unchanged. We forecast that 250,000 oz will be sold from government inventories this year, a reduction of over half a million ounces compared with the 775,000 oz shipped from stocks in 2011.

Palladium output from Norilsk Nickel's Kola and Polar divisions totalled 1.32 million ounces in the first half of 2012, a 3% decline on the same period of the previous year. Output of platinum also decreased by 3%, to 337,000 oz. Supplies of both metals in the first half were roughly in line with the company's

PGM Supplies: Russia '000 oz			
Supply	2010	2011	2012
Platinum	825	835	790
Palladium			
Primary Production	2,720	2,705	2,600
State Sales	1,000	775	250
Rhodium	70	72	70

full-year production plan, which allows for a small reduction in output. This reflects a change in the ore mix and a continued gradual decline in average grades as the richer massive ore is depleted and as the company relies more on disseminated ore production. Norilsk, in our understanding, continues to refine substantial quantities of stored pyrrhotite concentrate and old tailings, enabling the company to maintain pgm output despite increased dependence on disseminated ore.

Our figures for Russian supplies of platinum also include output from alluvial sources, in the Russian Far East and, to a lesser extent, in the Urals. Total production of platinum from these sources is expected to remain roughly flat this year.

NORTH AMERICA

PGM supplies from North America are forecast to remain stable this year following a return to normal production in 2011. Overall, platinum supplies are expected to decrease by 3% to 340,000 oz, while supplies of palladium are forecast to soften by 1% to 890,000 oz.

Stillwater Mining Company in the USA reported first-half mined output of 254,000 oz of pgm, a 7% decline on the same period in 2011. Output of palladium totalled 196,000 oz in the first half, down 7% on last year, while platinum output slipped by 8% to 58,000 oz. The company has reiterated its guidance output of 500,000 oz of pgm this year.

Despite flooding at its Thunder Bay operations in the second quarter, North American Palladium (NAP), Canada's only primary pgm producer, recorded solid production in

PGM Supplies: North America '000 oz			
Supply	2010	2011	2012
Platinum	200	350	340
Palladium	590	900	890
Rhodium	10	20	21

the first six months of 2012. NAP continues to expand its Lac des Iles (LDI) mine to transition from mining via a ramp to mining via a shaft to increase output at lower cost. It remains on track to begin producing from the Offset Zone of LDI via the shaft by the end of this year. The company is expected to reach its production guidance for the full year of 150,000 oz to 160,000 oz of palladium.

Production of by-product pgm at Vale's nickel operations in Canada is expected to be roughly flat this year following a return to normal operations after the strike two years ago. At Xstrata's nickel operations, we also anticipate a marginal improvement in output as a result of higher head grade at Nickel Rim South and at Raglan.

ZIMBABWE

Zimbabwe's platinum mines recorded another splendid first half in 2012. Zimplats and Mimosa continued to operate at full capacity while Unki reached steady-state production a year ahead of schedule. Platinum supplies from Zimbabwe are forecast to reach 360,000 oz in 2012, 6% higher than last year. Indigenisation negotiations between producers and the Zimbabwe government remain to be concluded.

Zimplats saw a 2% increase in platinum production in concentrate in the first half, to 95,000 oz. The Phase II expansion project continued to make progress, however this has now been slowed in order to conserve cash and is likely to delay the ramp-up by a year. The Zimbabwe government accepted in principle the new indigenisation plan submitted by Zimplats in March 2012 but management remains in discussions with the government to finalise details. The JV Mimosa mine between Zimplats and Aquarius logged a 1% increase in platinum production in concentrate to just under 54,000 oz in the first half. Anglo American Platinum's Unki mine reached full production in the first half of 2012, with equivalent refined production increasing by 46% year-on-year to almost 33,000 oz. Head grade and labour productivity at the mine both improved, helping raise output.

PGM Supplies: Zimbabwe '000 oz			
Supply	2010	2011	2012
Platinum	280	340	360
Palladium	220	265	280
Rhodium	19	29	30

NO_x EMISSIONS CONTROL

Emission of oxides of nitrogen (NO_x) into the atmosphere from combustion engines presents a significant global health threat. Over several decades emissions of NO_x from vehicles have been progressively mitigated by a range of strategies, enforced by regulations, including pgm aftertreatment. As legislation around the world is extended, tightens and covers more vehicle types, pgm use in emissions control is expected to grow. PGM demand should benefit from integrated catalyst solutions currently being developed that combine the functionality for NO_x reduction with that to reduce other pollutants.

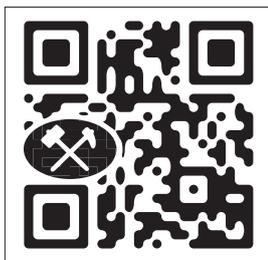
WHAT IS NO_x?

NO_x is a generic term for oxides of nitrogen, a mixture of nitric oxide (NO) and nitrogen dioxide (NO₂), which are by-products of combustion at high temperatures, such as those which occur in an engine cylinder. NO_x is a leading cause of, or contributing factor to, a range of respiratory diseases such as asthma, emphysema and bronchitis, conditions which can lead to premature death. The formation of ozone, which can result in lung damage, is another major adverse effect of NO_x emissions.

CONTROL OF NO_x

Legislation requiring the control of NO_x emissions from motor vehicle engines is now in force in many countries around the world. Technology to convert NO_x to less harmful gases has made significant progress over the last few decades, and recent developments mean that NO_x emissions from both gasoline and diesel engines can now be reduced to extremely low levels. In the European Union, the advent of Euro 5 emissions standards in 2009 introduced NO_x limits of 0.06 g/km for gasoline vehicles and 0.18 g/km for diesels. Stringent NO_x emissions limits are also in force in Japan. In the USA, considerably stricter emissions limits are in place for gasoline and diesel vehicles alike – on a fleet-averaged basis for each manufacturer, NO_x emissions must not exceed 0.07 g/mile. The next step-change in European legislation comes in 2014 with the advent of Euro 6, which cuts

the allowable NO_x limits by over 55% for diesel engines, to 0.08 g/km, while keeping limits for gasoline engines at their current level. Countries which follow the European standards, such as India and China, will also see a tightening of NO_x limits in the next decade as Euro 5 equivalent legislation is adopted.



For further information on NO_x control worldwide, please scan the code.



PGM DEMAND

Gasoline

The control of NO_x using palladium and rhodium in three-way catalysts (TWCs) is a well-established technology and gasoline emissions control accounts for the vast majority of rhodium demand. The new on-board diagnostic (OBD) limits that come into force at Euro 6 reduce by 70% the threshold amount of NO_x emitted before the driver is notified of a problem with the catalyst. Manufacturers are therefore currently working on further improving the durability of catalysts. One of the potential ways this could be achieved is by increasing relative rhodium loadings. Due to the superior activity of rhodium in NO_x reduction, it may be possible to thrift palladium from a TWC while adding a smaller amount of rhodium, to give a lower cost, higher performance system.

The drive towards more fuel-efficient engines has led to the development of gasoline engines which use a stratified charge, or lean burn, combustion. These engines generate more NO_x in the cylinder than conventional gasoline engines and require some kind of NO_x abatement, such as a lean NO_x trap (LNT) catalyst in order to deal effectively with these emissions. As LNTs are rolled out by certain manufacturers, this will add to future demand principally for platinum, but also for palladium and rhodium.

Light Duty Diesel

Tighter NO_x limits for light duty diesel vehicles around the world are driving the use of non-pgm Selective Catalytic Reduction (SCR) or pgm-containing LNT catalysts. In the US the emissions standards currently in force mean that light duty diesel vehicles already require some kind of NO_x aftertreatment, the majority using SCR. In Europe, the introduction of Euro 6 emissions standards from 2014 will trigger the use of either SCR or LNT on most diesel vehicles. The choice of which technology is used will be a result of a number of different considerations including size and weight of the vehicle, level of

engine-out NOx and total costs of the aftertreatment system. Typically LNTs will be used on small to medium-sized vehicles and SCR on larger vehicles. Adoption of LNTs in light duty diesels in anticipation of Euro 6 is expected to ramp up in the next few years, increasing pgm demand.

Heavy Duty Diesel

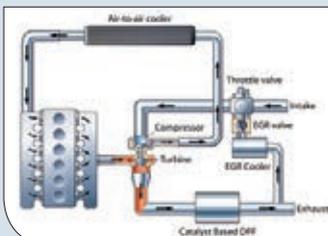
The use of SCR as a NOx reduction technique is well established in the heavy duty diesel market, where it allows operators to comply with emissions limits and maintain fuel efficiency. European manufacturers have used SCR for NOx control since Euro IV in 2005. In Japan, most manufacturers adopted SCR in the period leading up to the introduction of JP09 emissions limits in 2009. In the US, a diesel oxidation catalyst (DOC) and diesel particulate filter (DPF) were used by most manufacturers to meet US2007 limits. SCR was

added to meet US2010 when NOx limits were tightened, and an ammonia slip catalyst is also used by most companies. European manufacturers will adopt a similar aftertreatment system in 2013/14 with the introduction of Euro VI emissions limits, adding to pgm demand.

Non-road

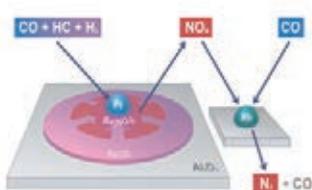
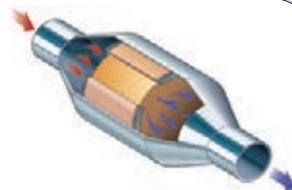
Emissions limits for non-road diesel engines were tightened sufficiently to require aftertreatment in January 2011 with the introduction of Interim Tier 4 limits in the US and Japan, and Stage IIIB limits in Europe. A wide variety of different aftertreatment strategies have been adopted by non-road engine producers based on the individual requirements of the engines in their diverse end-user applications. Tighter NOx emissions limits for these engines to be introduced from 2014 will require NOx aftertreatment.

NOx EMISSIONS CONTROL STRATEGIES



EXHAUST GAS RECIRCULATION (EGR) is an engine management strategy to control NOx which works by recirculating a portion of an engine's exhaust gas back to the engine cylinders. This acts to reduce the amount of excess oxygen in the gas stream and lower the temperature achieved during combustion. The technique is used on both gasoline and diesel engines but has the major disadvantage that it increases emissions of particulate matter (PM). EGR is not sufficient by itself to meet current NOx and PM limits in Europe, Japan and North America, and therefore some additional aftertreatment is typically required.

THREE-WAY CATALYSTS (TWCs) for gasoline vehicles were developed in the late 1970s to control hydrocarbons (HC), carbon monoxide (CO) and NOx. If a gasoline engine is operated around the stoichiometric point (air to fuel ratio of about 14.7:1), a single catalyst can remove the three pollutants simultaneously. Modern TWCs are typically palladium–rhodium or tri-metal platinum–palladium–rhodium formulations, where palladium is used to oxidise the HC and CO while rhodium performs the reduction of NOx to nitrogen.



LEAN NOx TRAPS (LNTs), or NOx adsorber catalysts, remove NOx from a lean (high oxygen content) exhaust stream by oxidation to NO₂ over a platinum catalyst, followed by adsorption onto a substrate to form a solid nitrate phase. The engine is then run rich (low oxygen content) and NOx is released from its adsorbed state and converted to nitrogen over a rhodium catalyst. Although this technique is effective at converting NOx, the need to periodically run the engine rich imposes a fuel penalty, which means LNTs have generally not seen the widest uptake in applications sensitive to fuel costs such as heavy duty diesel and agricultural machinery.

SELECTIVE CATALYTIC REDUCTION (SCR) uses urea solution (ammonia) as a reductant to convert NOx into nitrogen and water. The reaction typically takes places at temperatures that are high enough to enable a base metal catalyst to be used. Since this process requires an external urea tank and dosing system, it is typically restricted to heavy duty diesel vehicles and larger light duty vehicles. In some cases, particularly on heavy duty vehicles, a platinum-containing ammonia slip catalyst is also used to prevent the emission of excess ammonia from the tailpipe.



RECYCLING

- Due to the impact of lower prices for much of the year, recycling of pgms in autocatalyst and jewellery applications is forecast to decline in 2012.
- Platinum recovery from spent autocatalysts is expected to fall by 16% to 1.04 million ounces. Recovery of palladium is set to drop by 8% to 1.53 million ounces.
- Recycling of palladium-containing components from old electrical devices is predicted to increase by 8% to 520,000 oz.
- Recycling of old platinum jewellery is expected to decline by 3% to 785,000 oz, while recycling of palladium jewellery is expected to soften by 7% to 195,000 oz.

AUTOCATALYST

Largely as a result of lower average metal prices, global pgm recycling is forecast to fall in 2012. A declining stainless steel price for much of the first nine months resulted in scrap collectors holding on to vehicle exhaust systems, while lower pgm prices also reduced shipments of converter substrates to the major pgm smelters. With rising pgm prices in late August and September 2012, there was evidence of increased throughput of autocatalyst scrap at refineries, although pgm recovery rates are likely to be lower compared with 2011.

In Europe, recycling of platinum from spent autocatalysts is forecast to fall by 17% to 370,000 oz. Palladium recycling is expected to decline more substantially, by 22% to 300,000 oz. Euro 3 legislation around the turn of the millennium required catalysts to be fitted to diesel cars. These mainly platinum-containing formulations are now being recycled in large numbers, helping platinum recovery to hold up well compared with palladium.

Stronger new vehicle sales in Japan this year as the country recovered from the 2011 earthquake disaster meant that there was an associated increase in the scrapping of older vehicles. New car sales were enhanced by the reintroduction of a government subsidy for fuel-efficient vehicles, helping drive scrapping of older vehicles and translating into higher pgm recycling volumes.

In North America, pent-up demand for both light and heavy duty vehicles, originating from the recession in 2009, helped sales to accelerate during 2012, leading to more scrapping of older vehicles. Despite this, due to subdued pgm prices, intake of autocatalyst scrap at refineries declined year-on-year in the first three quarters as collectors hung on to inventories. Recycling of platinum, palladium and rhodium is expected to fall in 2012, but the relative decline in palladium recovery will be less than that for platinum and rhodium as a consequence of the large amount of palladium on vehicles from the late 1990s onwards that are now being scrapped.

JEWELLERY

Recycling of platinum jewellery is expected to decline by 25,000 oz to 785,000 oz this year, while palladium jewellery recycling is set to soften by 15,000 oz to 195,000 oz.

In China, platinum jewellery recycling is anticipated to increase by 10% to 500,000 oz in 2012 but remain as a similar proportion of gross demand to last year. Consumers continue to trade in older platinum jewellery at retailers in order to buy new designs. Normally by this route, the consumer will need to buy at least the same amount of metal as they are trading in – meaning an overall increase in the weight of metal purchased. Robust consumer demand for platinum jewellery this year is minimising the amount of surplus stock being scrapped.

Recovery of palladium from the Chinese jewellery sector is expected to weaken by 8% year-on-year to 175,000 oz. However, this amount is almost three quarters of the gross total, thus reducing net palladium jewellery demand in China to just over half of its 2011 level. In contrast to platinum, the majority of this recycled metal comes from unsold retail stock, as well as old consumer pieces. The current level of jewellery recycling in China is considerably higher than pre-2011 levels, yet of the 5.5 million ounces of palladium that has gone into the Chinese jewellery sector since 2004, only around a million ounces has been recycled.

Recycling of platinum jewellery in Japan is expected to fall this year due to lower precious metal prices and as scrapping of all types of jewellery moderates from the high levels of 2011.

	Recycling '000 oz					
	Platinum		Palladium		Rhodium	
	2011	2012	2011	2012	2011	2012
Autocatalyst	(1,225)	(1,035)	(1,655)	(1,525)	(280)	(227)
Electrical	(10)	(10)	(480)	(520)	0	0
Jewellery	(810)	(785)	(210)	(195)	0	0
Total	(2,045)	(1,830)	(2,345)	(2,240)	(280)	(227)

PLATINUM

- **Gross platinum demand is forecast to remain firm this year at 8.07 million ounces as more moderate purchasing in industrial applications is counterbalanced by strong demand in the jewellery sector.**
- **Sales of platinum to the global autocatalyst sector are expected to remain at a similar level to last year as lower demand in Europe is offset by growth elsewhere.**
- **Industrial demand for platinum is expected to soften by 265,000 oz to 1.79 million ounces in 2012, mainly due to lower purchasing by the glass industry.**
- **Due to growth in China, gross demand for platinum from the global jewellery industry is forecast to reach a three-year high of 2.73 million ounces. Physical investment demand is set to increase slightly on last year.**

AUTOCATALYST

Gross demand for platinum in the global autocatalyst sector is forecast to be 35,000 oz (1%) lower than in 2011, at 3.07 million ounces. Underlying this trend is a drop in the production of vehicles in Europe together with a slight decrease in the market share of diesel cars in that region. However, offsetting most of the decline in Europe, there is rising production at those manufacturers that still use platinum in three-way catalysts (TWCs) and higher demand in heavy duty diesel aftertreatment systems in other regions.

The global vehicle market has continued in its recovery phase during 2012 – for the year as a whole, worldwide vehicle production is expected to rise by around 6% to just under 84 million units, with particularly strong growth in North America and Japan. Although weaker European demand has dominated headlines this year, outside of Europe we predict flat or higher purchasing of platinum in all regions as a consequence of rising vehicle output. We anticipate a strong performance in the light duty diesel sector in India, the recovery of Japanese manufacturers from last year's natural disasters, and higher demand for platinum in heavy duty emissions control. This is being tempered by continued thrifting of platinum and substitution with palladium.

Europe

Consumer spending on vehicles in many parts of Europe has remained subdued this year as a consequence of austerity measures, high unemployment and limited credit. New car registrations across the region as a whole fell in the first half and the outlook for the remainder of the year is poor. In response to this weak domestic demand, light vehicle production in the region as a whole is projected to soften by over a million units to 16.7 million in 2012.

Fuel economy improvements in gasoline vehicles, designed

to meet fleet-average CO₂ reduction commitments, combined with discounted tax rates for low emission vehicles, and fierce price competition in the less expensive end of the market, have led budget-conscious European new car buyers to increasingly opt for small gasoline models. A combination of recession and low consumer confidence have led to a decline in car sales in traditionally strong diesel markets such as France and Italy, where new car registrations declined by 14% and 21% respectively in the first nine months of the year. Together with robust demand for exports of large gasoline vehicles, we therefore anticipate a fall in the production of light diesel vehicles to just under 50% of light duty output this year. As a result of this and continuing substitution of platinum with palladium in light duty diesel aftertreatment formulations, we forecast a reduction in purchases of platinum by the European auto sector of 210,000 oz (14%) to 1.26 million ounces.

Production of heavy duty diesel vehicles is forecast to fall in Europe this year as a number of manufacturers have scaled back output in response to lower orders domestically and slower growth in emerging markets. Despite this, the introduction of some Euro VI-compliant models is expected to result in robust platinum demand in heavy duty aftertreatment systems. Due to weaker than expected economic conditions, several manufacturers have delayed production schedules for Euro VI engines this year ahead of the legislation beginning to come into force in 2013.

Platinum Demand: Autocatalyst '000 oz						
	Gross		Recycling		Net	
	2011	2012	2011	2012	2011	2012
Europe	1,465	1,255	(445)	(370)	1,020	885
Japan	500	570	(60)	(80)	440	490
North America	380	380	(640)	(495)	(260)	(115)
China	110	115	(10)	(15)	100	100
Rest of the World	650	750	(70)	(75)	580	675
Total	3,105	3,070	(1,225)	(1,035)	1,880	2,035

Japan

Light duty vehicle production in Japan is forecast to rise by 21% to 9.3 million units this year as the country's car industry recovers from the effects of the Great East Japan Earthquake in March 2011 and severe flooding in Thailand in October which affected operations at component manufacturers. Platinum demand is expected to increase by 14% to 570,000 oz.

In the first eight months of the year, passenger car output increased by 42% year-on-year according to the Japan Automobile Manufacturers Association (JAMA), driven by strong domestic sales. Exports of cars also returned to more normal levels this year, although a strong yen and depressed demand in Europe constrained growth. Overall, this recovery in the light vehicle market is expected to be positive for platinum, which continues to be used in many gasoline aftertreatment systems in proportion to mined output.

Heavy duty emissions control, responsible for a third of platinum demand in the Japanese autocatalyst sector, is also expected to show increased demand for the full year of 2012. Production of heavy duty trucks recovered well in the first eight months of the year, increasing by 30% according to JAMA, on the back of a general rebound.

North America

Despite a predicted double-digit rise in vehicle production in North America this year, platinum demand is expected to remain flat overall as a consequence of thrifting and substitution in both heavy and light duty aftertreatment systems.

The share of light diesel vehicles manufactured in North America, including pickup trucks – the mainstay of diesel production – is expected to remain steady at 5% this year. With growth in total production, we anticipate higher platinum demand in the light duty diesel sector. Platinum demand in light duty gasoline vehicles is expected to fall this year. Japanese brands manufactured in North America, which still use platinum in light duty gasoline aftertreatment, have so far gained market share in 2012 as a result of aggressive pricing and a ramp-up to full production after the last recession. Despite this, continued thrifting of platinum and substitution with palladium helped counterbalance the rise in production, resulting in a modest decline in platinum use in the gasoline sector. In heavy duty emissions aftertreatment there is also expected to be a slight decline in platinum use, despite an increase in vehicle production in the first half, as manufacturers increasingly thrift platinum in oxidation catalysts.

China

In the first eight months of the year, Chinese light duty vehicle production increased by 5% year-on-year, up from the 3% rate of growth seen in the same period in 2011. Overall, Chinese light duty vehicle production is expected to reach 16.9 million units in 2012. Platinum, used by some foreign JVs in gasoline aftertreatment, is forecast to see a 5,000 oz increase in demand to 115,000 oz, driven by increased vehicle output and the first full year of operation of China 4 gasoline emissions regulations.

Rest of the World

Growth in light duty vehicle production in India is expected to moderate this year to around 6% following several years of double-digit increases as high interest rates and sluggish GDP growth dampen consumer purchasing. Diesel models remain popular with consumers, in spite of a recent cut to a government subsidy for diesel fuel, which continues to cost around 45% of the price of gasoline. Production of light duty diesel vehicles is therefore set to increase this year, raising the share of diesels to almost half of light duty output. This will have an associated impact on demand for platinum in diesel oxidation catalysts. In Mexico, production of light duty diesel trucks for export is set to benefit from an uptick in sales in the US market, further boosting platinum demand.

JEWELLERY

Gross platinum jewellery demand worldwide is expected to increase by 10% to 2.73 million ounces this year as a result of a strong performance from the Chinese market and growth in India.

Europe

The UK economy shrank in the first half of 2012, and the jewellery trade reported subdued conditions as consumers reined in spending on jewellery items. Lower prices relative to gold this year have allowed retailers to 'upsell' platinum pieces to consumers for a smaller premium than usual, helping platinum to gain market share relative to white gold. This has been particularly true in the engagement and bridal sector where the share of platinum pieces has risen against a backdrop of long-term falling marriage rates. Hallmarking of British-made platinum jewellery pieces accelerated in the first quarter before dropping back year-on-year in quarter two, then

increasing again in the third quarter, rising by 2% overall in the first nine months.

Even with tough economic conditions in much of Europe, parts of the platinum jewellery market look set for a strong year in 2012. In the first eight months of the year, hallmarking of Swiss-made platinum watch cases, a top-end luxury item, increased by 4% year-on-year to over 6,000 pieces.

Japan

Despite softer average platinum prices than in 2011, there has continued to be a trend towards manufacturing lighter weight items to meet lower price points in the Japanese bridal sector. Platinum wedding bands have gained market share at the expense of white gold, due to higher relative gold prices, but the drop in average piece weight should reduce overall platinum consumption.

The outlook for sales of high-end jewellery in 2012 is positive and retail sentiment across the industry has improved. However, Japanese platinum jewellery manufacturers remain exposed to a number of long-term downward pressures, including falling marriage rates and an ageing, declining population. As the bridal sector is still the main driver of platinum jewellery demand in Japan, these factors, as well as competition from imported jewellery, mean that domestic manufacturing demand continues to be eroded.

North America

Purchasing of platinum by the jewellery trade in North America is expected to decline by 10,000 oz this year to 175,000 oz. This decrease results not from lower manufacturing, but from a rationalisation of inventory at major producers. With little room left to eke out further efficiencies in the North American jewellery trade, we expect this to be a one-off adjustment.

Despite this, manufacturing demand for platinum is forecast

to remain solid this year, driven by a thriving high end of the market both domestically and for export. Notwithstanding headwinds from long-term social and demographic trends towards fewer and later marriages, the domestic engagement ring segment is gaining share from white gold. High gold prices relative to platinum are encouraging 'upselling' at retail level, with a consequent impact on manufacturing. In the export market, the opening of brand-name stores in the Middle East and Asia is helping to further augment platinum jewellery output in North America.

China

Gross platinum demand in the Chinese jewellery sector is forecast to rise by 14% to 1.92 million ounces this year, the highest level since 2009. Strong purchasing in the first three quarters of the year is expected to give way to a slightly slower final quarter as a result of higher metal prices.

In the first eight months of 2012, new purchases of platinum by the Chinese jewellery industry reached a three-year high as the trade took advantage of RMB prices that were on average 16% lower than the equivalent period in 2011. Manufacturers increased working stocks of metal to meet burgeoning demand and purchasing by the trade was also driven higher by the need to manufacture stocks of platinum jewellery for the large number of new retail outlets which are being opened by Hong Kong jewellery brands. These fully-stocked branches are typically located in new shopping malls and department stores, often in fast-growing second and third-tier cities.

Retailers also took advantage of the lower price to rebuild platinum stock, although the remarkable increase in manufacturing and retailer stocking has not yet fully translated into higher consumer demand. Sales of platinum jewellery benefited somewhat from a reduction in the retail price, improving the affordability of the white metal. Some consumers in China are still put off buying platinum jewellery as a semi-investment, believing it does not hold its value. However, this section of the jewellery-buying public is increasingly outnumbered by young consumers who are able to afford platinum jewellery for the first time.

Rest of the World

Platinum demand in our Rest of the World region is expected to show another strong year-on-year increase as the fast-growing Indian market continues to see expansion in jewellery manufacturing and retailing. There are now 550 authorised

Platinum Demand: Jewellery '000 oz						
	Gross ¹		Recycling ²		Net ³	
	2011	2012	2011	2012	2011	2012
Europe	175	180	(5)	(5)	170	175
Japan	315	305	(350)	(280)	(35)	25
North America	185	175	0	0	185	175
China	1,680	1,920	(455)	(500)	1,225	1,420
Rest of the World	125	145	0	0	125	145
Total	2,480	2,725	(810)	(785)	1,670	1,940

NOTES TO TABLE

¹ Gross demand is equivalent to the sum of platinum jewellery manufacturing volumes and any increases 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 is the sum of these figures and therefore represents the industry's net requirement for new metal.

Platinum Demand: Industrial '000 oz			
	2010	2011	2012
Chemical	440	470	450
Electrical	230	230	200
Glass	385	555	225
Petroleum	170	210	200
Other	530	585	710
Total	1,755	2,050	1,785

retailers of platinum in India, a number of which are large regional department stores, all of which carry stock. Higher margins on platinum relative to gold, increasing confidence in the product and growing demand from consumers for new styles have helped drive stocking at manufacturer and retail level. Sales of men's chains and bracelets have shown particularly strong growth in the south of the country.

INDUSTRIAL

Platinum demand in industrial applications is expected to soften this year, by 13% to 1.79 million ounces, as a result of lower purchasing in glass manufacturing and in electrical devices. This decline will be offset to a degree by higher demand in non-road emissions control.

In the glass sector, construction of new liquid crystal display (LCD) manufacturing plants continues to drive demand for platinum melting tanks, particularly in Asia with the majority being installed in China. We also anticipate the addition of new capacity in the glass fibre sector this year. Despite this, platinum purchasing is expected to fall, by almost 60% to 225,000 oz, as a result of continued sales from decommissioned plants, as well as the use of inventories accumulated last year when exceptional quantities of metal were purchased.

Demand for platinum in electrical applications is forecast to decline this year by 13%, to 200,000 oz, due to a contraction of purchasing by the manufacturers of hard disk drives. Hard disk production did not fully recover from the disruption to production caused by the floods in Thailand in October 2011 until the second quarter. In addition, a downturn in demand for hard disks has slowed platinum purchasing. Underlying this, desktop and laptop computers, which employ traditional magnetic hard disk drives, are losing market share to tablet computers which use non-pgm solid-state memory.

Non-road emissions control is developing into a significant growth area for platinum demand. With various pgm-forcing legislation now in effect for the control of pollution from non-

road diesel engines in the major markets of Europe, Japan and North America as well as some other jurisdictions, we anticipate that platinum demand will more than double this year, to 130,000 oz (counted in our 'Other' demand category).

INVESTMENT

Investment demand for platinum is forecast to remain positive this year; new investment is expected to be 30,000 oz higher than in 2011, at 490,000 oz.

The Japanese large investment bar market reacted to type in the first nine months of the year – with the exception of January and August, there was disinvestment in a rising price environment and net investment during periods of falling prices. Investment outweighed liquidation overall, particularly in the second quarter. For the year as a whole, investment is forecast to remain positive.

In the physically-backed exchange traded fund (ETF) market, cumulative net investment stood at 1.7 million ounces at the end of the third quarter, some 127,000 oz above the level at the same point in 2011. Platinum investment holdings generally moved in line with the price in 2012, rising until early March, by 119,000 oz, before succumbing to a sell-off later that month which continued through to June, by which time net year-to-date investment had fallen to 50,000 oz. Holdings remained relatively stable until mid-August, as did prices, after which point the price began to rise amid labour-related disruption to South African mining operations. Reacting to higher prices, investors piled into the ETF market in the second half of August and on into September, during which time total platinum holdings reached record highs.

We expect this year to be a strong one for platinum investment demand in coins and small bars. The Royal Canadian Mint (RCM) restarted one-ounce Platinum Maple Leaf bullion coin releases this year. The Perth Mint released a 2012 edition of its one-ounce 'Platinum Platypus' investment coin, the mintage of which was once again limited to 30,000.

Platinum Demand: Investment '000 oz			
	2010	2011	2012
Europe	140	155	90
Japan	45	250	160
North America	465	10	210
China	0	0	0
Rest of the World	5	45	30
Total	655	460	490

PALLADIUM

- Gross demand for palladium is forecast to rise by 15% to 9.73 million ounces in 2012 as a result of historically high autocatalyst purchasing and a swing back to positive investment demand.
- Growth in vehicle production in all regions apart from Europe is predicted to raise global palladium demand in autocatalysts by 7% to 6.48 million ounces.
- A return of positive investor sentiment is forecast to result in net physical palladium investment demand of 385,000 oz in 2012, compared with negative net investment demand last year.
- We anticipate softer industrial demand overall due to substitution in the electrical sector. Gross palladium jewellery demand is also set to decline.

AUTOCATALYST

Gross demand for palladium in the autocatalyst sector is forecast to grow by 7% this year and reach a record high of 6.48 million ounces. Use of palladium in exhaust aftertreatment is set to benefit from an acceleration of growth in vehicle production. Most of this growth will come from higher numbers of gasoline vehicles being manufactured for sale in the USA, Japan and China where palladium makes up the largest share of pgm in aftertreatment systems. Continuing substitution of platinum with palladium in both light and heavy duty diesel systems is anticipated to result in further demand growth in 2012.

Europe

Purchasing of palladium by the European autocatalyst sector is forecast to dampen by 3% in 2012 to just under 1.40 million ounces. Although we anticipate over a million fewer vehicles will be produced this year compared with 2011, growth in the relative share of gasoline vehicles will result in only a moderate contraction in demand for palladium. According to the European Automobile Manufacturers' Association, new car sales dropped by 8% in the European Union in the first nine months of the year. Despite this subdued domestic market, palladium demand will continue to benefit from exports of primarily gasoline-powered premium vehicles from Europe to the USA and emerging markets.

Palladium continues to be adopted as a partial substitute for platinum in light duty diesels, helping demand in this sector to hold up fairly well even with a fall in the number of diesel cars being produced in the region.

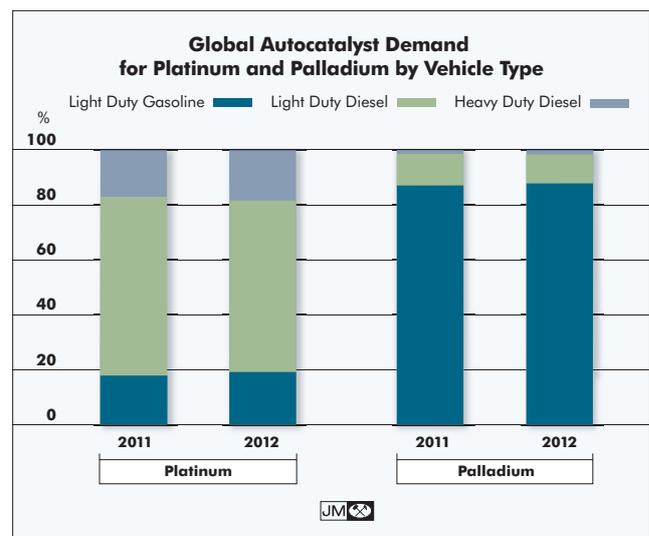
Higher purchasing of palladium by the heavy duty diesel sector is also expected as some manufacturers produce small numbers of Euro VI-compliant vehicles in advance of these new regulations coming into effect next year. Euro VI systems

typically contain a platinum-palladium diesel particulate filter (DPF) designed to capture soot, in addition to an oxidation catalyst employing the same metals. Use of palladium helps add thermal stability to the DPF, which is important when the filter undergoes periodic high temperature regenerations to burn off the accumulated soot.

Japan

We forecast a 15% increase in palladium purchasing in the Japanese automotive sector this year, to 765,000 oz, as output of vehicles, driven by resurgent domestic demand, rebounds strongly from the disruption of 2011.

In the first eight months of 2012, passenger car production in Japan increased by 42% year-on-year, to just under 6 million vehicles, with the strongest growth seen in the smallest vehicle category, that of mini-vehicles. Domestic sales of passenger cars grew by 50% year-on-year, also with the greatest increase in the mini-vehicle category. Sales of these small cars were boosted by a government subsidy for eco-friendly vehicles as part of a scheme that has now ended.



The use of palladium in gasoline aftertreatment is well established. Palladium is now making inroads in diesel emissions control.

The number of Japan-made vehicles which are exported suffered a sharp drop in the first half of last year following the Great East Japan Earthquake. In January to August 2012 the volume of exports rose by 24% year-on-year as manufacturers fulfilled orders delayed from 2011, with higher shipments to all regions apart from Europe. Exports to the biggest overseas market, North America, grew by over 40% to around 1.3 million vehicles in the first eight months. With an overwhelmingly gasoline vehicle fleet in Japan, and the majority of exports also going to gasoline markets, higher output strongly favoured growth in palladium demand.

North America

A combination of pent-up demand following the recession, cheap credit and gradually improving economic conditions is expected to drive rising consumer demand for light duty vehicles in North America this year. Propelled by these factors, US car sales in the first half of 2012 reached a four-year high of over 7 million units.

Light vehicle production is forecast to grow by 14% to 12.1 million units. This remarkable rise is set to be more than twice the pace that car production is increasing in China, until recently the world's fastest-growing auto market. We predict an associated rise in palladium demand in North America this year of 14% to a new level of 1.68 million ounces.

In the first half of 2012, a strong performance by Detroit's big three and the recovery of automotive production at Japanese plants in North America helped raise purchasing of palladium. With new fuel economy and emissions standards on the horizon, automakers' efforts continued to be focused



2012 is set to be a record year for palladium demand in autocatalysts, led by the light duty sector.

Palladium Demand: Autocatalyst '000 oz						
	Gross		Recycling		Net	
	2011	2012	2011	2012	2011	2012
Europe	1,440	1,395	(385)	(300)	1,055	1,095
Japan	665	765	(70)	(105)	595	660
North America	1,475	1,680	(1,050)	(945)	425	735
China	1,115	1,275	(35)	(45)	1,080	1,230
Rest of the World	1,335	1,365	(115)	(130)	1,220	1,235
Total	6,030	6,480	(1,655)	(1,525)	4,375	4,955

on developing smaller, more powerful engines and optimising catalyst systems. For gasoline vehicles, this has generally meant thrifting palladium although the effect of this will be offset by rises in production volumes this year. In the diesel sector, there has been further substitution of platinum by palladium, adding to palladium demand.

China

Prospects for a return to double-digit increases in vehicle production this year have been muted as a result of expectations of lower GDP growth and continuing efforts in some provinces to limit new car sales. Light duty vehicle production in China is forecast to grow at 6% in 2012 to 16.9 million units for the year as a whole. This represents an acceleration on the anaemic rate seen in the previous year but is still considerably below the growth seen in the years prior to 2011.

Following a poor first quarter of this year, new passenger car production accelerated year-on-year in the period May through to August, growing 5% overall on a cumulative basis for the first eight months of the year. Joint venture manufacturers continued to do brisk business in China, particularly in sales of medium-sized and large cars, which tend to have higher catalyst loadings, while domestic brands and smaller vehicles sold less well.

Palladium demand is forecast to be augmented by the anticipated introduction of Euro 5 equivalent emissions legislation (China 5) in Beijing during 2012, although the standard remains to be finalised. Many automakers now supply Euro 5-compliant gasoline models to the Beijing area. The catalysts on these vehicles contain an estimated 10-20% more pgm than those intended to meet China 4 regulations. The Chinese government has not yet confirmed a date for the nationwide implementation of China 5 and cars sold outside of Beijing still use China 4 aftertreatment systems.

See notes to table on page 21.

Palladium Demand: Jewellery '000 oz						
	Gross ¹		Recycling ²		Net ³	
	2011	2012	2011	2012	2011	2012
Europe	60	70	0	0	60	70
Japan	70	70	(20)	(20)	50	50
North America	45	45	0	0	45	45
China	305	240	(190)	(175)	115	65
Rest of the World	25	25	0	0	25	25
Total	505	450	(210)	(195)	295	255

Rest of the World

Another strong year for vehicle production in Mexico, where vehicles are mainly built for the US market, is forecast to result in higher demand for palladium in both gasoline and diesel emissions control. Confounding expectations of a dip in production following the end of the scrappage scheme in 2011, the Russian car industry looks set for another splendid year. Registrations of new vehicles were higher in each of the first eight months of this year compared with 2011, and locally-produced vehicles dominated the top-selling models. In this mainly gasoline market, palladium demand is predicted to rise in response, helping raise demand in the Rest of the World region as a whole by 30,000 oz to 1.37 million ounces.

JEWELLERY

Gross palladium jewellery demand is forecast to dampen by 11% this year to 450,000 oz. Once again, this is expected to be mainly the result of lower purchasing by the jewellery trade in China, where palladium continues to suffer generally from a lack of positioning and effective marketing, as well as increasing competition from alternatives at similar price points.

China

We forecast another decline in gross palladium jewellery demand in China this year, of 21% to 240,000 oz, with most of the purchasing that remains being for the manufacture of plain jewellery. The number of palladium jewellery manufacturers in China continues to decline, with even those remaining in the business reducing their output in response to weak retail pull. The RMB price was on average 18% lower in the first three quarters compared with the same period last year. With concerns that palladium jewellery pieces may not hold

their value when traded in, consumers have been reluctant to purchase the metal. In addition, a continued lack of effective marketing means that awareness of palladium remains fairly limited overall.

Despite new sales being constrained by a low exchange value, this has not prevented consumers returning old palladium jewellery, thus increasing palladium jewellery recycling as a share of gross demand. For more information, please see the Recycling chapter on page 18.

Other Regions

Hallmarking of UK-made palladium jewellery items increased by 13% in the first three quarters of 2012 – largely as a result of the increasing popularity of the metal in the men's wedding band market, where it is competitively priced against white gold and has been introduced across a number of jewellery lines. Growth of palladium in the UK jewellery sector was augmented by an increase in use of the palladium-500 alloy, which saw a near-three-fold rise in British-made pieces stamped, to over 13,000 items in the first nine months. In the European market as a whole, we anticipate a modest increase in purchasing of palladium by the jewellery trade, by 10,000 oz to 70,000 oz.

In North America, demand for palladium jewellery is set to remain quiet. Palladium's current positioning against base metals makes it relatively expensive in the eyes of many consumers, although a trade and consumer marketing campaign continues to raise palladium's profile. Some mass market chain stores have begun to order palladium pieces to broaden their range of lower cost precious metals in the bridal segment.

The Japanese market, where palladium is mainly used as a whitening agent in white gold alloys as well as in platinum jewellery alloys, is expected to be flat this year at 70,000 oz. There is limited appetite for plain palladium jewellery, with only a small number of companies currently offering pieces in the metal.

Palladium Demand: Industrial '000 oz			
	2010	2011	2012
Chemical	370	445	530
Dental	595	550	540
Electrical	1,410	1,380	1,210
Other	90	105	130
Total	2,465	2,480	2,410

INDUSTRIAL

Despite higher purchasing in the chemical sector and in the control of non-road emissions, softer sales to electrical applications are forecast to dampen industrial demand for palladium by 70,000 oz (3%) to 2.41 million ounces in 2012.

Demand for palladium in the chemical sector is expected to show a 19% year-on-year increase to 530,000 oz, a record high, on the back of strong growth in China. The opening of new chemical plants in that country, as well as the expansion of several others, is driving purchasing of palladium for catalysts used in the production of purified terephthalic acid (PTA) and vinyl acetate monomer (VAM). Production of these bulk chemicals is expanding rapidly to satisfy booming demand for consumer products including textiles (made from PTA) and coatings and adhesives (made using VAM) in China and elsewhere in Asia. Purchasing of palladium for use in nitric acid catchment gauze is forecast to remain steady in 2012. The production of hydrogen peroxide, used mainly in the paper and pulp industry but with growing demand in water treatment and disinfection, also continued to support palladium demand.

In electrical applications, we forecast that palladium demand will decline this year by 12% to 1.21 million ounces. The use of palladium in multi-layered ceramic capacitors (MLCCs) destined for mass-market electronics has been declining for several years due to competition from cheaper base metal alternatives. This has broadly offset growth in the complexity of devices, which has meant that typically more MLCCs are required per consumer product. Palladium-based MLCCs continue to be used in high-end and niche applications where component reliability is key, however even in those markets palladium faces threats from technically improved nickel-based MLCCs, use of lower palladium content alloys on the basis of cost and the emergence of copper as a potential replacement material.

Demand for palladium in dental applications is expected to see another decline in 2012, weakening by 2% to 540,000 oz. Ceramic treatments continue to grow in popularity in dental restorations in developed markets for aesthetic reasons, leading to a decline in palladium use.

We forecast increased demand for palladium in non-road emissions control as a result of legislation-driven adoption of pgm aftertreatment for a range of construction and agricultural machinery in Europe, Japan and North America. Palladium is used alongside platinum in oxidation catalysts and filters designed for various non-road diesel engines.

INVESTMENT

We forecast a 950,000 oz swing in identifiable net physical investment demand for palladium as the market returns to net positive investment this year following heavy liquidation in 2011.

The palladium ETF market saw steady net investment in the first six months of the year as investors returned to the market following a steep sell-off in the fourth quarter of 2011. Total palladium ETF holdings continued to rise between late February and mid-May this year even as the price was on a downwards trend, in contrast to platinum holdings which fell generally along with the price during this time. The divergence of investor sentiment towards the two metals may be explained by the fundamental picture for palladium still looking strong, together with lower prices than in 2011 representing a buying opportunity. Cumulative investment volumes reached the highest since September 2011 in early June before experiencing light selling as the price fell towards a nine-month low in late July.

As pgm prices tracked upwards in response to supply disruptions in South Africa in the second half of August and into September, there was initially net investment. This soon gave way to a sell-off that took cumulative holdings back to their level of six months prior, of just over two million ounces, considerably down on the record level in early 2011 of more than 2.4 million ounces. The behaviour of investors in the palladium ETF market contrasted with that in platinum ETFs, which reached record holdings in September, perhaps reflecting investors seeking exposure to the upside brought about by disruption in South Africa.

On an individual fund basis, the two funds that were responsible for most of the net disinvestment in 2011, ETFs' London and US funds, both saw net inflows in the first nine months of 2012. The US fund saw over 200,000 oz of net investment, in contrast with almost half a million ounces of liquidation last year.

Palladium Demand: Investment			
	'000 oz		
	2010	2011	2012
Europe	(5)	(35)	105
Japan	10	5	0
North America	1,090	(535)	280
China	0	0	0
Rest of the World	0	0	0
Total	1,095	(565)	385

OTHER PLATINUM GROUP METALS

- **Gross rhodium demand is forecast to increase by 7% to 973,000 oz, led by stronger purchasing by the autocatalyst and investment sectors.**
- **Rhodium supplies and recovery from autocatalyst scrap are predicted to decline. The rhodium market is therefore expected to move into a deficit of 43,000 oz.**
- **We anticipate weaker demand for ruthenium as a result of lower purchasing for use in chemical and electrical applications.**
- **Iridium demand is also expected to fall as the exceptional level of purchasing of iridium crucibles seen in recent years moderates.**

RHODIUM

Gross demand for rhodium is forecast to strengthen in 2012 as a result of higher purchasing by the autocatalyst sector, a rise in physical investment demand and higher sales to the chemical industry. A fall in mined output of rhodium, together with lower volumes recovered from autocatalyst scrap, is predicted to push the market into a 43,000 oz deficit, the first for five years.

Autocatalyst

Higher worldwide vehicle production this year and the return to full output by Japanese automakers after the Great East Japan Earthquake of 2011 is expected to raise rhodium demand in autocatalysts by 9% to 778,000 oz.

Japanese manufacturers remain the largest purchasers of rhodium in the autocatalyst sector and tend to use rhodium, together with platinum and palladium, in a similar proportion to mined output. During 2012, demand for rhodium increased in line with higher vehicle production both in Japan and at Japanese production facilities overseas, particularly in North America and China.

Only in Europe do we expect to see a decline in purchasing of rhodium for use in exhaust aftertreatment. This is partly a function of lower light duty vehicle production in the region this year, and also a result of a long-term trend towards lower rhodium use.

Rhodium is an excellent catalyst for the control of NOx and has been used for many years in light duty gasoline aftertreatment systems. However, the metal's perceived price volatility has led many automakers to thrift rhodium where possible, a trend which continues to reduce average rhodium loadings per vehicle. Some automakers, in the light of lower prices and forthcoming tighter NOx emission and on-board diagnostic limits, have now begun to reassess their use of rhodium and in certain cases are increasing the rhodium content of catalysts to improve performance and durability.

Other Demand

Demand for rhodium in the glass industry is forecast to slip this year to 37,000 oz, less than half of its 2011 level, as manufacturers draw down inventory purchased last year. Expansion of glass fibre production capacity and the construction of new liquid crystal display (LCD) glass lines are forecast to account for some additional platinum–rhodium alloy demand in China. This will be more than offset by a decline in purchasing by manufacturers elsewhere in Asia, however, and the sell-back of metal from decommissioned facilities worldwide.

Sales of rhodium to the chemical sector are expected to see another strong year in 2012, with a predicted rise of 12,000 oz (17%) to 84,000 oz. New acetic acid and oxo-alcohol plant construction in China continues to drive demand for rhodium process catalysts to produce these bulk chemicals, which are used to manufacture plastics and polymers.

The strongest relative growth in rhodium demand this year is forecast to be in physical investment, counted in our 'Other' category. A physically-backed rhodium ETF, launched in May 2011, saw steady investment, reaching 17,000 oz by the end of last year. In 2012, the fund experienced periods of strong buying throughout the first nine months with no net selling. A falling price for much of that time, which would have left investors facing losses, perhaps helps explain why rhodium holdings were not liquidated, although this contrasts with

Rhodium Demand by Application			
	'000 oz		
	2010	2011	2012
Autocatalyst	727	712	778
Chemical	67	72	84
Electrical	4	5	6
Glass	68	78	37
Other	21	39	68
Total Gross Demand	887	906	973
Autocatalyst Recycling	(241)	(280)	(227)
Total Net Demand	646	626	746

investor behaviour in the much larger platinum and palladium ETF markets. There was a surge in investment in September which coincided with the price spiking to a six-month high in response to South African supply concerns. By the end of September, the price had fallen again. We forecast that there will be further net investment in the remainder of the year. Together with newly-launched rhodium investment bars, rhodium ETF investment will continue to contribute to our 'Other' demand category.

Supplies

Supplies of rhodium are forecast to fall by 62,000 oz (8%) to 703,000 oz in 2012 as a result of reduced mine output in South Africa caused by labour stoppages and mine closures. Sales of refined rhodium from the other producing regions will remain roughly flat. Lower volumes of rhodium being recovered from spent autocatalysts together with growth in gross demand are predicted to move the rhodium market into a deficit for the first time since 2007.

RUTHENIUM & IRIDIUM

We forecast that demand for ruthenium will fall by 20% year-on-year to 770,000 oz, while demand for iridium will be 35% weaker than in 2011 at 218,000 oz.

Demand

Ruthenium demand in the chemical sector is predicted to drop by 172,000 oz this year to 101,000 oz following unusually high levels of purchasing in 2011, when several ammonia plants globally bought complete new charges of ruthenium catalyst. Chemical demand this year is expected to return to more normal levels.

Purchasing of ruthenium by the electrical sector is expected to soften by 5% to 479,000 oz in line with lower use by the global hard disk drive industry amid falling sales of hard disk-containing desktop and laptop PC devices. Demand in other electrical applications, such as chip resistors, is expected to remain robust.

Electrochemical demand for ruthenium is forecast to remain broadly flat at 127,000 oz this year. The chlor-alkali industry in China has undergone a massive expansion and upgrade of plants in the last three years, moving from mercury and diaphragm technology to more energy-efficient and environmentally friendly membrane cells containing

Ruthenium Demand by Application

	'000 oz		
	2010	2011	2012
Chemical	100	273	101
Electrical	679	502	479
Electrochemical	124	130	127
Other	42	58	63
Total Demand	945	963	770

ruthenium-iridium coated electrodes. As this capacity building is now coming to an end, we forecast reduced purchasing. We anticipate modest growth in demand for both metals for chlor-alkali plants in North America which are seeing an upswing in the production of chlorine for polyvinyl chloride (PVC) products used in the construction sector.

Electrical demand for iridium, which has stood at exceptionally high levels in the last two years, is forecast to drop in 2012. The main market for iridium has been in crucibles used to manufacture sapphire crystal wafers for use in light-emitting diodes (LEDs). Demand for backlit LED TVs has driven the growth of crystal-growing capacity by suppliers of substrates to the LED manufacturers, but this has fallen in 2012 as sufficient capacity is now in place. We still anticipate some demand from other crucible-using applications, including the manufacture of acoustic wave filters for mobile phones and components for medical scanners.

The use of organic iridium complexes in organic light-emitting diodes (OLEDs) is forecast to continue to grow from a low base this year in line with increased adoption of OLED technology in smartphones, tablets and some high-end TVs.

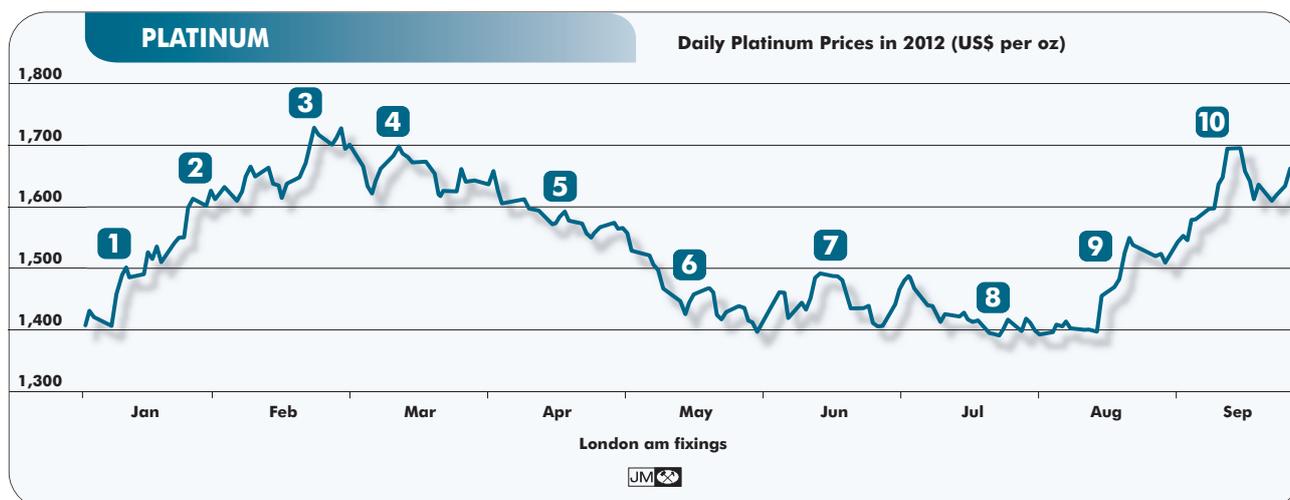
Supplies

Underlying mine output of ruthenium and iridium is forecast to decline this year as a result of disruption in the South African platinum mining sector. Even accounting for this, due to falling demand both markets are expected to remain adequately supplied from primary mine production.

Iridium Demand by Application

	'000 oz		
	2010	2011	2012
Chemical	18	19	19
Electrical	201	190	82
Electrochemical	79	76	70
Other	40	48	47
Total Demand	338	333	218

PRICES



Platinum's price made a promising start in quarter one, but drifted lower in the months following, dragged down by a combination of perceived weak demand, oversupply, a falling gold price and macroeconomic anxiety surrounding the eurozone. Reaching a low for the year to date of \$1,391 on 25th July, prices staged a swift and sudden recovery in mid-August on the back of labour disruption in South Africa. Supply concerns put the platinum price on a generally upwards trajectory throughout September, supported by a surge in speculative and physical investment interest.

1 Platinum fixed at \$1,408 on the morning of 3rd January, the lowest opening New Year price since 2009. Better than expected European and Chinese manufacturing data and improved US jobs numbers gave investors the confidence that had proved elusive in the final quarter of 2011, and platinum's price quickly rose. It was given further upwards momentum following warnings from South Africa's main electricity provider Eskom of possible power shortages during routine maintenance. Speculative buying and a short-covering rally boosted the price to \$1,500 on the 12th, the highest in over a month.

2 A surprise announcement by the US Federal Reserve that interest rates will be kept on hold until late 2014 helped commodities to gain some ground at the expense of the dollar. Platinum's price appreciated further late in January as an illegal strike began at Impala Platinum's Rustenburg operations. Investors bought heavily into the rising price, adding 380,000 oz to combined NYMEX and TOCOM net long positions in the month of January.

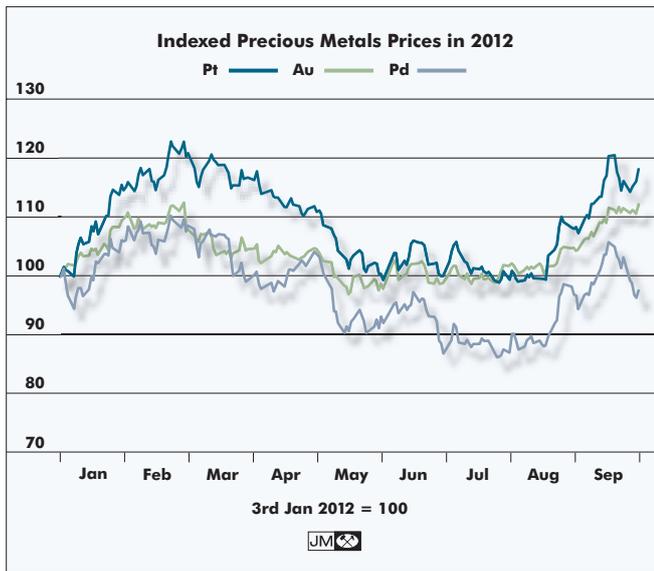
3 Supply concerns intensified in February as over 17,000 illegally striking workers at Impala were dismissed and operations remained suspended. Anticipating lower supplies, investors drove the price higher in the first half of the month. A loosening of Chinese monetary policy and a \$130 billion bailout for Greece, the eurozone's weakest economy, led to a return of risk appetite among investors after a temporary lull. Platinum appreciated to \$1,728 on the 23rd, the highest since September 2011. ETF holdings and net long positions on NYMEX also reached a five-month high by the end of February.

4 Profit-taking and the end of the illegal strike at Impala sent the platinum price sharply lower in early March, wiping off over \$100 in the week to the 7th. Strong physical buying re-emerged at this level, boosting the price briefly. Comments from the US Federal Reserve were widely interpreted as ruling out a further round of quantitative easing – the gold price plunged and the dollar soared in response. In the turmoil that followed, platinum also lost ground in mid-March but at a slower rate than gold, allowing the white metal to briefly recapture a price premium over gold.

Average PGM Prices in \$ per oz (Jan-Sep)			
	2011	2012	Change
Platinum	1,782	1,535	(14%)
Palladium	768	641	(17%)
Rhodium	2,163	1,321	(39%)
Ruthenium	178	116	(35%)
Iridium	1,020	1,077	6%

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

Precious metal prices came under pressure in the middle part of the year before rallying in September.



5 Fresh concerns regarding the financial stability of the eurozone put pressure on risk assets in **April** as Spain missed targets to reduce its budget deficit. New passenger car registrations in the EU were reported to have fallen by 8% year-on-year in the first quarter of 2012, adding further to the gloom. Platinum slid below \$1,600 on 11th April and continued its downward trajectory for the remainder of the month. Combined net long positioning also fell, shedding over a third of a million ounces during April.

6 Quiet trading around various public holidays in early **May** meant it took only small movements in the market to affect the price. Reports of unemployment in the eurozone at record highs of almost 11% were sufficient to weaken the euro and trigger heavy falls in the precious metal complex. Platinum fell beneath \$1,500 for the first time since January on 10th May amid the general gloom. London Platinum Week saw a distinctly sombre mood prevail as South African producers weighed up the prospects of high costs and inadequate revenues against a backdrop of lower supplies and tapering demand. Liquidation in the ETF market saw cumulative platinum holdings trimmed to just under 1.5 million ounces by late May, leaving year-to-date net investment at around 37,000 oz. Combined net long futures positions, having declined in April and May, dropped below a million ounces for the first time since August 2009.

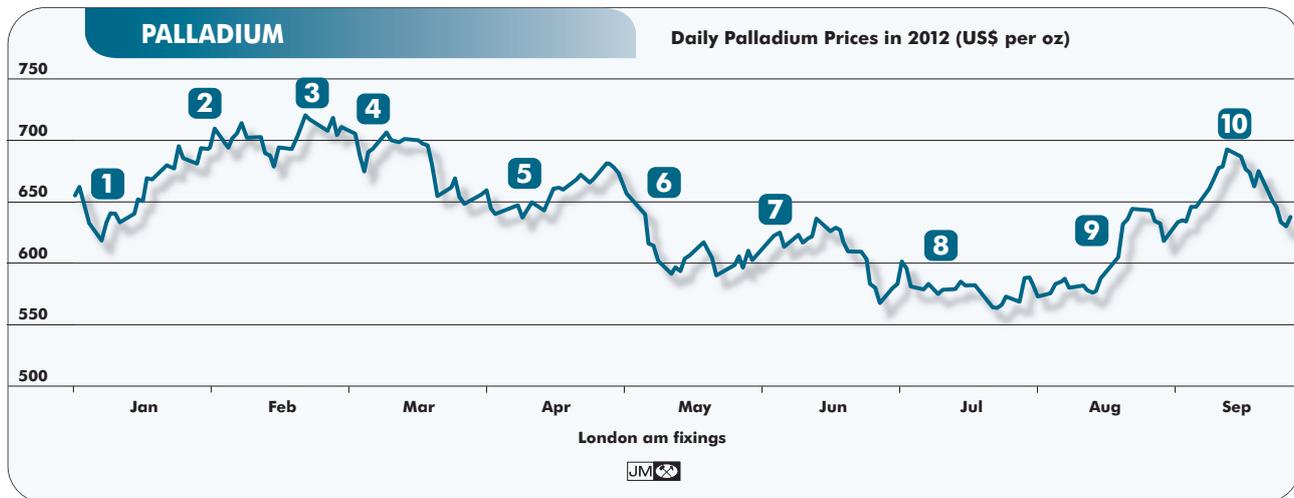
7 Prevailing weak platinum prices and rising costs for producers finally began to prompt action on the supply side in **June**. It was announced that Aquarius was putting its Marikana

mine on care and maintenance, while Eastern Platinum said it was suspending the development of its eastern limb assets pending better prices. These announcements appeared to be welcomed by the market and the price jumped to \$1,485 on the 14th. A further statement from Aquarius that it was also shuttering its Everest mine had less impact on prices.

8 Platinum was at the mercy of macroeconomic factors for much of **July**. Prices drifted downwards amid a risk-off backdrop as the full extent of bad loans in the Spanish banking sector became clear, adding further pressure to the ailing eurozone economy. Slack industrial demand and nervous anticipation of further downside led the price to reach a low for the year of \$1,391 on the morning of 25th July, wiping out all of the gains in the year to date. With platinum cowed, the spread with gold widened to 0.86:1, a ratio not seen since 1985.

9 There were echoes of the earlier strike at Impala as an illegal walkout began at Lonmin's Marikana mine on 10th **August**. The dispute spilled over into violence between rival union factions, causing Lonmin to halt production at the mine. In unprecedented and shocking scenes, 34 striking miners were shot dead by the South African Police Service on the 16th. This tragic loss of life had an immediate and obvious effect on the platinum price as investors feared a prolonged disruption to operations and a spread of the conflict to other South African mines. Gaining over \$150 in the space of a few days, platinum reached \$1,549 on the 23rd, the highest since early May. Futures markets rallied, with net long positioning increasing by over 600,000 oz in the last two weeks of August.

10 Platinum prices were underpinned by a volatile and highly fluid situation in the South African pgm mining industry during **September**, while also benefitting from a risk rally that followed the US Federal Reserve's long-awaited announcement of a third round of quantitative easing. As the strike continued at Lonmin, Anglo American Platinum announced a suspension of its Rustenburg operations in order to protect the workforce from intimidation. Driven by a high degree of speculative investment, rather than any physical shortages, platinum rose to a six-month high of \$1,695 on the 17th and net long NYMEX platinum futures reached a record high of over 2.2 million ounces by late September. Wage agreements at Lonmin and Impala and the re-opening of Amplats' operations saw prices soften somewhat, although further disruption continued to be anticipated by investors. By the end of September, over 80% of Amplats' Rustenburg workforce remained absent.



The palladium price followed a broadly similar course to that of platinum in the first nine months of 2012. Like platinum, the average palladium price was more subdued than in the equivalent period in 2011 as a positive start to the year gave way to risk aversion and concerns about industrial demand. Palladium was briefly lifted by supply side concerns during August and into September.

1 Palladium opened the year at \$655, slightly up on the end of 2011 as the gloom that had enveloped the pgm markets in the final quarter began to lift. An estimated 10% rise in US new car and light truck sales in 2011, the fastest since the 1980s, helped give some upwards momentum to the palladium price, although it quickly retreated to \$617 on 9th **January**.

2 Electricity supply concerns in South Africa, together with firm physical demand, helped put the palladium price on an upwards trend for much of January and on into early **February**. Comments from the CEO of Norilsk Nickel, the world's biggest palladium miner, confirmed that its pgm production would be flat or lower this year. Together with another rise in US car sales in January, this helped palladium to regain the \$700 level for the first time in five months on 3rd February. Combined net long speculative positions increased by over 740,000 oz to 1.2 million ounces in the four weeks to 7th February, while ETF investment for the year to date rose to over 100,000 oz, reflecting a return of investor appetite for palladium.

3 The price dipped sharply in mid-February as investors reduced their exposure to industrial commodities in the wake of a credit rating downgrade for six European countries, including Italy, Spain and Portugal. Palladium proved relatively resilient,

however, due to tightness in availability of the metal in sponge form, and quickly recovered to reach \$721 on 23rd February. This was to mark the high point for the first nine months of 2012. Palladium was supported by lingering supply concerns, a weaker dollar and stronger platinum and gold prices.

4 With palladium looking overbought investors liquidated positions, bringing the price down. A fall in platinum as the Impala strike came to an end also affected palladium, which briefly reached \$675 on 7th **March**. This was despite positive news from the auto sector, in particular an 11% year-on-year rise in US auto sales for February which beat analysts' expectations, and rising sales in Japan aided by government subsidies. Unusually, as the palladium price was falling in March, ETF holdings continued to grow suggesting investors still had confidence in the underlying market fundamentals.

5 Thin trading conditions in Europe around the Easter holiday meant that the palladium price behaved rather erratically, before settling on an upwards trend. In contrast to platinum, which lost value in **April**, the palladium price was lifted by news of a return to growth in the Chinese car market as well as generally positive investor sentiment, reflecting strong physical demand. Futures positions grew in line with price rises, adding another 100,000 oz in the week to 24th April while ETF holdings were steady, unlike those of platinum which declined.

6 Palladium saw its year-to-date gains wiped out in a sharp downward price correction in the first two weeks of **May**. Palladium's peak-to-trough decline was more severe than that for platinum, losing 13% of its value between 30th April and 14th May, in contrast to a 9% fall for platinum between 30th

April and 16th May. The trigger for the fall in both metals was investor concerns over eurozone debt levels as well as dimmer prospects for growth in China and the USA. Risk aversion and a falling price triggered a steep sell-off in the futures market, with combined net long positions shedding over half a million ounces in the first three weeks of May, leaving the palladium futures market at an historic low of just under 250,000 oz. Illustrating the divergent behaviour of the futures and physical investment markets, investors in ETFs continued to add to positions as the price fell during May.

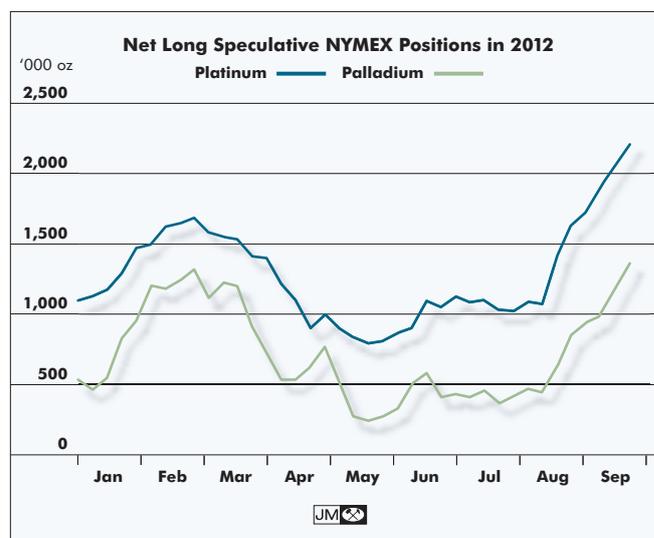
7 Johnson Matthey's "Platinum 2012" publication, launched on 14th May, forecast a market deficit for palladium in 2012, due in part to lower Russian state stock sales and healthy autocatalyst demand. With the fundamentals in the palladium market remaining strong, the price struggled higher in the second half of May and into **June**. Palladium gained some support from a rising platinum price in early June, itself boosted by reports of mine closures in South Africa. Rising to \$636 on 15th June, palladium once again came under pressure alongside the other precious metals as the US Federal Reserve slashed its growth forecasts and embarked on an extension of 'Operation Twist', designed to boost bank lending.

8 The price recovered in late June and into early **July**, as investors regained confidence in palladium following a loosening of monetary policy in China and the eurozone. Reports of improved domestic sales for US automakers and better sales in China also helped. Palladium was becalmed in mid-July before a sell-off in gold and platinum caused palladium to lose ground, dipping to a low for the year of \$564 on July 24th. Total physical investment in palladium ETFs continued to hold up relatively steadily at just over 2 million ounces in July, despite some light selling, perhaps reflecting some positions being out of the money at prevailing prices and also that some investors see long-term upside to palladium.

9 After a somewhat quiet start to **August**, prices moved up rapidly in response to renewed supply concerns as a labour dispute at Lonmin developed into a violent confrontation between rival union factions. Between 14th and 24th August, palladium gained 12%. News of a strike at Royal Bafokeng Platinum and fears of contagion further unsettled the market.

10 Early **September** saw palladium make further gains as a double-digit rise in August US auto sales helped investor sentiment for the metal. Palladium rose alongside platinum

Net long platinum positions on NYMEX reached a record high level in September 2012.



as the South African supply situation deteriorated. With operations shuttered at Lonmin due to inter-union violence and intimidation, Amplats' Rustenburg mines suspended and workers at Impala agitating for another wage increase, investors moved in. Following announcements of monetary stimulus in the eurozone, Japan and the USA, the price soared as part of a broad-based risk rally, rising to \$692 on the 14th, the highest since March. Palladium dropped back under pressure from speculative liquidation and technical selling in late September.

OTHER PGM

The rhodium price suffered a poor first nine months of 2012. Beginning the year at the lowest level since 2009, the price gained some momentum in the initial two months of the year before succumbing to the prevailing market sentiment that also dragged down platinum and palladium. With the exception of a brief price spike in mid-September, for the remainder of the nine-month period rhodium was seemingly at the mercy of negative news while experiencing little of the periodic upside seen in the platinum and palladium markets. Overall, rhodium traded on average at \$1,321, 39% lower than the same period in 2011.

Rhodium came under light selling pressure early in the New Year, resulting in the price falling from an opening Johnson Matthey Base Price of \$1,400 on 3rd **January** to \$1,350 on the 10th – the lowest for 32 months. At this level, it attracted steady buying interest from Europe and Asia. This, together with supply side pressure coming from the prolonged strike taking place at Impala, helped rhodium to make gains, reaching a

high for the year of \$1,550 on 14th **February**. At this point, Asian investors held back and light selling in Europe saw the rhodium price soften to \$1,525, where it remained until 15th **March**.

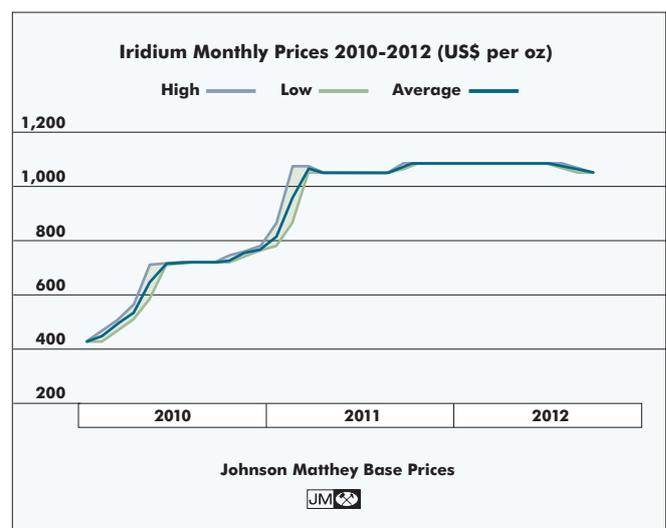
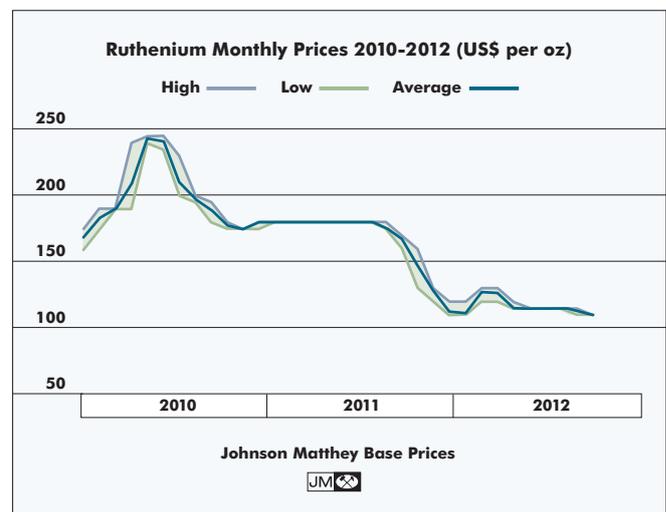
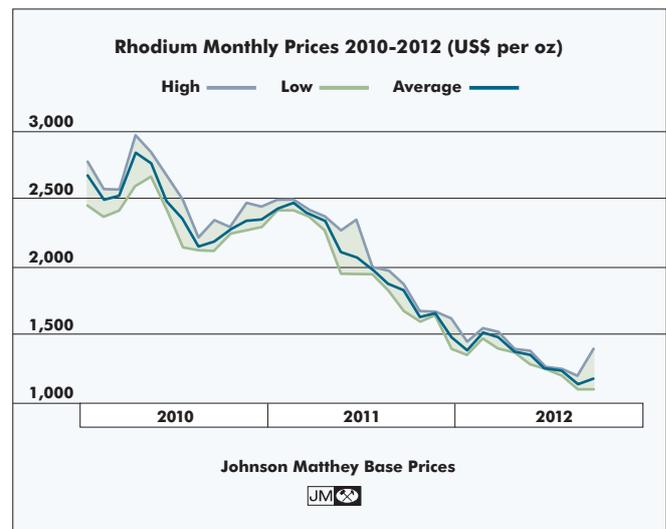
A year on from the earthquake and tsunami disaster in Japan, recovery in automotive production by Japanese manufacturers, the biggest users of rhodium in emissions control catalysts, failed to have much impact on the rhodium price, which continued to shed value under the pressure of selling in the market. Wiping out its gains for the year to date, the rhodium price declined to \$1,375 by mid-**April** before appreciating by \$10 in steady two-way trade.

Rhodium was not immune to the negative market conditions in **May**. With weak prospects for economic growth in the eurozone, the USA and China dominating the news wires, rhodium succumbed to selling pressure and dropped by 10% between 9th **May** and 1st **June** to reach \$1,250. Rhodium remained unchanged at this level until 10th **July** with quiet trading. The price then softened for the remainder of the month as the weight of European selling exceeded Asian buying.

Subdued trading flows in **August** saw the price come under further pressure, reaching a new low for the nine month period of \$1,100. Prices showed almost no reaction initially to the supply disruptions in South Africa, rhodium merely gained \$20 on Asian buying interest, before softening once again to \$1,100. After remaining becalmed for the first half of **September**, speculators and industrial buyers moved to cover their rhodium requirements in the light of the disruption to South African pgm supplies. In the space of three days, the price gained \$300, briefly spiking at a five-month high of \$1,400 on the 18th. At this level, investors liquidated speculative holdings and the price dropped almost as quickly as it had risen, coming to rest at \$1,100 once again.

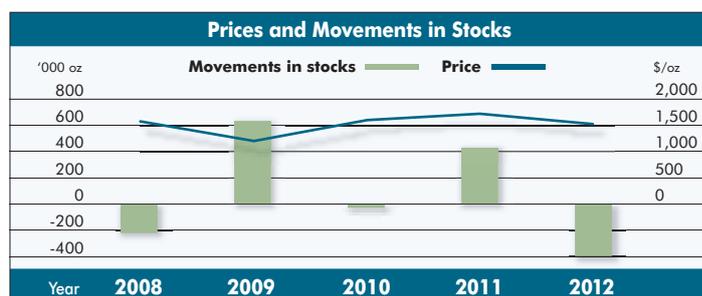
Ruthenium made gains in **January** and **February** on the back of industrial purchasing, increasing by 18% to \$130. The price weakened in **March** and early **April** amid a surfeit of sellers in the market to reach \$115, where it remained until mid-**August**. Immune from the wider price movements in the precious metals markets, ruthenium then softened to \$110, ending **September** where it had begun the year.

There was very limited activity in the **iridium** market between **January** and **July**, with the price having remained at \$1,085 since September 2011. The market finally succumbed to some selling pressure and a lack of buyers on 10th **July** to reach a new Johnson Matthey Base Price of \$1,070. Iridium fell by a further \$20 in **August** amid light selling and subdued buying demand, ending **September** at \$1,050.



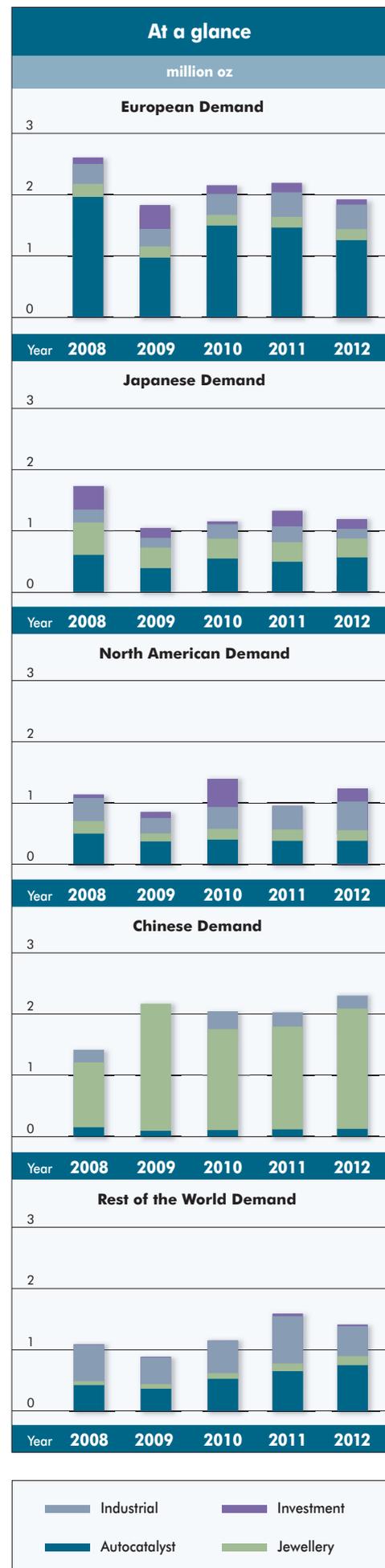
SUPPLY AND DEMAND TABLES

Platinum Supply and Demand							
		'000 oz	2008	2009	2010	2011	2012
Supply ¹	South Africa		4,515	4,635	4,635	4,855	4,250
	Russia ²		805	785	825	835	790
	North America		325	260	200	350	340
	Zimbabwe ³		180	230	280	340	360
	Others ³		115	115	110	100	100
Total Supply			5,940	6,025	6,050	6,480	5,840
Gross Demand by Application ⁴	Autocatalyst ⁴		3,655	2,185	3,075	3,105	3,070
	Chemical		400	290	440	470	450
	Electrical ⁴		230	190	230	230	200
	Glass		315	10	385	555	225
	Investment		555	660	655	460	490
	Jewellery ⁴		2,060	2,810	2,420	2,480	2,725
	Medical & Biomedical ⁵		245	250	230	230	240
	Petroleum		240	210	170	210	200
	Other		290	190	300	355	470
	Total Gross Demand			7,990	6,795	7,905	8,095
Recycling ⁶	Autocatalyst		(1,130)	(830)	(1,085)	(1,225)	(1,035)
	Electrical		(5)	(10)	(10)	(10)	(10)
	Jewellery		(695)	(565)	(735)	(810)	(785)
Total Recycling			(1,830)	(1,405)	(1,830)	(2,045)	(1,830)
Total Net Demand⁷			6,160	5,390	6,075	6,050	6,240
Movements in Stocks⁸			(220)	635	(25)	430	(400)

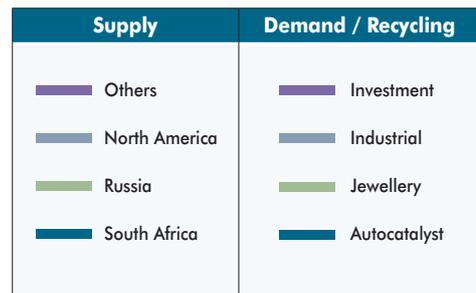
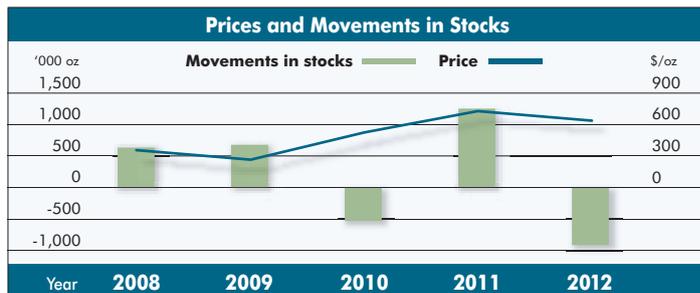
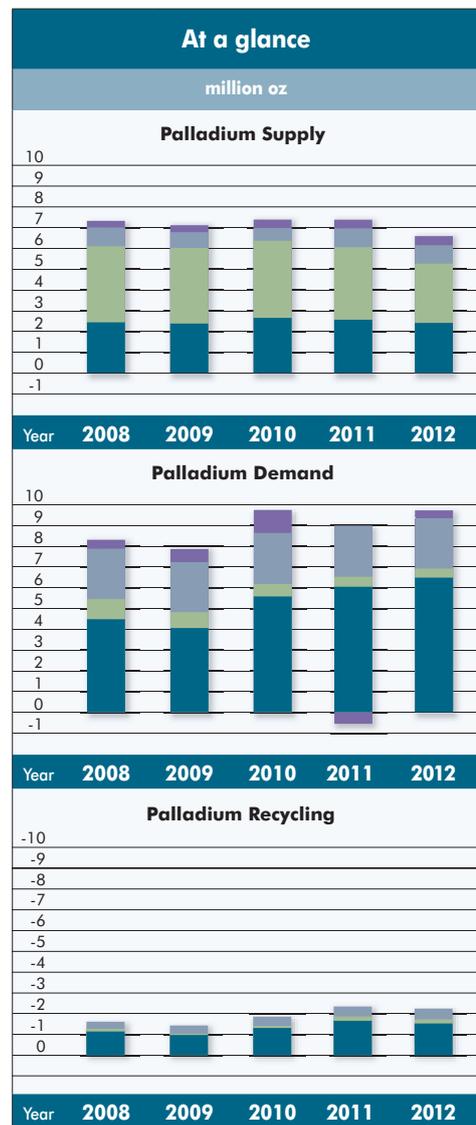


Average Price (US\$ per oz) ⁹				
2008	2009	2010	2011	2012
1,576	1,205	1,611	1,721	1,535

Gross Platinum Demand by Region							
		'000 oz	2008	2009	2010	2011	2012
Europe	Autocatalyst	1,970	970	1,495	1,465	1,255	
	Chemical	105	70	110	120	110	
	Electrical	20	20	15	20	20	
	Glass	(25)	5	10	30	15	
	Investment	105	385	140	155	90	
	Jewellery	205	185	175	175	180	
	Medical & Biomedical	115	115	90	90	95	
	Petroleum	30	25	20	35	20	
	Other	85	55	100	105	140	
	Total		2,610	1,830	2,155	2,195	1,925
Japan	Autocatalyst	610	395	550	500	570	
	Chemical	55	45	50	30	35	
	Electrical	35	30	30	25	25	
	Glass	65	40	90	140	20	
	Investment	385	160	45	250	160	
	Jewellery	530	335	325	315	305	
	Medical & Biomedical	20	20	20	20	20	
	Petroleum	10	10	5	5	5	
	Other	25	15	40	45	55	
	Total		1,735	1,050	1,155	1,330	1,195
North America	Autocatalyst	505	370	405	380	380	
	Chemical	95	65	100	95	105	
	Electrical	30	25	25	25	20	
	Glass	(5)	(35)	10	(5)	10	
	Investment	60	105	465	10	210	
	Jewellery	200	135	175	185	175	
	Medical & Biomedical	85	90	90	90	90	
	Petroleum	25	15	25	50	60	
	Other	150	90	105	130	185	
	Total		1,145	860	1,400	960	1,235
China	Autocatalyst	145	85	100	110	115	
	Chemical	60	40	80	105	95	
	Electrical	30	20	30	30	30	
	Glass	85	(90)	130	40	80	
	Investment	0	0	0	0	0	
	Jewellery	1,060	2,080	1,650	1,680	1,920	
	Medical & Biomedical	10	10	10	10	15	
	Petroleum	10	10	15	15	10	
	Other	10	10	25	30	35	
	Total		1,410	2,165	2,040	2,020	2,300
Rest of the World	Autocatalyst	425	365	525	650	750	
	Chemical	85	70	100	120	105	
	Electrical	115	95	130	130	105	
	Glass	195	90	145	350	100	
	Investment	5	10	5	45	30	
	Jewellery	65	75	95	125	145	
	Medical & Biomedical	15	15	20	20	20	
	Petroleum	165	150	105	105	105	
	Other	20	20	30	45	55	
	Total		1,090	890	1,155	1,590	1,415
Total Gross Demand		7,990	6,795	7,905	8,095	8,070	

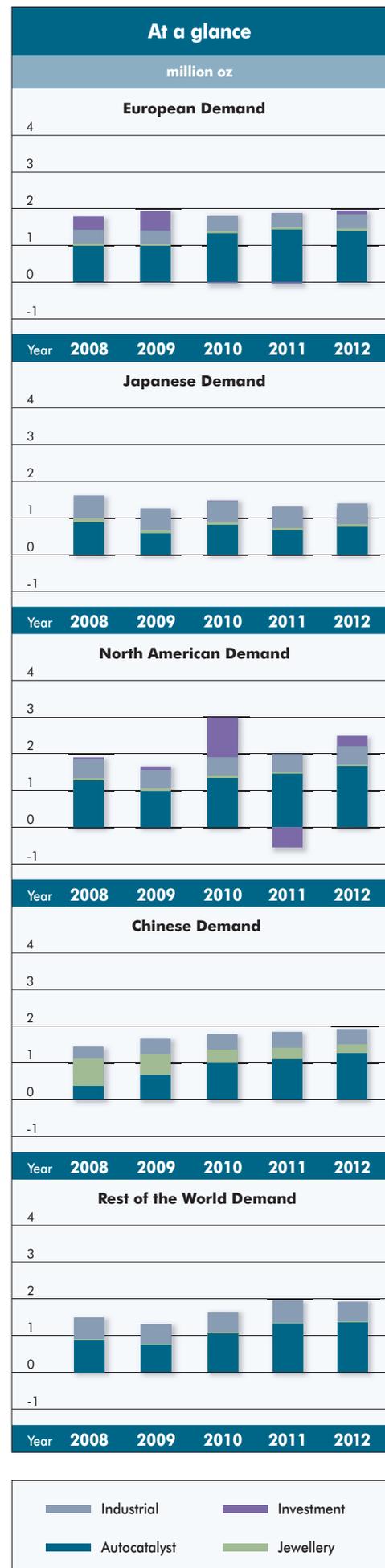


Palladium Supply and Demand							
		'000 oz	2008	2009	2010	2011	2012
Supply ¹	South Africa		2,430	2,370	2,640	2,560	2,400
	Russia ²						
	Primary		2,700	2,675	2,720	2,705	2,600
	Stock Sales		960	960	1,000	775	250
	North America		910	755	590	900	890
	Zimbabwe ³		140	180	220	265	280
	Others ³		170	160	185	155	150
	Total Supply		7,310	7,100	7,355	7,360	6,570
	Gross Demand by Application ⁴	Autocatalyst ⁴		4,465	4,050	5,580	6,030
Chemical			350	325	370	445	530
Dental			625	635	595	550	540
Electrical ⁴			1,370	1,370	1,410	1,380	1,210
Investment			420	625	1,095	(565)	385
Jewellery ⁴			985	775	595	505	450
Other			75	70	90	105	130
Total Gross Demand			8,290	7,850	9,735	8,450	9,725
Recycling ⁶	Autocatalyst		(1,140)	(965)	(1,310)	(1,655)	(1,525)
	Electrical		(345)	(395)	(440)	(480)	(520)
	Jewellery		(130)	(70)	(100)	(210)	(195)
	Total Recycling		(1,615)	(1,430)	(1,850)	(2,345)	(2,240)
Total Net Demand⁷			6,675	6,420	7,885	6,105	7,485
Movements in Stocks⁸			635	680	(530)	1,255	(915)

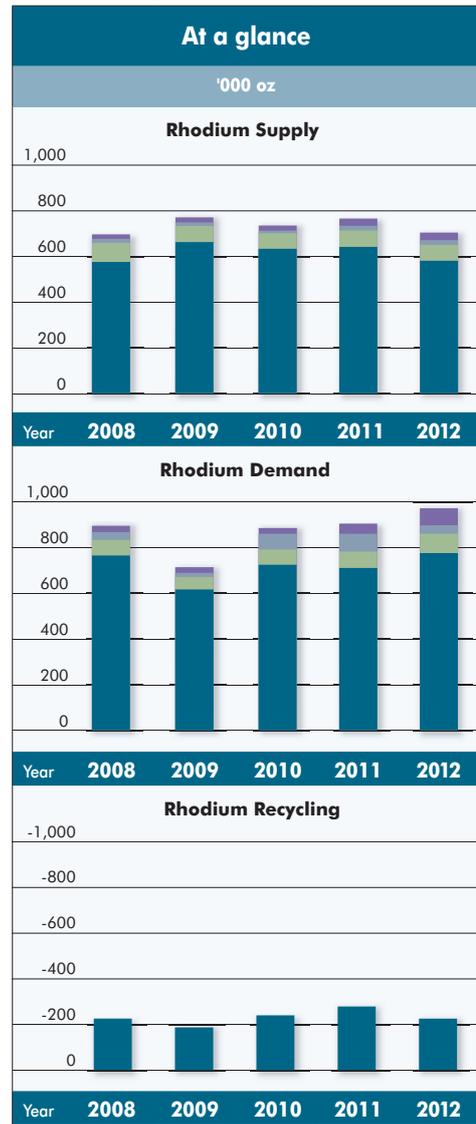


Average Price (US\$ per oz) ⁹					
2008	2009	2010	2011	2012	
352	264	526	733	641	

Gross Palladium Demand by Region							
		'000 oz	2008	2009	2010	2011	2012
Europe	Autocatalyst		1,005	995	1,330	1,440	1,395
	Chemical		100	85	105	80	85
	Dental		65	65	80	80	80
	Electrical		190	195	195	185	190
	Investment		370	525	(5)	(35)	105
	Jewellery		45	50	65	60	70
	Other		20	20	30	30	35
	Total		1,795	1,935	1,800	1,840	1,960
Japan	Autocatalyst		885	590	820	665	765
	Chemical		20	20	20	20	20
	Dental		275	295	250	230	225
	Electrical		320	270	295	310	315
	Investment		0	0	10	5	0
	Jewellery		115	80	75	70	70
	Other		10	10	10	10	10
	Total		1,625	1,265	1,480	1,310	1,405
North America	Autocatalyst		1,290	1,020	1,355	1,475	1,680
	Chemical		55	50	65	80	85
	Dental		270	260	250	225	220
	Electrical		170	170	160	145	140
	Investment		50	95	1,090	(535)	280
	Jewellery		60	60	65	45	45
	Other		20	15	25	35	55
	Total		1,915	1,670	3,010	1,470	2,505
China	Autocatalyst		390	685	1,005	1,115	1,275
	Chemical		55	75	65	150	215
	Dental		0	0	0	0	0
	Electrical		255	335	360	270	185
	Investment		0	0	0	0	0
	Jewellery		740	560	360	305	240
	Other		10	10	10	10	10
	Total		1,450	1,665	1,800	1,850	1,925
Rest of the World	Autocatalyst		895	760	1,070	1,335	1,365
	Chemical		120	95	115	115	125
	Dental		15	15	15	15	15
	Electrical		435	400	400	470	380
	Investment		0	5	0	0	0
	Jewellery		25	25	30	25	25
	Other		15	15	15	20	20
	Total		1,505	1,315	1,645	1,980	1,930
Total Gross Demand		8,290	7,850	9,735	8,450	9,725	

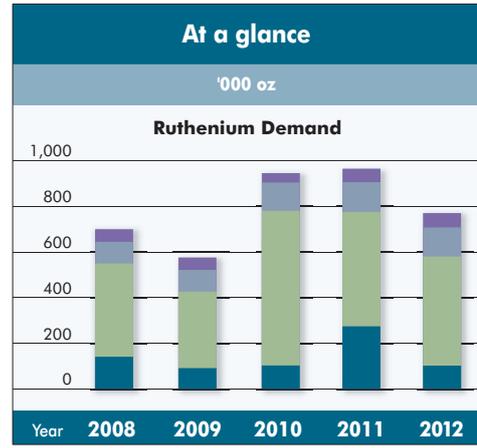


Rhodium Supply and Demand							
		'000 oz	2008	2009	2010	2011	2012
Supply ¹	South Africa		574	663	632	641	580
	Russia ²		85	70	70	72	70
	North America		18	15	10	20	21
	Zimbabwe ³		15	19	19	29	30
	Others ³		3	3	3	3	2
Total Supply			695	770	734	765	703
Gross Demand by Application ⁴	Autocatalyst ⁴		768	619	727	712	778
	Chemical		68	54	67	72	84
	Electrical		3	3	4	5	6
	Glass		34	19	68	78	37
	Other		24	21	21	39	68
Total Gross Demand			897	716	887	906	973
Recycling ⁶	Autocatalyst		(227)	(187)	(241)	(280)	(227)
	Total Recycling		(227)	(187)	(241)	(280)	(227)
Total Net Demand⁷			670	529	646	626	746
Movements in Stocks⁸			25	241	88	139	(43)



Average Price (US\$ per oz) ⁹				
2008	2009	2010	2011	2012
6,564	1,592	2,458	2,022	1,321

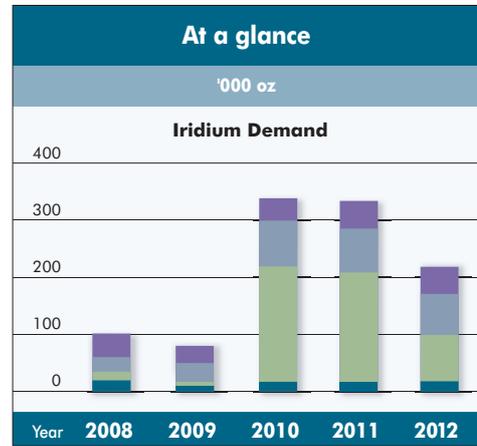
Ruthenium Demand						
'000 oz		2008	2009	2010	2011	2012
Demand by Application	Chemical	139	89	100	273	101
	Electrical	410	336	679	502	479
	Electrochemical	95	95	124	130	127
	Other	55	54	42	58	63
Total Demand		699	574	945	963	770



Average Price (US\$ per oz)⁹

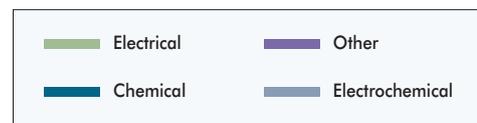
Year	2008	2009	2010	2011	2012
Average Price	323	95	197	166	116

Iridium Demand						
'000 oz		2008	2009	2010	2011	2012
Demand by Application	Chemical	21	11	18	19	19
	Electrical	15	7	201	190	82
	Electrochemical	25	33	79	76	70
	Other	41	30	40	48	47
Total Demand		102	81	338	333	218



Average Price (US\$ per oz)⁹

Year	2008	2009	2010	2011	2012
Average Price	450	425	642	1,036	1,077



NOTES TO TABLES

¹ **Supply** figures represent estimates of sales by the mines of primary pgm and are allocated to where the initial mining took place rather than the location of refining. Additionally, we continue to report sales of metal which we believe has not previously been priced, principally sales of Russian state stocks, as supplies.

² Our **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. **Russian supply** figures for palladium have been split into sales from primary mining and sales of stocks.

³ Supplies from **Zimbabwe** have been split from **Others' supplies**. Platinum group metals mined in Zimbabwe are currently refined in South Africa, and our supply figures represent shipments of pgm in concentrate or matte, adjusted for typical refining recoveries.

⁴ **Gross demand** figures for any given application represent the sum of manufacturer demand for metal in that application and any changes in unrefined metal stocks in that sector. Increases in unrefined stocks lead to additional demand, reductions in stock lead to a lower demand figure.

⁵ Our **Medical and Biomedical** category represents combined metal demand in the medical, biomedical and dental sectors.

⁶ **Recycling** figures represent estimates of the quantity of metal recovered from open loop recycling (i.e. where the original purchaser does not retain control of the metal throughout). For instance, autocatalyst recycling represents the weight of metal recovered from end-of-life vehicles and aftermarket scrap in an individual region, allocated to where the car is scrapped rather than where the metal is finally recovered. These figures do not include warranty or production scrap. Where no recycling figures are given, open loop recycling is negligible. In our recycling charts, we label recovery of electrical scrap as 'industrial' recycling.

⁷ **Net demand** figures are equivalent to the sum of gross demand in an application less any metal recovery from open loop scrap in that application, whether the recycled metal is reused in that industry or sold into another application. Where no recycling figure is given for an application, gross and net demand are identical.

⁸ **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.

⁹ **Average price** figures for platinum and palladium are the mean of all daily fixing values in a given year except for 2012 which cover the period January to September inclusive. Average price figures for rhodium, ruthenium and iridium are based on Johnson Matthey European Base Prices.

GLOSSARY

AMCU	Associated Mineworkers and Construction Union	OBD	On-Board Diagnostic
ARM	African Rainbow Minerals	OLED	Organic Light-Emitting Diode
ASC	Ammonia Slip Catalyst	oz	Ounces Troy
CIS	Commonwealth of Independent States	PET	Polyethylene Terephthalate
CO	Carbon Monoxide	pgm	Platinum Group Metal(s)
CO ₂	Carbon Dioxide	Platreef	A platiniferous ore body in South Africa
DOC	Diesel Oxidation Catalyst	PM	Particulate Matter
DPF	Diesel Particulate Filter	PTA	Purified Terephthalic Acid
EGR	Exhaust Gas Recirculation	SCR	Selective Catalytic Reduction
ELV	End-of-Life Vehicle	SGE	Shanghai Gold Exchange
ETF	Exchange Traded Fund	SOx	Oxides of Sulphur
g	Gram	SUV	Sports Utility Vehicle
GDP	Gross Domestic Product	TOCOM	Tokyo Commodity Exchange
HC	Hydrocarbons	tonne	1,000 kg
JAMA	Japan Automobile Manufacturers Association	TWC	Three-Way Catalyst
JV	Joint Venture	UG2	A platiniferous ore body in South Africa
kg	Kilogram	VAM	Vinyl Acetate Monomer
LCD	Liquid Crystal Display		
LED	Light-Emitting Diode		
LNT	Lean NOx trap		
Merensky	A platiniferous ore body in South Africa		
MLCC	Multi-Layer Ceramic Capacitor		
NO	Nitric Oxide		
NOx	Oxides of Nitrogen		
NUM	National Union of Mineworkers		
NYMEX	New York Mercantile Exchange		

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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