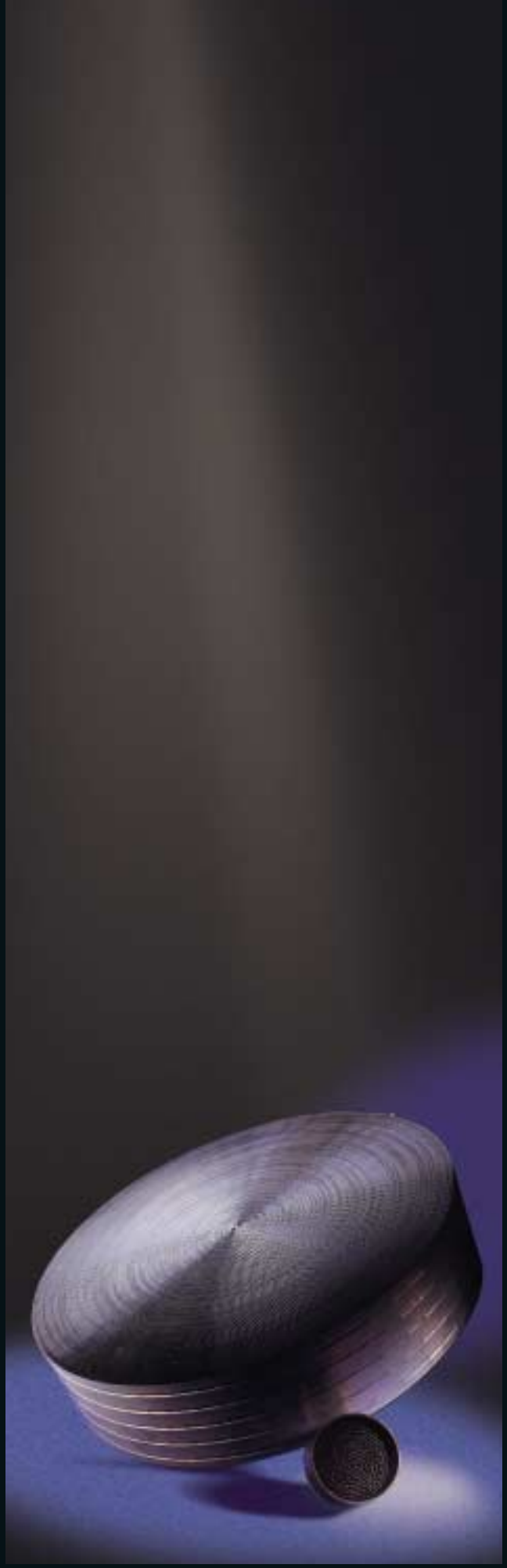
Platinum 2001



Johnson Matthey

Interim Review

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Platinum 2001

by Alison Cowley and Danielle Hankin

Summary and Outlook	2
Supplies, Mining and Exploration	8
Platinum	11
Palladium	15
Other Platinum Group Metals	18
Prices	20
Supply and Demand Tables	23
Glossary	inside back cover

Johnson Matthey

Interim Review

Summary & Outlook

Platinum

- Demand for platinum is expected to climb by 5 per cent to a record 5.94 million oz in 2001.
- Auto industry purchases of platinum are forecast to rise by 25 per cent as diesels gain market share and platinum is substituted for palladium in some gasoline catalysts.
- Jewellery demand is expected to decline by 11 per cent as sharp falls in Japan and the USA outweigh another record year in China.
- Increasing use of platinum in glass production, dental alloys and petroleum refining will boost industrial demand by 3 per cent.
- Investment offtake is expected to be positive this year, though still relatively small.
- Supplies of platinum are forecast to rise by 5 per cent as mine expansions in South Africa begin to come on stream.
- Despite strong demand and limited market stocks, negative sentiment and short selling dragged the price down to $429 at the end of September, 30 per cent lower than at the start of 2001.

Platinum Supply and Demand
'000 oz

	2000	2001
Supply		
South Africa	3,800	4,080
Russia	1,100	1,050
North America	285	340
Others	105	110
Total Supply	**5,290**	**5,580**
Demand		
Autocatalyst: gross	1,890	2,360
recovery	(470)	(510)
Jewellery	2,830	2,520
Industrial	1,470	1,520
Investment	(60)	50
Total Demand	**5,660**	**5,940**
Movements in Stocks	(370)	(360)

JM

Overview

Demand for platinum is forecast to increase to 5.94 million oz in 2001, boosted by another sharp increase in consumption in autocatalysts. This year, further expansion in the diesel sector has been augmented by growth in the use of platinum on gasoline vehicles and demand is forecast to reach 2.36 million oz. High palladium prices have triggered a return to platinum by some auto makers, a trend that is expected to continue despite recent changes in the relative price of the two metals.

Sales of platinum to jewellery manufacturers will contract sharply this year, to 2.52 million oz. This is mainly due to a collapse in demand in Japan, where the market has been adversely affected by a switch to gold at the cheaper end of the market, and by substantial recycling of surplus stocks of platinum jewellery. In contrast, the Chinese market has continued to expand rapidly this year, with consumers proving less price sensitive than was previously feared.

Industrial demand, at 1.52 million oz, is expected to record a modest increase. Although the world economy has slowed significantly, investment decisions made in previous years are still generating additional platinum demand in the glass and petroleum sectors. However, consumption in hard disks has been hit by lower sales of personal computers.

Investment demand, at 50,000 oz, is forecast to be positive in 2001, reversing the disinvestment that occurred last year.

Supplies are expected to reach 5.58 million oz this year, despite lower sales from Russia. Expansions by South African producers are beginning to add to supply although, as in 2000, some production has been lost due to technical problems and industrial action. Despite the increase, supplies will again fall below the level of demand, leading to a deficit of 360,000 oz.

The platinum price peaked at $645 in January and remained above $550 throughout the first half of 2001, supported by strong consumer demand and limited availability. The price subsequently eased, falling to $429 at the end of September. The decline was heavily influenced by speculative activity. Large net long positions held by the

general public on TOCOM were liquidated between June and August, and by September a substantial short position had been accumulated.

Supply

Supplies of platinum from South Africa are expected to exceed 4 million oz for the first time in 2001. Several projects have come on stream in the last 2-3 years and are currently building up towards full production. At Anglo Platinum, additional ounces have been generated from the new Bafokeng Rasimone Platinum Mine (BRPM), and capacity increases at the existing Amandelbult and Lebowa operations. Impala, through its Barplats subsidiary, has benefited from the start up of the refurbished Crocodile River mine. Lonmin, Kroondal and Northam have also increased capacity this year.

However, this year's increase in output will be significantly less than the mines themselves had originally intended. Some expansions have encountered delays in the build up to full production, while industrial action has also affected production. We estimate that, had existing and new operations operated as planned, platinum output this year would have been at least 200,000 oz higher than our current forecast.

Next year should see a significant jump in refined platinum output. Two new mines are scheduled to enter production in 2002 – Anglo Platinum's Waterval and Maandagshoek operations – while capacity expansions by other producers should also add to industry totals. Platinum production is planned to rise by around 500,000 oz, but in reality we believe the increase will be smaller – it is unlikely that the industry will entirely escape the technical problems and industrial disputes that have reduced output in recent years.

Despite pgm output falling below plan, industry profits have been at record levels during the last year, boosted by high pgm prices and a weak rand. This, combined with expectations of strong growth in platinum demand, has encouraged producers to plan further increases in capacity. During the first nine months of 2001, Anglo Platinum, Lonmin and Impala all announced further investment in new platinum mining ventures. If all currently-planned projects proceed as scheduled, South African platinum production could exceed 5.5 million oz by the middle of this decade. However, we believe that the recent weakening in the world economic outlook may be the trigger for producers to re-examine their expansion schedules.

Supplies of platinum from Russia are expected to total 1.05 million oz in 2001. Shipments were restricted during the first quarter, with more substantial quantities of metal beginning to flow from April onwards. Following the implementation of a new presidential decree concerning exports of precious metals, there was some disruption to exports during August and September, but this is not expected to have a material impact on overall platinum sales this year.

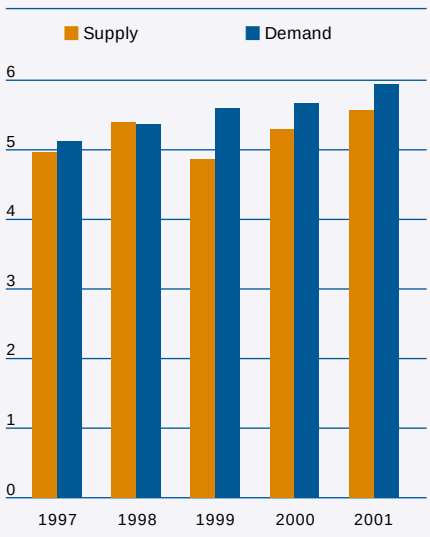
The new decree allows for a wider range of banks and producers to export refined pgm. It also allows for longer-term quotas covering periods of up to five years, a provision from which Norilsk Nickel is expected to benefit. However, sales remain under the control of the Ministry of Finance, as all pgm exports must continue to be made through the state marketing agency, Almaz.

Output of pgm by Norilsk Nickel is expected to increase gradually in future years, as the company invests in new facilities to treat disseminated ore and reprocess tailings. However, production from the alluvial operations of the Russian Far East has fallen since the late 1990s and is not expected to return to previous levels. With government stocks of platinum now small, we expect Russian sales of platinum to be close to actual production in future.

Supplies of platinum from other regions will be up slightly in 2001. In North America, production will be boosted by the end of a seven month strike at Falconbridge and by expansion at Stillwater. Output of pgm in Zimbabwe remains very small, but will increase next year as Zimplats' Ngezi open-pit project enters production.

Supply and Demand for Platinum 1997-2001

Million oz



Demand

Sales of platinum to auto makers are forecast to rise by 25 per cent to 2.36 million oz in 2001. The most important single contributor to this increase will be the European diesel sector, where the use of platinum is expected to rise by 40 per cent this year. This reflects the growing market share taken by diesel vehicles, and a significant rise in loadings to meet European Stage III legislation.

The re-adoption of platinum-based catalysts for gasoline vehicles is also beginning to have an impact on demand. The dramatic rise in the palladium price that occurred between 1999 and early 2001 encouraged auto makers to reassess their catalyst strategy, with the result that some companies – especially those which had moved most heavily into palladium technology – are now increasing their use of platinum. This has made a moderate contribution to demand in 2001 and is expected to have a more significant impact next year.

Jewellery demand for platinum is forecast to retreat further from the peak of 2.88 million oz seen in 1999, falling by 11 per cent to 2.52 million oz in 2001. It has been a year of sharply contrasting fortunes in the two major markets: another remarkable increase in Chinese platinum jewellery fabrication, which is forecast to reach 1.3 million oz this year, will be offset by a plunge in Japanese demand to a 16 year low of just 700,000 oz.

Predictions that Chinese demand would at best stabilise this year have proved unfounded. Although fabrication levels have undoubtedly been affected by a combination of higher platinum prices and a wave of government tax investigations, the effect has been to slow the rate of expansion rather than to halt it altogether. Consumers have proved less price sensitive than previously expected, and a series of increases in retail prices appears to have had little impact on purchasing activity.

In contrast, the Japanese market has been hard hit by higher platinum prices. Although unit sales of all precious metal jewellery rose by 5 per cent in the first half of 2001, consumer demand for platinum pieces fell by 17 per cent. This reflected a sharp contraction in platinum's share of the market for lower-priced jewellery items, with white gold now being widely used for inexpensive white fashion jewellery.

In terms of platinum demand, the impact of falling retail sales has been magnified by financial weakness in the Japanese jewellery industry. In order to reduce funds tied up in slow-moving product lines, manufacturers and retailers have continued to recycle outdated stocks of jewellery. This has provided some of the platinum required for fabrication this year, reducing purchases of fresh metal from the market.

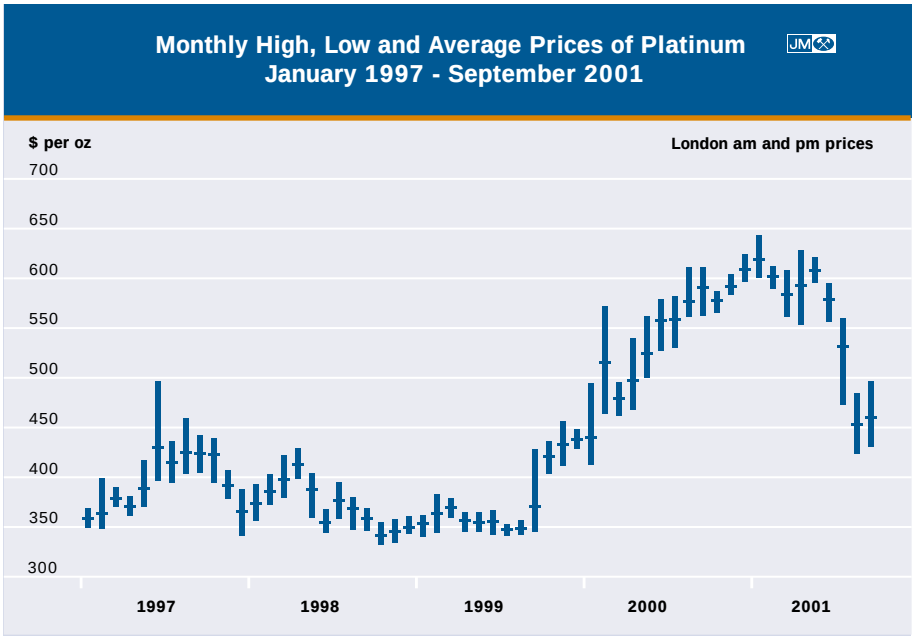
In the USA, the world's third largest market for platinum jewellery, demand during the first nine months of 2001 was affected by higher platinum prices and a slowdown in consumer spending. Following the terrorist attacks on 11th September, the industry is expecting poor sales during the final quarter and we therefore predict a sharp decline in sales of platinum to jewellery makers this year. Most European and Asian countries will also see a fall in platinum jewellery fabrication, although the UK is likely to prove an exception to this trend.

Industrial demand for platinum is forecast to rise by 3 per cent to 1.52 million oz. Sales to the glass sector will be particularly strong, with the construction of new LCD glass capacity continuing to consume large quantities of platinum. Offtake by the petroleum industry will also rise, mainly due to sales of platinum for new reforming capacity in the Middle East. There will also be strong growth in the use of platinum in a range of smaller applications such as dental alloys and biomedical devices. Demand in the chemical sector will be stable, with growth in the use of platinum catalysts for the production of speciality silicones being offset by lower consumption in other processes.

The only industrial sector in which demand is expected to contract is the electrical industry. Following rapid growth in the use of platinum in hard disks in the last three years, demand in 2001 has been hit by a downturn in

computer sales. Technological advances are also having an impact: improvements in disk storage capacity have resulted in a decline in the average number of disks used in each hard drive, though this has been partly offset by a modest increase in the platinum content of each disk.

Investment demand will be positive this year, following significant disinvestment in 2000. Last year's negative number was primarily due to profit-taking by Japanese investors, as 500g and 1kg platinum bars bought in earlier years at low prices were returned to the market. Further disinvestment occurred in early 2001, but a decline in the price since mid year has stimulated new demand. For the year as a whole we expect fresh investment in large platinum bars to balance sales back to the market. Sales of the US Mint's bullion platinum Eagle coin are expected to be slightly up on the level of last year.



Outlook

The full impact of the 11th September terrorist attacks is not yet clear, but there is little doubt that world growth will slow significantly. Many economic forecasters believe that the major markets of the USA and Japan are already in recession and will remain so despite fiscal stimulation by governments. As a result, our forecasts of platinum demand for next year are subject to much greater uncertainty than usual. Changes in relative pgm prices may also affect demand, especially in the auto industry, but it is too early to determine the precise impact. While we remain positive about the outlook for platinum, short-term growth in the market will be lower than previously anticipated.

Jewellery demand is the area of greatest sensitivity. In Japan, retail sales of jewellery are likely to contract again, especially in the upper price levels where platinum is strongest. However, we believe that inventories of platinum jewellery held by manufacturers and retailers are now at very low levels, and next year should therefore see a decline in the recycling of old jewellery stocks that has reduced fresh demand for platinum over the last two years. If so, sales of platinum to Japanese jewellery fabricators could stabilise or even rise modestly.

There is little prospect of any immediate increase in sales of platinum jewellery in the USA, but the outlook in China is brighter. The rapid development of the Chinese platinum jewellery market in 2001, despite less than favourable circumstances, suggests that the prospects for future expansion remain good. Lower platinum prices have helped to improve profit margins, and this should stimulate manufacturers and retailers to continue to expand their platinum jewellery business.

In the autocatalyst sector, we believe that platinum demand will grow again, despite expectations of a significant downturn in vehicle production worldwide. Catalyst changes have a lead-time of many months, so the very high palladium prices of late 2000 and early 2001 will continue to have an impact over the next year. There will be further switching back to platinum catalysts on gasoline vehicles, especially in North America and Europe. Demand in the latter region will also continue to benefit from rising demand in the diesel sector.

Industrial demand is likely to slow during 2002, in line with a downturn in world economic activity. It is likely that some planned expansions in the chemical, glass and petroleum sectors will be delayed or cancelled, and we may see another fall in the use of platinum in hard disks.

Supplies are expected to rise next year. While we think it unlikely that the Russians can deliver much more than 1 million oz of platinum in a single year, production in South Africa is planned to increase sharply. However, the last two years have demonstrated the extent to which technical problems can cause production to fall short of planned levels.

Market stocks held by investors and fabricators have been depleted by substantial deficits since 1999, while the underlying lack of liquidity is indicated by consistently high lease rates. However, we expect the weaker economic outlook to continue to affect market sentiment. This will limit any recovery in the price in the short term. We expect that platinum will trade between $400 and $500 during the next six months.

Palladium

- After experiencing rapid growth throughout the second half of the 1990s, demand for palladium is expected to slump by 24 per cent in 2001.
- Purchases by the auto industry are forecast to fall by 14 per cent as auto makers reduce consumption and draw on stocks built up in earlier years.
- Demand from the electronics industry has plummeted and is expected to be less than half that of last year.
- Largely in response to the high price of recent years, dental demand is forecast to be 16 per cent down and other uses will decline by 4 per cent.
- Sales by Russia have fallen back but increased output in South Africa and North America will limit the decline in overall supplies to 3 per cent.
- In response to the dramatic weakening of demand in 2001, the palladium price slumped from its peak of $1,094 in January to $360 by the end of September.

Palladium Supply and Demand
'000 oz

	2000	2001
Supply		
South Africa	1,860	2,000
Russia	5,200	4,600
North America	635	815
Others	105	115
Total Supply	**7,800**	**7,530**
Demand		
Autocatalyst: gross	5,640	4,840
recovery	(230)	(290)
Dental	820	690
Electronics	2,160	1,050
Other	570	550
Total Demand	**8,960**	**6,840**
Movements in Stocks	(1,160)	690

Overview

After substantial deficits during the last two years, the palladium market has moved into surplus during 2001. Annual supplies are expected to fall by 3 per cent to 7.53 million oz, but there will be a much sharper contraction in demand: down 24 per cent to 6.84 million oz. This decline will be caused by lower consumption in virtually all applications, combined with substantial reductions in palladium stocks held by consumers in the auto and electronics sectors.

Sharp rises in the palladium price between 1999 and early 2001 have begun to have an impact in the auto sector. Auto makers are thrifting palladium using a variety of strategies, including the increased use of other pgm. Also, part of this year's palladium requirement has been met from stocks built up by the auto industry in 1998-99.

The electronics industry has also drawn heavily on palladium inventories in 2001. This has magnified an already sharp drop in consumption due to a plunge in the output of multi-layer ceramic capacitors (MLCC). As a result, sales to electronics manufacturers, at 1.05 million oz, are forecast to be less than half last year's level.

Supplies of palladium from Russia are expected to total 4.6 million oz, 600,000 oz lower than last year. As demand has weakened, we believe that Norilsk Nickel, and perhaps also the Ministry of Finance and the Central Bank, has withheld palladium from the market in order to support the price. Meanwhile, South African supplies are expected to rise slightly, reaching the 2 million oz mark for the first time.

The palladium price surged to a record $1,094 in January, reflecting consumers' concern about potential disruption in Russian supplies. With an increase in sales of Russian metal at the London fixings, the price began to descend rapidly from February onwards, collapsing to a two year low of $360 at the end of September.

Supply

Russian shipments of palladium are forecast to decline to 4.6 million oz in 2001, the lowest since 1995. Although trade statistics show that almost 4.5 million oz was shipped to Switzerland and the USA in the first quarter, we believe that only part of this metal was actually sold.

There are now substantial stocks of Russian palladium in Switzerland, believed to be under the ownership of the Russian Ministry of Finance and the Central Bank. It is difficult to predict when this metal might be made available to the market, but we have assumed that there will be no significant sales in the last quarter of this year.

During 2001, Norilsk Nickel has continued to supply palladium under its ten year export quota, granted in 1999. Much of its output is sold to consumers under long-term contracts, with the remainder being sold on the spot market. However, in August a spokesman indicated that

Norilsk was limiting spot sales in order to support the palladium price.

South African supplies are forecast to rise by 8 per cent to 2 million oz in 2001. Looking ahead, if planned expansions in platinum mining go ahead, palladium production in South Africa will rise by more than 1 million oz by the middle of the decade. Much of this will come from new projects on the Eastern Bushveld, where the UG2 reef contains unusually high concentrations of palladium.

North American supplies are forecast to rise by 28 per cent to 815,000 oz in 2001. Both North American Palladium and Stillwater are currently undertaking major expansion programmes which could lift North American output by a further 50 per cent by mid decade.

Demand

In the auto sector, thrifting programmes stimulated by steep rises in the palladium price in 1999 and 2000 have begun to have an impact. As a result, palladium use in catalysts is expected to fall by around 10 per cent this year, despite further tightening of emissions legislation in many markets.

As in 2000, this year's purchases of palladium by the auto industry are expected to be substantially below the level of actual consumption, with some companies drawing upon their strategic stocks. We estimate that demand will fall by 14 per cent to 4.84 million oz, the lowest level for three years.

In the electronics industry, demand for palladium is expected to more than halve to a 19 year low of 1.05 million oz. This decline is mainly a result of a collapse in output of MLCC, which is expected to be down by more than 30 per cent this year. In addition, some of the larger MLCC manufacturers have been able to meet much of their palladium requirement from inventories.

Outlook

Efforts to thrift palladium by auto makers are expected to continue, despite recent falls in the price. We believe that the industry will remain cautious in the face of perceived insecurity of palladium supplies, and will continue with efforts to reduce loadings through a combination of engine management, advanced catalyst technology and greater use of other pgm.

Despite this, we do not foresee any dramatic reduction in usage of palladium in autocatalysts. We believe that increasingly stringent HC limits, especially in North America and Europe, will help to maintain demand for palladium close to current levels.

Thrifting is also expected to continue in the electronics industry, with further adoption of nickel pastes for the electrode layers in MLCC. Ultimately, palladium is likely to be retained only in certain high-specification capacitors.

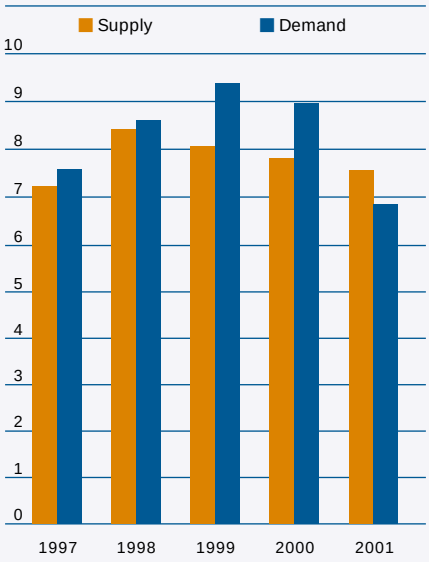
Paradoxically, despite these negative trends, it is possible that palladium demand could increase in 2002. Both the auto and electronics industries have consumed large quantities of palladium from stocks during 2001, and fresh purchases of metal could therefore be higher next year. In addition, lower prices may encourage a limited return to palladium-based dental alloys.

As ever, the level of supplies in 2002 will depend heavily upon Russian sales. Allowing for modest increases in South African and North American production, we believe that shipments of Russian metal in excess of 4 million oz would result in a further surplus.

In the short term we have assumed that the Russians will continue to moderate sales in order to prevent a further decline in the price, which we forecast will vary between $260 and $380 over the next six months.

Supply and Demand for Palladium 1997-2001

Million oz



Monthly High, Low and Average Prices of Palladium January 1997 - September 2001

Supplies, Mining and Exploration

South Africa

In 2001, South African supplies of platinum are expected to rise by 7 per cent to exceed 4 million oz for the first time, as recent expansions in mining capacity begin to come on stream. Shipments of palladium will rise by 8 per cent to reach 2 million oz, but rhodium supplies will fall, with sales slightly below the actual level of production.

At 4.08 million oz, platinum supplies from South Africa will be 280,000 oz higher than in 2000 but will fall below earlier expectations. Some expansions have encountered delays in the build up to full production, while industrial action has also affected production, with mining operations at Northam being interrupted by a five week strike in August and September.

Further expansions and new projects were announced during the first nine months of 2001. If all current projects are brought into production as planned, they will add nearly 2 million oz of platinum per annum by the middle of the decade. However, it remains to be seen whether expansion programmes will be affected by recent steep declines in pgm prices. Projects on the Eastern Bushveld could be especially vulnerable, since UG2 ore in this area is particularly rich in palladium. Companies are likely to reassess their plans, and it is possible that some projects could be downscaled, delayed or even cancelled.

Anglo Platinum

At just over 1 million oz, refined platinum output at Anglo Platinum was up 15 per cent in the first half of 2001, with additional throughput coming from expansions at Amandelbult and Lebowa, and the build up of underground operations at the new Bafokeng Rasimone Platinum Mine (BRPM). Production of palladium rose by 10 per cent to 479,000 oz, while that of rhodium was up 28 per cent to 94,000 oz, reflecting increasing production from the UG2 reef. For the year as a whole, refined platinum production should exceed the group's record of 2.02 million oz in 1999.

Anglo Platinum has released further details of its expansion programme, which is intended to lift the group's annual platinum capacity to 3.5 million oz by 2006. The Pandora joint venture with Lonmin Platinum was announced in April 2001; further details are given below. In July it was confirmed that Anglo Platinum is to double output at BRPM via the extension of mining onto the farm Styldrift, and in September the group announced its intention to develop a new mine, with a capacity of 160,000 oz of platinum per annum, on the farms Twickenham, Paschaskraal and Hackney on the Eastern Bushveld.

Impala Platinum

Output from Impala's mines in the Rustenburg area is expected to be around 1 million oz in 2001, little changed compared with last year. Although mill throughput has improved, output has been affected by a decline in recoveries during the commissioning of a new UG2 concentrator, while the head grade has been affected by the mining of narrower sections of Merensky Reef.

Impala will benefit this year from the start up of the redeveloped Crocodile River mine, owned by its 83 per cent subsidiary Barplats. However, pgm output from the project has been lower than planned, at around 15,000 oz of platinum in concentrate during the first half of 2001.

Since the beginning of this year, Impala has announced three new projects in the form of joint ventures with other mining companies. Two of these involve mines in Zimbabwe; further details can be found on page 10. A third, the Two Rivers project with Anglovaal Mining, will involve the development of a 100,000 oz per annum platinum mine at Dwars Rivier on the Eastern Bushveld.

Lonmin Platinum

At Lonmin, a new UG2 concentrator stream at the Karee mine was commissioned in February 2001, adding around 1.5 million tonnes to annual milling capacity. We expect refined platinum production during this calendar year to approach 700,000 oz, and output is planned to reach 750,000 oz next year, following the commissioning of a new smelter during the last quarter of 2001. Lonmin's long-term target is to lift annual platinum production at its existing mines to 870,000 oz by 2007.

Lonmin will also benefit from additional production from the Pandora joint

PGM Supplies: South Africa
'000 oz

	2000	2001
Platinum	3,800	4,080
Palladium	1,860	2,000
Rhodium	457	441

venture with Anglo Platinum, announced in April 2001. The Pandora mine will initially use infrastructure at Lonmin's Eastern Platinum mine to access adjacent reserves owned by Anglo. Later, a new decline shaft will be constructed, lifting the venture's annual production to 3.6 million tonnes of UG2 ore yielding 230,000 oz of platinum by 2008.

Northam Platinum

Following the start up of the company's UG2 expansion, total mill throughput at Northam exceeded 1 million tonnes during the first six months of 2001, an increase of 30 per cent compared with the same period of last year. However, there was a decline in the average head grade, mainly because the UG2 has a lower pgm content than the Merensky Reef on Northam's lease area. This contributed to a reduction in refined pgm output compared with the same period of 2000.

A strike halted mining operations at Northam for five weeks during August and September, and this will affect the mine's performance during the second half. We expect refined platinum production for 2001 to be at least 10 per cent below last year's level. Output should improve significantly next year, as the UG2 expansion project contributes its first full year of production.

Aquarius Platinum

At Kroondal Platinum (of which Aquarius owns 95 per cent), production of pgm in concentrate rose by 41 per cent to 77,000 oz in the first six months of 2001. The mine should see a further increase in output during the second half, following the commissioning of a new flotation circuit and regrind mill in June. Platinum production for this calendar year should exceed 100,000 oz, up by around a third compared with 2000. The company expects to achieve full production of around 130-140,000 oz of platinum per annum in 2002.

At Aquarius' Marikana project, a mining licence was received in May 2001 and the company estimates that it will take 13 months to construct a new mine and processing plant. However, at the time of writing, the mine location had not yet been finalised: the original site was found to be unsuitable due to poor ground conditions.

Messina Platinum

At the Messina mine, which is being redeveloped by the Canadian company SouthernEra, small-scale mining and processing has commenced and the first pgm concentrate was produced in June 2001. However, platinum output will be small this year, at under 10,000 oz.

Development of a full-scale mine at Messina is continuing. In June 2001, SouthernEra announced that it had raised R345 million in debt finance in order to complete the project, which is due to enter production towards the end of next year. Annual pgm production is planned to be 160,000 oz.

Russia

Sales of pgm by Russia in 2001 are expected to be lower than last year. Although there were large shipments of Russian palladium into Switzerland in the first quarter of the year it seems probable that, in the face of weak demand, not all of this metal has been sold to consumers. Supplies of rhodium are expected to be sharply lower than in 2000, when a large amount of metal was sold from stocks.

As in each of the past four years, the early months of 2001 were marked by speculation about when export quotas for pgm would be signed by the President. In the event, it was not until March that this happened and platinum and rhodium did not begin to flow out of Russia until April. In contrast, Norilsk Nickel was able

PGM Supplies: Russia
'000 oz

	2000	2001
Platinum	1,100	1,050
Palladium	5,200	4,600
Rhodium	290	100

to export palladium from January under its ten year quota granted in 1999.

In addition, very large quantities of palladium, reported to be of Russian origin, were imported into Switzerland and the USA in the first quarter of the year. It seems likely that these shipments were of metal owned by either the Russian Government or Central Bank. Although the imports coincided with substantial offerings of palladium, especially on the London fixings, the quantities sold appear to have been much less than the reported imports. However, the increased liquidity in the palladium market from late February suggests that some of the unsold metal may have been available for leasing.

In June a new decree regulating Russian imports and exports of precious metals and stones was signed by President Putin. This came into effect in late August, but there was a hiatus in exports as not all the necessary regulating structure had been put in place; this was remedied in mid September. A more significant interruption in supplies was a voluntary one by Norilsk Nickel, which in early August indicated that it was unhappy with the fall in the price of palladium in the preceding months. As a result, the company said it intended to restrict its spot sales of palladium, although it would continue to supply metal under existing long-term contracts.

As part of its ten year development plan, in September Norilsk Nickel announced that contracts worth $250 million had been signed with Outokumpu to construct a new concentrator at Norilsk, replacing the present facility that was built in 1948, and to expand the concentrator at Talnakh. These facilities should enable the company to treat more disseminated ore and to process tailings accumulated from mining in earlier years, allowing it to increase its output of pgm without necessarily expanding its production of nickel and other base metals.

This year has seen the alluvial producers in the Far East of Russia – at Kondyor and Koryak – obtain export quotas in their own right for the first time. However, current production levels at these operations are believed to be at lower levels than in the late 1990s.

North America

Supplies of pgm from North America are forecast to rise sharply in 2001, with higher output from all producers. Platinum shipments are expected to increase by 19 per cent to 340,000 oz, while those of palladium will jump by 28 per cent to 815,000 oz.

At the North American Palladium mine in Canada, a new 15,000 tonne per day concentrator was commissioned at the beginning of June and is expected to reach design capacity by the end of this year. Palladium production is predicted to approach 150,000 oz in 2001, up from 85,000 oz last year.

We also expect an increase in output of by-product pgm from Canada's nickel mines. Inco forecasts that its total pgm output (which includes some metal from secondary sources) will rise to 416,000 oz in 2001, compared with 344,000 oz last year. At Falconbridge, a seven month strike that ended in late February has affected production, but refined pgm output is nevertheless expected to rise in 2001. Metallurgical problems led to a build up in stocks of unrefined metal last year, and the release of pgm from the refining pipeline should help to offset the effects of the strike.

At Stillwater Mining Company's Nye mine in Montana, USA, combined palladium and platinum output totalled 247,000 oz during the first six months of 2001, compared with 210,000 oz the previous year. This rise is the result of a 19 per cent increase in mill throughput during the period. The company expects to produce around 500,000 oz of pgm this year.

Zimbabwe

Supplies of pgm from Zimbabwe are set to increase significantly over the next few years. A new project at Ngezi is under development and expansion at Mimosa should proceed next year.

The expansion of Zimbabwe's only functioning platinum mine, Mimosa, now seems likely to go ahead. In July 2001, it was announced that Impala Platinum had purchased a 35 per cent stake in Mimosa Mining Company for $30 million, providing most of the capital necessary for an increase in platinum output to 70,000 oz per annum, up from around 15,000 oz at present.

By the beginning of next year, Zimbabwe will have a second operating platinum mine: Zimplats' open-cast project at Ngezi. It was announced in March 2001 that financing had been raised, with Impala taking a 30 per cent share in the venture for $30 million. A further $30 million in debt finance is to be provided by South African bank ABSA. In addition, Impala and ABSA have each purchased a 15 per cent equity stake in Zimplats.

Mine development at Ngezi commenced in June 2001. Ore will be transported to the Selous Metallurgical Complex (at the mothballed Hartley Platinum mine) for processing, and the resulting smelter matte will be refined by Impala in South Africa. At full capacity, Ngezi's annual output is planned to be 208,000 oz of pgm.

PGM Supplies: North America
'000 oz

	2000	2001
Platinum	285	340
Palladium	635	815
Rhodium	16	22

Platinum

Jewellery

The popularity of platinum jewellery in China continues to grow, with demand set to reach 1.3 million oz in 2001. However, high platinum prices and weaker economic conditions have had a serious impact on fabrication levels in the USA and Japan. Overall sales of platinum to jewellery makers are forecast to total 2.52 million oz, down 11 per cent compared with last year.

Europe

European demand for platinum in jewellery fabrication is forecast to fall by 16 per cent to 160,000 oz in 2001. Further growth in the UK market will be outweighed by weak domestic demand for jewellery in Germany and lower exports of platinum chain from Italy to the USA and China.

UK Assay Office statistics show a 4 per cent increase in the weight of platinum jewellery hallmarked during the first nine months of this year, despite a slight decline in the number of pieces sent for hallmarking. While bridal rings still account for a large share of this market, platinum accessories such as neck chains and pendants are becoming more popular, and this has contributed to an increase in the average weight of platinum jewellery items.

In Germany, weak economic conditions have affected consumer demand for luxury goods, and sales of platinum jewellery have therefore been lower this year.

In recent years, Italian jewellery manufacturers have supplied substantial quantities of very lightweight platinum chain to the USA and China. Exports to these markets are expected to be down sharply in 2001.

Japan

Sales of platinum to Japanese jewellery makers are expected to plunge by over a third to 700,000 oz in 2001, the lowest level since 1985. High bullion prices have been the principal factor behind this decline, triggering a loss of market share to white gold in the lower price segments of the market, and encouraging the recycling of old stocks of platinum jewellery.

Overall unit sales of precious metal jewellery rose by 5 per cent during the first half of 2001, but platinum sales slumped by 17 per cent, largely due to higher prices. With bullion trading at over ¥2,200 per gram for much of the first six months of 2001, it became increasingly difficult to offer platinum in the lower price segments of the jewellery market. Instead, manufacturers and retailers turned to white gold to satisfy consumer demand for inexpensive white jewellery. As a result, unit sales of white gold products rose by a third in the first half of 2001, eating into platinum's market share, which has fallen from a peak of 35 per cent in 1999 to 27 per cent in 2001.

Fabrication demand is once again expected to fall more sharply than retail sales, as old stocks of platinum jewellery are melted down and the metal either re-used in the manufacture of new products, or sold back to the market. The bankruptcy of a major jewellery company in August 2001 has also added to recycling levels.

North America

In North America, sales of platinum for jewellery fabrication are forecast to fall by 29 per cent to 270,000 oz. Even before 11th September, the slowdown in the US economy and sharp falls in equity values had discouraged consumer spending on luxury items such as jewellery. During the final quarter, the markets for such goods are likely to be severely affected by increased economic uncertainty in the wake of the terrorist attacks.

At the retail level, the reaction to declining consumer demand has been to reduce inventories, with the result that orders to jewellery manufacturers have fallen sharply. The decline has been exacerbated by the fact that many retailers began 2001 with unusually high stocks of precious metal jewellery, following weaker than expected sales last Christmas. High platinum prices have also had a negative impact on the market, with manufacturers finding it difficult to offer platinum products in the lower price brackets.

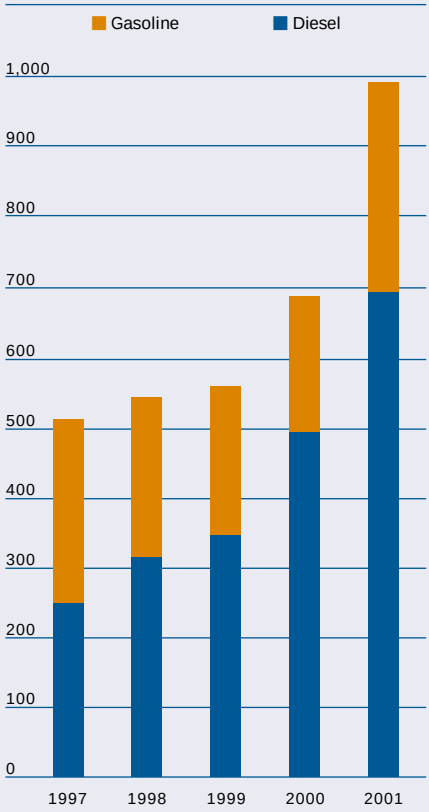
Platinum Demand: Jewellery
'000 oz

	2000	2001
Europe	190	160
Japan	1,060	700
North America	380	270
Rest of the World	1,200	1,390
Total	**2,830**	**2,520**

Rest of the World

This year has seen further significant expansion of the Chinese platinum jewellery market. Sales of platinum for jewellery fabrication are forecast to rise by 18 per cent to reach 1.3 million oz in 2001, making this the world's largest platinum jewellery market by a wide

European Demand for Platinum in Autocatalysts 1997-2001
'000 oz



margin. Growth could have been even stronger had it not been for high platinum prices, which reduced profitability in the industry, and a series of tax investigations which periodically interrupted production.

Consumer demand for platinum jewellery, formerly concentrated in the areas around Beijing and Shanghai, has now spread to many smaller regional centres of population throughout China. At the same time, the availability of a wider range of designs, often inspired by Japanese products, has encouraged existing consumers to add to their collections of platinum jewellery. White jewellery is extremely fashionable among affluent younger consumers and increasingly among older women too. Platinum remains the metal of choice; there has been some move to white gold in cheaper jewellery, but to a lesser extent than in other markets.

Consumer demand has proved less price sensitive than initially expected, and sales growth has been maintained despite rises in retail prices for platinum jewellery during 2001. These increases have partly restored manufacturers' and retailers' profit margins, which were squeezed towards the end of last year and in the first quarter of 2001.

Elsewhere in the Rest of the World region, demand is forecast to weaken slightly, mainly due to lower fabrication levels in Thailand. Once a major source of jewellery for the Japanese market, Thai manufacturers have been severely affected by the downturn in their principal export market.

Autocatalyst

At 2.36 million oz, the use of platinum in autocatalysts is forecast to reach an all-time high in 2001, exceeding the previous record set in 1994. This year has seen increased use of platinum-rich catalysts on gasoline models and another sharp rise in consumption in the European diesel sector.

Europe

In Europe, sales of platinum to auto makers are forecast to rise by 44 per cent to 980,000 oz. Consumption has been boosted by three factors: strong consumer demand for diesel vehicles, tighter emissions legislation, and a switch away from palladium in favour of platinum-rich catalyst systems on gasoline cars. This has more than compensated for a slight decline in total vehicle sales and production, both of which are expected to decline by around 2 per cent this year.

Diesel vehicles continue to increase in popularity and are expected to take around 36 per cent of the market this year. At the same time, platinum loadings on catalysts for diesel engines have increased significantly to comply with European Stage III emissions legislation, which applied to all new vehicles from January 2001. Use of platinum on diesel catalysts is expected to account for almost three quarters of auto demand in this region.

In the gasoline sector, platinum demand is expected to climb by over 50 per cent this year – the first increase in this market segment since 1993. In response to rises in the palladium price since the late 1990s, some auto makers have started to re-introduce platinum-rich catalysts, although others plan to remain with palladium technology for the time being.

North America

The North American auto market has slowed sharply in 2001, with vehicle sales falling 5 per cent in the first eight months of the year. Auto production was down 13 per cent: US manufacturers have been drawing on inventories of finished vehicles, which were unusually high at the start of this year, while imports have gained market share.

Despite the contraction of the auto market, the use of platinum in autocatalysts is forecast to rise strongly in 2001. In response to concerns over the availability and price of palladium, some car companies have chosen to increase the amount of platinum in the pgm mix on their catalyst systems. As a result, we estimate that auto makers will consume 36 per cent more platinum this year than they did in 2000. However, demand last

Platinum Demand: Autocatalyst
'000 oz

	2000	2001
Europe	680	980
Japan	290	345
North America	620	700
Rest of the World	300	335
Total	**1,890**	**2,360**
Autocatalyst recovery	**(470)**	**(510)**

year was inflated by purchasing of platinum for strategic stocks. With little or no stockbuilding this year, demand by North American automakers is expected to rise by just 13 per cent to 700,000oz.

Japan

Sales of passenger cars in Japan were up slightly during the first seven months of 2001, at 2.6 million units, and the market is expected to expand by around 1 per cent during the year as a whole. However, exports have fallen sharply – shipments were 9 per cent lower in the January to July period – and we therefore expect auto production to be down by around 5 per cent this year.

Despite the decline in vehicle output, demand for platinum from Japanese auto makers is forecast to rise by 19 per cent to reach 345,000 oz in 2001. The introduction of new emissions standards, which came into force in October 2000 for new models manufactured in Japan, has resulted in a significant increase in average pgm loadings. The legislation will extend to all new vehicles from September 2002. In selecting catalysts to meet the new standards, Japanese car companies have tended to increase the amount of platinum in the pgm mix on domestic models, thus reducing their reliance on palladium.

Rest of the World

Demand for platinum in the Rest of the World is forecast to rise by 12 per cent to 335,000 oz in 2001, principally due to stricter emissions legislation in some Asian markets. Following the enforcement of new Korean LEV regulations from January 2001, there has been a significant increase in average platinum loadings on vehicles sold in the domestic market. Indian demand has also been lifted by new regulations: in Delhi and eight other major cities, Bharat II regulations (similar to Stage II European standards) were introduced in late 2000 and early 2001. In China, European Stage I limits have been imposed on all new vehicles since January this year, and incentives are on offer for vehicles meeting EU Stage II limits. As a result, there has been a substantial increase in demand for all the autocatalyst pgm.

Autocatalyst Recovery

Recovery of platinum from spent catalytic converters is forecast to rise by 9 per cent to 510,000 oz in 2001. In Europe, it was not until 1993 that all new gasoline cars were equipped with catalysts; post-1993 models are now arriving in scrap yards in greater numbers. At the same time, collection of autocatalyst scrap is becoming more efficient, although it is still mainly confined to Germany with smaller amounts coming from other northern European countries such as the Netherlands, the UK and Scandinavia.

In the USA, recovery of platinum will increase modestly. Higher pgm prices have stimulated the collection and processing of spent autocatalysts, but many models now being scrapped carry palladium-rich systems.

Industrial

The use of platinum in industrial applications is expected to rise by 3 per cent to 1.52 million oz in 2001, with demand lifted by investment in new LCD glass plants and the construction of new petroleum refining capacity. However, electrical demand has been hit by a downturn in the production of hard disks for personal computers.

Consumption of platinum in the chemical industry will be stable at 285,000 oz in 2001. Lower sales to paraxylene producers will be offset by growth in the use of platinum catalysts in the manufacture of high specification silicones, and increased demand for platinum gauze in the nitric acid industry.

The use of platinum in electrical applications is expected to fall by 16 per cent to 380,000 oz in 2001. This is largely a result of lower consumption by hard disk manufacturers. The current global downturn in the electronics industry means that computer sales are expected to fall by around 10 per cent this year. In addition, improvements in disk storage capacity technology have resulted in fewer disks being required in each hard drive. These negative factors have been partly offset by further small rises in the average platinum content of a disk.

Platinum Demand: Industrial
'000 oz

	2000	2001
Chemical	285	285
Electrical	450	380
Glass	255	290
Petroleum	105	130
Other	375	435
Total	**1,470**	**1,520**

Fuel cell development has continued to flourish and this has led to an increased requirement for platinum, although the quantities used are still small. Many of the major automotive companies are now committed to commercialising fuel cell cars. Heavy investment in research and development means that technical barriers are being overcome, but some issues remain to be resolved. One of these is the choice of fuel, with methanol and gasoline emerging as the main contenders. The development of fuel cells for stationary power generation is further advanced, with systems already installed in locations such as hospitals and schools.

The use of platinum in glass production is forecast to rise by 14 per cent to 290,000 oz this year, primarily as a result of investment in the production of high purity glass for liquid crystal displays. The market for this glass, used in devices such as laptop computers, mobile phones and digital cameras, continues to expand, albeit at a lower rate than in recent years. Only a few companies are capable of producing this glass and all are in the process of increasing their production capacities, although some have scaled back their expansion plans. Demand in the glass sector is also being supported by expansions in the fibreglass industry in the Far East.

In the petroleum industry, purchases of platinum for the construction of new refining capacity in the Middle East will lift world consumption by 24 per cent to 130,000 oz. In Europe and North America, demand will remain stable with no major new construction expected.

Other demand for platinum will rise by 16 per cent during 2001 to reach 435,000 oz, with higher consumption in a range of small applications. The largest single increase will occur in the dental sector, where a move away from palladium alloys has boosted sales of gold alloys with a small platinum content.

Investment

After significant disinvestment in 2000, net demand for platinum investment products is expected to be positive in 2001. In Japan, purchases of large platinum bars have increased since the platinum price began to fall in mid year; this is expected to balance disinvestment during the first half of the year. Lower platinum prices have also boosted sales of bullion coins.

The US Mint's platinum American Eagle programme has again accounted for virtually all new coin sales in 2001; demand for other coins and small bars has been negligible. During the first half of the year, purchases of the bullion platinum Eagle were down 16 per cent compared with the same period of 2000, with investors deterred by high platinum prices. However, demand revived after platinum sank below $500 in late July. Following two strong months in August and September, sales at the nine month mark were up 13 per cent at 20,350 oz. Unless platinum prices rise sharply during the final quarter, sales of the bullion Eagle this calendar year should exceed last year's total of 27,050 oz.

The US Mint also produces a high-quality proof version of the platinum Eagle, which is sold at a higher premium and is purchased by collectors. This year's proof coins were launched in June 2001 and assuming that the edition is sold out will account for a further 26,750 oz of platinum this year.

In 2000, investment demand was depressed by the melting down of old coins and bars, with most of the metal being re-used in jewellery fabrication. The rate of recycling has fallen this year, and this has contributed to a slight increase in net demand for coins and small bars, which we forecast will total 50,000 oz in 2001.

In Japan, net demand for 500 g and 1 kg platinum bars is forecast to be zero this year. After steep rises in platinum's yen value last year, the price traded in a ¥2,200 to ¥2,500 range between January and mid July 2001. This discouraged investors from buying platinum, and stimulated further sales back to the market of bars purchased at much lower prices in earlier years. However, these sell-backs were at a lower level than witnessed in 2000.

With the price falling to 16 month lows of under ¥1,700 per gram during August and September, fresh purchases of bars were seen. Unless the price rises significantly we expect new demand for bars during the second half of 2001 to balance disinvestment earlier in the year.

Platinum Demand: Investment
'000 oz

	2000	2001
Coins and small bars		
Europe	0	0
Japan	5	5
North America	35	45
Rest of the World	0	0
	40	**50**
Large bars in Japan	**(100)**	**0**
Total	**(60)**	**50**

Palladium

Autocatalyst

Sales of palladium to auto makers are forecast to fall by 14 per cent to 4.84 million oz in 2001. Consumption in North America and Europe will decline sharply, with some car companies increasing their use of other pgm in order to thrift palladium. In addition, we believe that the US auto industry will draw upon strategic stocks, thereby reducing fresh purchases of metal in 2001.

Europe

After reaching 1.9 million oz in 2000, the use of palladium by the European auto industry is expected to decline by 8 per cent to 1.74 million oz this year. Consumption will be hit by lower sales of gasoline cars, combined with a shift back to platinum technology by some auto makers.

Between 1995 and 2000, European car companies switched to palladium-rich catalysts on a large majority of their gasoline models, and most initially selected this technology to meet the European Stage III legislation which came into effect from January 2000.

Palladium Demand: Autocatalyst
'000 oz

	2000	2001
Europe	1,900	1,740
Japan	510	540
North America	2,805	2,020
Rest of the World	425	540
Total	**5,640**	**4,840**
Autocatalyst recovery	**(230)**	**(290)**

However, high and volatile palladium prices, combined with concerns about the metal's availability, have led some car companies to move back towards platinum technology on gasoline vehicles. This will have a modest impact on palladium demand in 2001, and a more significant effect next year.

Japan

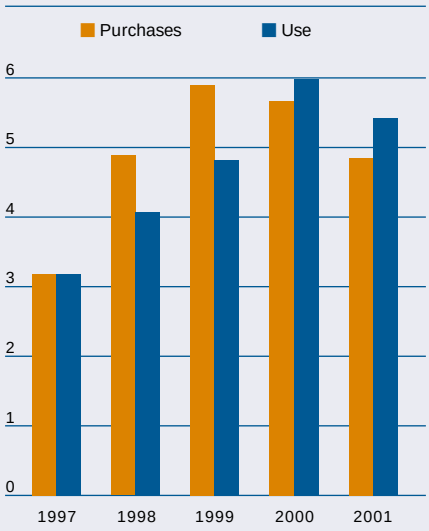
In Japan, autocatalyst demand for palladium is forecast to rise by 6 per cent to 540,000 oz in 2001. Tighter emissions standards came into effect for new domestic models in October 2000, and will apply to all new vehicles (including imports) by September 2002. Most Japanese car companies have opted to comply with the new standards in advance of their full implementation, and are voluntarily meeting even stricter limits on some models. This has resulted in a significant increase in pgm loadings on catalysts. The increase in palladium consumption is less than that of platinum as some Japanese car companies have reduced the proportion of palladium in the pgm mix on vehicles sold in their domestic market.

Palladium-rich technology continues to dominate on export models, especially those sold in Europe and North America. However, a contraction in the auto market in both these regions resulted in a 9 per cent fall in total vehicle shipments from Japan during the first six months of 2001. We therefore expect the amount of palladium used on export models to decline slightly this year.

North America

Sales of palladium to North American auto makers are forecast to be 2.02 million oz in 2001, down 28 per cent compared with last year and nearly 1.5 million oz lower than the peak recorded in 1999. This year's decline reflects a combination of lower consumption in catalysts, and the use of metal from stocks purchased in previous years.

Palladium Autocatalyst Demand 1997-2001
Million oz



There are two main factors behind the fall in actual usage on catalysts: a sharp drop in vehicle production, which was down 13 per cent in the first eight months of the year, and thrifting of palladium in response to concerns about price and availability. A reduction in average palladium loadings has been achieved through a combination of improved engine management, advanced catalyst technology, and increased use of the other autocatalyst pgm. Nevertheless, palladium remains a vital ingredient of emission control systems in the USA: it is the most effective catalyst for HC, and emissions limits for this pollutant continue to tighten.

During 1998 and 1999, the US auto industry made substantial additions to strategic stocks of palladium. High prices and increasingly difficult business conditions have encouraged some companies to draw upon inventories this year, with the result that fresh sales of palladium to car companies will be significantly below the level of actual consumption.

Rest of the World

In the Rest of the World, the use of palladium in autocatalysts continues to rise rapidly, with the enforcement of stricter emissions standards outweighing declines in vehicle production in most countries. We forecast that demand will rise by 27 per cent to reach 540,000 oz in 2001.

The most significant increase will occur in Korea, where LEV standards were introduced in January 2001. In order to comply with strict new HC emissions limits, there has been a significant increase in palladium loadings on domestic models. However, this has been partly offset by a decline in vehicle production, which is expected to be down at least 6 per cent this year.

China has also seen a rise in the use of palladium in autocatalysts. European Stage I legislation has been imposed on all new vehicles since January 2001, and some vehicles meeting Stage II standards are being offered in response to fiscal incentives. Palladium technology is being used on some models in order to meet the new limits.

In Latin America, a decline in auto production in Argentina and Mexico has been outweighed by significant expansion of the Brazilian market. We expect palladium demand to increase modestly in 2001, reflecting higher vehicle output and rising loadings.

Palladium Demand: Dental
'000 oz

	2000	2001
Europe	100	60
Japan	470	430
North America	230	190
Rest of the World	20	10
Total	**820**	**690**

Autocatalyst Recovery

The recovery of palladium from autocatalyst scrap is expected to rise by 26 per cent to 290,000 oz in 2001. Higher palladium prices encouraged an increase in collection rates during the first half of the year. In addition, palladium catalysts were widely adopted by the European and US auto industry during the second half of the 1990s and these vehicles are now starting to enter the scrap network in greater numbers.

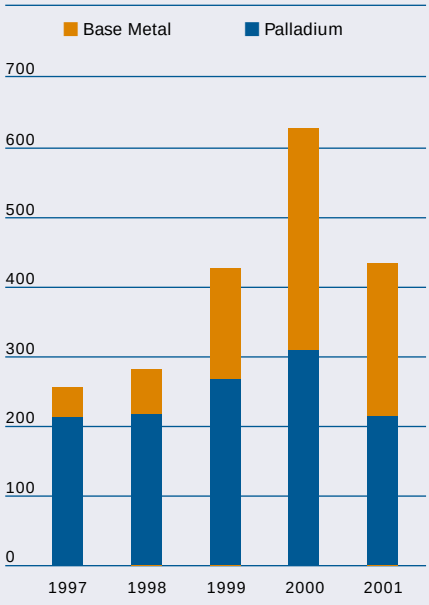
Dental

Dental demand is forecast to fall by 16 per cent to 690,000 oz in 2001. However, following a drop in the palladium price to two year lows of under $400, there are signs that demand has stabilised and may begin to recover next year.

In both Europe and North America, there has been a move away from palladium-based dental alloys over the last two to three years. This trend accelerated in late 2000 and early 2001, with huge rises in metal costs precipitating a widespread movement to high gold alloys and, especially in Europe, base metal formulations. European palladium demand is forecast to fall by 40 per cent this year, and this decline is unlikely to be reversed: many alloy manufacturers have now ceased production of high palladium compositions. The downturn has been less severe in North America, with demand 17 per cent lower than last year. Here, weaker palladium prices have already encouraged some return to palladium alloys and, if the price remains near current levels, it is likely that the use of palladium will stabilise or even increase slightly in 2002.

In Japan, the fall in palladium usage has been more moderate, with consumption down 9 per cent to 430,000 oz. Demand in this region tends to be less sensitive to changes in metal prices, as the use of an alloy containing 20 per cent palladium is subsidised by the state health insurance scheme. The main factor behind the fall in palladium consumption this year is the weak Japanese economy, which is deterring patients from spending money on dental treatments.

MLCC Production by Electrode Type 1997-2001
Billions



Electronics

Sales of palladium to the electronics industry are expected to fall by over 50 per cent to 1.05 million oz this year. There has been a sharp decline in production of multi-layer ceramic capacitors, due to weakness in sales of electronic devices. In addition, MLCC manufacturers have used large amounts of palladium from stocks.

Output of multi-layer ceramic capacitors (MLCC) has been severely affected by a reversal of fortunes in the electronics market, which had been growing at rapid rates for several years. As a result of an unexpectedly sharp downturn during the final months of 2000, electronic device manufacturers began this year with unsold stocks of finished products and large inventories of components such as MLCC. The electronics market has continued to weaken this year, with sales of computers forecast to fall by about 10 per cent and those of mobile phones by around 5 per cent. As a result, worldwide production of MLCC is expected to plummet by a third, to just over 420 billion units.

Technical developments have had little impact on palladium demand this year. Since the mid 1990s, MLCC manufacturers have adopted nickel pastes for the conductive layers in an increasing percentage of their capacitor output. In consequence, the proportion of capacitor production using palladium diminished from around 85 per cent in 1997 to under 50 per cent in 2000. This year, poor profitability has led manufacturers to freeze investment in new furnaces for nickel MLCC, with the result that palladium's share of the market is not expected to change significantly. The move to base metal technology will resume once conditions in the industry improve, though palladium will continue to be used in certain high-specification MLCC.

Production of palladium-based capacitors is expected to be down 30 per cent this year, and underlying consumption of the metal will fall by a similar percentage. However, sales of palladium to MLCC makers will see a much more drastic decline. Japanese manufacturers in particular held substantial stocks which we believe have been consumed when palladium prices were high during the first half of 2001.

Demand has also fallen in palladium's other electronic applications. Weakness in the telecommunications market has led to lower use of palladium pastes in hybrid integrated circuits (HIC). In the connector market, there has been a move back to gold coatings, although palladium is still required for high-end products. The adoption of palladium for plating leadframes has been halted by high prices, while there has been thrifting by manufacturers already using this technology.

Palladium Demand: Electronics
'000 oz

	2000	2001
Europe	265	180
Japan	990	330
North America	485	240
Rest of the World	420	300
Total	**2,160**	**1,050**

JM

Other

High palladium prices have generally had less impact on consumption of palladium in its smaller industrial applications, but jewellery demand has been affected by lower sales of platinum-palladium alloys in Japan. Total demand for palladium in other sectors is forecast to fall by 4 per cent to 550,000 oz in 2001.

Demand for palladium in jewellery alloys is expected to fall slightly this year, with its increasing use as a whitening agent in white gold offset by a large fall in consumption in platinum jewellery alloys in Japan.

Platinum jewellery alloys used in Japan typically contain between 5 and 15 per cent palladium, and sharp falls in the fabrication of platinum jewellery will therefore have a negative impact on palladium demand. In contrast, consumption of similar alloys in China continues to increase, although the rate of growth in palladium usage has been tempered by a move towards alloys with a higher platinum content.

Palladium Demand: Other
'000 oz

	2000	2001
Chemical	255	245
Jewellery	255	240
Other	60	65
Total	**570**	**550**

JM

The use of palladium in white gold has increased sharply in the last two years. In Japan in particular, high platinum prices have encouraged manufacturers to adopt white gold for inexpensive fashion jewellery, with the result that sales of white gold items were up by a third during the first half of 2001. However, this gain was partly offset by the development of white gold alloys with a lower palladium content.

The use of palladium in the chemical industry is expected to weaken slightly to 245,000 oz to this year. This is primarily due to lower sales of palladium catalysts to producers of vinyl acetate monomer. However, demand for palladium in the manufacture of pharmaceutical and speciality products remains strong.

Other applications will consume 65,000 oz of palladium in 2001, up slightly on last year. In the petroleum sector, the replacement of some palladium hydrocracking catalysts with base metal formulations has continued, but at a lower rate than in 2000. This will result in a reduction in sales of palladium back to the market this year. There will be little change in demand in smaller applications, such as oxygen sensors, brazing alloys and catalysts for pollution control from stationary sources.

Other Platinum Group Metals

Rhodium

Demand for rhodium is predicted to fall by 31 per cent to 557,000 oz in 2001. Last year, car companies in the USA and Japan made significant additions to strategic stocks; in contrast, stock levels are thought to have fallen this year, thus reducing fresh demand from the auto sector. Other demand will rise slightly, due to higher sales of rhodium catalysts to the chemical industry.

Autocatalyst

Sales of rhodium to auto makers are expected to fall by 31 per cent to 548,000 oz in 2001. This decline is a result of changes in stock levels during 2000 and 2001; underlying consumption in catalysts continues to rise, due to tightening legislation and the use of extra rhodium as a means of thrifting palladium.

Sales to European car companies will be up slightly this year. Average rhodium loadings on gasoline vehicles have increased, following the application of Stage III emissions legislation to all new vehicles from January 2001. This trend will outweigh a decline in production of gasoline cars, due to a shift in consumer preferences in favour of diesels (on which platinum-only catalysts are used).

In Japan, stricter emissions standards were applied to new models from October 2000, and will apply to all new vehicles from September 2002. Most auto makers are already meeting the new regulations across their vehicle ranges, and some are voluntarily meeting tighter limits: consequently, rhodium loadings are up on last year. However, actual sales to the Japanese auto industry are expected to fall; following a build up in inventories last year, we believe that there has been a reduction in stock levels in 2001.

US auto companies are also thought to be drawing upon stocks of rhodium purchased in 2000, and as a result demand will be significantly lower this year. North America is the only region in which actual use of rhodium on catalysts will fall: vehicle production declined 13 per cent in the first eight months of this year, and this has affected total consumption, despite a small increase in average loadings.

In the Rest of the World region, sales to auto makers will be boosted by the introduction of Korean LEV regulations, which have been in force since January 2001. This has led to significant increases in loadings of all the autocatalyst pgm.

The outlook for consumption of rhodium in autocatalysts is positive. Higher loadings will be required in all regions in order to meet tightening emissions standards. In addition, some auto makers are planning to use additional rhodium in order to permit greater thrifting of palladium.

Rhodium Supply and Demand
'000 oz

	2000	2001
Supply		
South Africa	457	441
Russia	290	100
North America	16	22
Others	3	4
Total Supply	**766**	**567**
Demand		
Autocatalyst: gross	793	548
recovery	(79)	(92)
Chemical	35	43
Electrical	7	6
Glass	42	41
Other	11	11
Total Demand	**809**	**557**
Movements in Stocks	(43)	10

Other Demand

Demand for rhodium in other applications is expected to rise by 6 per cent to 101,000 oz in 2001. In the chemical sector, there have been increased sales of rhodium catalysts for new oxo alcohol plants being constructed in South Africa and the Far East. The use of rhodium in glass manufacture will be little changed, with continued strong demand from LCD and fibreglass producers.

Ruthenium & Iridium

Demand for ruthenium is forecast to decline by 7 per cent to 409,000 oz in 2001, mainly due to a sharp drop in consumption in electronic components. Use of iridium will be stable, with lower sales to the chemical industry balanced by strong demand from the electronics industry, which uses iridium crucibles for crystal growing.

Consumption of ruthenium in the electronics sector will decline by 14 per cent to 204,000 oz in 2001, reflecting a worldwide downturn in the electronics industry. Ruthenium's principal use is in resistor chips, demand for which has

Ruthenium Demand by Application
'000 oz

	2000	2001
Chemical	79	62
Electrochemical	97	84
Electronics	238	204
Other	28	59
Total Demand	**442**	**409**

JM

fallen in line with lower production of devices such as personal computers and mobile phones. Usage of ruthenium has also been affected by a continuing trend towards miniaturisation. However, the decline in demand in resistor chips has been partly offset by increased use of ruthenium resistor pastes in hybrid integrated circuits.

The use of iridium in the electronics industry is mainly in the form of crucibles, used to grow crystals for a variety of end uses. In 2001, there has been an increase in demand for crucibles from manufacturers of yttrium aluminium garnet crystals, used in lasers for medical and industrial products. However, sales of crucibles used to grow lithium-based crystals for electronic devices have softened this year: the downturn in the mobile phone market means that crystal producers currently have sufficient capacity to meet demand from end users.

In the electrochemical sector, sales of ruthenium are forecast to decline by 13 per cent to 84,000 oz this year, while iridium demand is expected to be unchanged at 19,000 oz. Both metals are incorporated into coatings for electrodes used in a number of electrochemical processes, the principal one being the production of chlorine and caustic soda. The downturn in demand for ruthenium is a result of some manufacturers drawing upon inventories of metal built up in earlier years.

Another significant user of ruthenium is the chemical industry. In recent years large quantities of metal have been purchased for a catalyst used in the manufacture of ammonia. We do not expect any purchases of ruthenium for new ammonia plants this year and, as a result, total demand from the chemical sector will be lower than in 2000. However, a number of other proprietary speciality and bulk chemical processes will continue to consume substantial amounts of ruthenium. Chemical demand for iridium is also expected to decline this year, due to lower purchases of an iridium-ruthenium catalyst for acetic acid production.

Demand for ruthenium in other applications is forecast to rise sharply this year, reflecting the rising use of ruthenium in titanium pipes for the oil and gas industry. The addition of ruthenium to the titanium alloy gives improved corrosion resistance, and as a result this material is increasingly being adopted in harsh environments, such as those encountered in geothermal and offshore drilling projects.

Iridium Demand by Application
'000 oz

	2000	2001
Chemical	16	9
Electrochemical	19	19
Electronics	38	45
Other	29	27
Total Demand	**102**	**100**

JM

Supplies

Rhodium

Supplies of rhodium are forecast to fall by 26 per cent to 567,000 oz this year. After record shipments of rhodium in 2000, much of it from government controlled stocks, Russian exports have returned to more normal levels this year. Sales by Almaz are expected to total around 100,000 oz.

Supplies of rhodium from South Africa were also augmented by sales from stocks last year, but shipments in 2001 will be similar to production. As a result, South African supplies will fall this year, despite an increase in underlying output.

Further substantial increases in rhodium output are in the pipeline. Most of the recently announced expansions of platinum mining in South Africa will exploit the UG2 reef, which typically contains about twice as much rhodium as Merensky Reef. If all these expansions proceed, by the middle of the decade UG2 will account for nearly 60 per cent of all ore milled by South African platinum producers – up from around 45 per cent in 2001.

Ruthenium & Iridium

Ruthenium prices have fallen sharply since the beginning of 2001, reflecting an increase in availability following last year's shortages of metal. Mine output has risen, in line with higher output from the ruthenium-rich UG2 reef. We also believe that some of the metal purchased by investors in 2000 has been sold, adding to liquidity in the market.

With demand for iridium at around 100,000 oz, supplies of this metal are ample to meet consumer requirements.

Prices

Platinum

Strong physical demand, concerns about Russian supplies and dramatic rises in the palladium price pushed platinum to $645 in January, the highest price recorded during the first nine months of 2001. Although the price subsequently eased, steady consumer demand and limited availability kept platinum in a $550-$630 range until mid July. Growing concerns about a slowdown in the US economy then affected market sentiment, and selling by investors in New York and Tokyo pushed the price down to $422 in mid August. Although platinum rallied briefly in the wake of the terrorist attacks in the USA, it retreated to $429 at the end of September.

Platinum recorded $610 at the first London fixing in **January** 2001, holding on to gains made at the end of the previous year. Further rises were seen during the first half of the month, with the price bolstered by strong physical demand and concerns over Russian pgm supplies. As palladium broke through $1,000, platinum followed its sister metal upwards to a peak of $645 on the 11th, the highest price since April 1987. The price stabilised around $635 for the following week, as reports suggested that Russian pgm export quotas would not be signed until February. However, from the 18th onwards, selling on TOCOM and NYMEX became the driving force in the market and platinum embarked on a steady descent, recording $604 at the month end.

This slide continued during the early part of **February**, with the price dipping below $600 on the 2nd for the first time since the beginning of December 2000. For the remainder of the month, strong consumer demand and further confusion over the approval of Russian pgm quotas tempered the decline and platinum traded within a narrow range of $592-$613.

During **March**, sharp falls in the palladium price began to take their toll on platinum, and the price dropped from $609 at the beginning of the month to $576 on the 5th. It bounced back to $600 on the 8th, despite reports that the Russian quotas had been signed, but this proved to be only a temporary respite. During the second half of the month, sharp falls in world stock markets and growing evidence of weakness in the US economy began to have a negative effect on platinum. The price dropped to an eight month low of $563 on the 30th, following a bout of selling by US funds.

After slipping back to $558 on the first day of **April**, platinum staged a recovery throughout the first two weeks of the month, supported by speculative activity on the back of rising lease rates. Reports early in the month that Vladimir Putin had signed the year's export quotas for platinum and rhodium seemed to have little immediate effect on the price. On the 17th loco Zurich rates hit 35 per cent and the following day the price surged to $630. High borrowing costs then began to ease and, as offers of platinum from Russia were reported in the market, the price started to soften. Platinum ended the month at $594.

After a brief spike to $622 on the 4th **May**, platinum traded either side of $605 during the first half of the month. From the 16th onwards it was lifted by a round of fund buying on NYMEX and a rally in gold, which reached an 11 month high of $291.25 on the 21st. Platinum peaked at $622 on the 29th, before selling by investors on NYMEX and TOCOM knocked it back to $607 at the month's final fixing.

Average PGM Prices in $ per oz

Average	Platinum	Palladium	Rhodium	Iridium	Ruthenium
January - September 2000	528.93	640.76	2,025.47	415.00	118.72
January - September 2001	558.88	687.26	1,829.79	415.00	143.97
Percentage Change	6%	7%	–10%	0%	21%

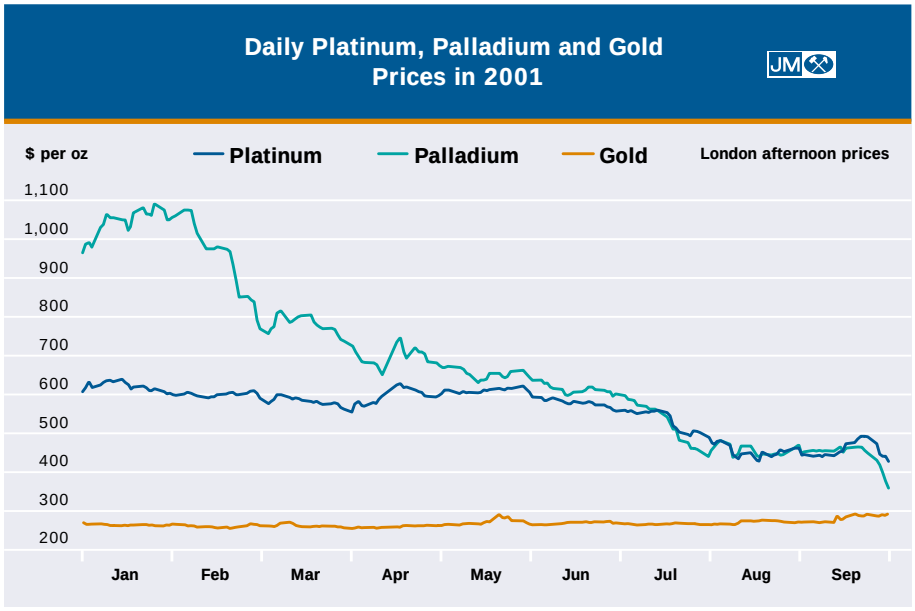
Platinum and palladium prices are averages of London am and pm fixings. Other pgm prices are averages of Johnson Matthey European base prices.

Platinum traded either side of $590 for the first ten days of **June**. Modest amounts of Russian metal were reported to be coming onto the market, but this was absorbed by strong demand from China. From the 11th onwards market sentiment became more negative, influenced by the slowdown in the US economy. This triggered long liquidation by dealers and funds, and platinum fell back to $558 at the month end.

The price stabilised in the first two weeks of **July**, but this period of calm was shortlived, with heavy selling on TOCOM triggering a steep fall in the price during the third week of the month. Platinum fell by more than $50 in just five days, sinking below $500 for the first time since April 2000. Further liquidation by US funds in New York and by private investors on TOCOM depressed the price to $476 on the 31st.

During **August**, platinum was subject to further bouts of heavy selling on TOCOM, and the price tumbled to a 19 month low of $422 on the 16th. At this level there was some bargain hunting by industrial consumers, and platinum was able to recoup some of its losses. Reports that Russian precious metals exports had been suspended also lifted sentiment, and the price recovered briefly to $465 on the 29th. However, the rally quickly ran out of steam and platinum sank back to $446 on the 31st following further selling on TOCOM.

The market was quiet at the beginning of **September**, but platinum rallied in the wake of gold following the terrorist attacks in the USA on the 11th. Continued delays in Russian exports gave a further boost to the price, which peaked at $495 on the 20th. However, the rally came to an abrupt end the following week, as investors responded to growing concerns that a world economic slowdown would hit demand. Rumours of Russian selling reinforced the negative sentiment and platinum dropped to a month end fixing of $429.



Palladium

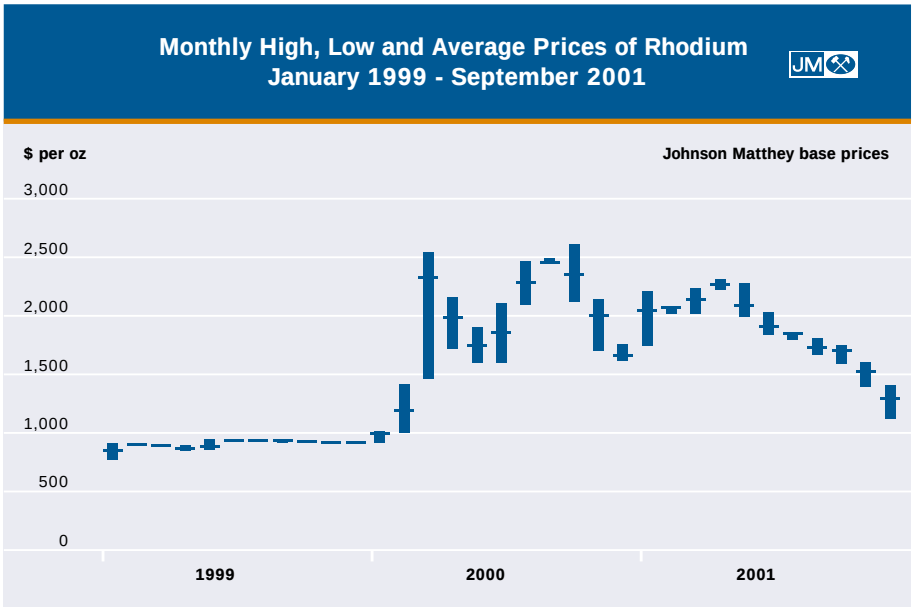
Concerns over delays in Russian exports propelled palladium to an all-time high of $1,094 at the end of January. However, it began a rapid descent in February, with consumer demand drying up and an influx of metal for sale on the London fixings. Selling on the fixings continued to affect the price during the following months and, with consumers reluctant to return to the market, palladium fell steadily to a two year low of $360 at the end of September.

After opening the year with a fixing price of $965, palladium made spectacular gains during early **January**. Steady consumer demand combined with a shortage of liquidity in the market forced the price higher, and palladium breached the $1,000 barrier on the 8th. On the 11th, rumours began circulating in the market that there would be no shipments from Russia until February. Palladium lease rates tightened, with one month borrowing costs rising to over 20 per cent, and the price surged to $1,085. The market eased in mid month following a bout of profit taking, but concerns over availability of Russian metal soon resurfaced and the price was propelled up to a record $1,094 on the 26th. A lack of activity at this level allowed palladium to drift back to $1,050 at the month end.

Palladium remained strong during the first week of **February**, edging back to $1,081 on the 6th. However, it began to falter from the 8th after reports that the signing of Russian export quotas was imminent. During the rest of the month heavy selling, rumoured to originate from Russia, was seen on the London fixings. Although consumer demand remained firm, palladium was unable to hold its ground and the price rapidly dropped below $1,000, plunging to a three month low of $839 at the month's final fixing.

The selling continued into early **March**. Palladium dropped to $750 on the 5th, before staging a strong but short-lived recovery which took it back to $828 on the 9th. It then retreated again, as the return of modest but persistent selling on the London fixings began to outweigh industrial demand. The price sank to a five month low of $738 on the 30th.

During the first two weeks of **April**, heavy selling on the London fixings precipitated a further fall in the price, which reached a nine month low of $650 on the 12th. The selling eased in mid



month, allowing palladium to recover briefly to $765 on the 18th, but with metal once more on offer at the fixings the price retreated to $682 at the end of the month.

May was a quieter month for palladium. After trading either side of $670 for the first ten days, a bout of selling pushed the price down to $630 on the 14th. However, once this dried up palladium recovered to trade in a $638-$665 range for the remainder of the month.

The downward trend resumed during **June** as selling on the London fixings met with little interest from consumers. Palladium fell below $600 on the 13th; at this level some buyers were attracted back into the market and there was a brief recovery to $620 on the 20th. Renewed selling pressure then forced the price down to a one year low of $594 on the 29th.

It was a similar story in **July**, with little consumer demand to break palladium's fall. The price slid downwards throughout the month, dropping below that of platinum on the 13th for the first time since May 2000. By the morning of the 31st it had fallen to an 18 month low of $438, although a last minute rally pushed it up to $457 in the afternoon.

Palladium continued to strengthen during the first days of **August,** reaching $485 on the 3rd. However, this ascent was interrupted on the 7th as a plunge in the platinum market precipitated a similar sharp fall in palladium. After touching a low of $438, it bounced back to $475 on the 13th following reports that Norilsk Nickel was planning to reduce spot sales, but retreated the next day in reaction to news of disposals from the US Defense National Stockpile. There was a further spike to $473 on the 29th triggered by reports of a temporary suspension of Russian pgm exports but palladium soon eased back to a month end price of $453.

The palladium market was very quiet for most of **September**. After trading in a $450-$466 range for the first three weeks of the month, selling on the London fixes coupled with low industrial demand began to take its toll from the 24th. The price collapsed to a two year low of $360 at September's final London fixing.

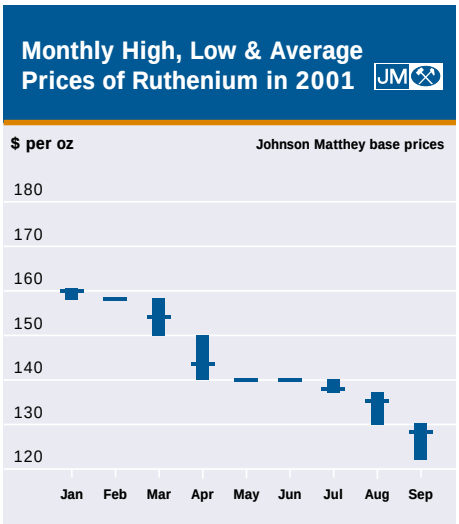
Other PGM

A lack of Russian selling boosted rhodium to a six month high of $2,300 in February. However this rally came to a halt as Russian metal became available and, with little consumer demand to break the fall, the price dropped to a 20 month low of $1,125 in September. The ruthenium price also softened during the year, dropping almost $40 to $122.

A shortage of Russian sales triggered a rally in the rhodium price at the beginning of 2001. The Johnson Matthey base price climbed from $2,025 at the beginning of January to a high of $2,300 in February. However the price dropped sharply in March, sinking to $2,000 as Russian metal came onto the market.

For the rest of the year rhodium followed a downward trend, punctuated by periods of price stability. The price continued to fall during April as Russian sales were met by a market nervous in the face of a perceived world economic slowdown. It then stabilised at $1,850 until the end of May when it resumed its descent. With no cessation of supplies during the traditionally quiet summer months, rhodium found little support in the market and by the end of September was trading at a 20 month low of $1,125.

After significant price rises in 2000, ruthenium saw a reversal of fortunes throughout 2001, in line with a reduction in speculator activity and a fall in consumer demand. The JM base price slipped from $160 at the beginning of the year to $122 at the end of September. The iridium market was again quiet, with the price remaining at $415, unchanged since January 1999.



Supply and Demand Tables

Platinum Supply and Demand	24
Platinum Demand by Application: Regions	25
Palladium Supply and Demand	26
Palladium Demand by Application: Regions	27
Rhodium Supply and Demand	28

Notes to tables

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

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

From 1993, demand numbers for **Europe** include an estimate of net consumption in the former COMECON countries of eastern Europe. From 1996, consumption in China is incorporated into our figures for the **Rest of the World** region. We continue to exclude the CIS from our demand estimates.

Movements in stocks in a given year reflect changes in stocks held by fabricators, dealers, banks and depositories but excluding stocks held by primary refiners and final consumers. A positive figure indicates an increase in stocks; a negative figure indicates a rundown in stocks.

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

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

Platinum Supply and Demand

'000 oz	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Supply										
South Africa	2,750	3,360	3,160	3,370	3,390	3,700	3,680	3,900	3,800	**4,080**
Russia	750	680	1,010	1,280	1,220	900	1,300	540	1,100	**1,050**
North America	200	220	220	240	240	240	285	270	285	**340**
Others	120	130	140	100	130	120	135	160	105	**110**
Total Supply	**3,820**	**4,390**	**4,530**	**4,990**	**4,980**	**4,960**	**5,400**	**4,870**	**5,290**	**5,580**
Demand By Application										
Autocatalyst: gross	1,550	1,685	1,870	1,850	1,880	1,830	1,800	1,610	1,890	**2,360**
recovery	(230)	(255)	(290)	(320)	(350)	(370)	(405)	(420)	(470)	**(510)**
Chemical	215	180	190	215	230	235	280	320	285	**285**
Electrical	165	165	185	240	275	305	300	370	450	**380**
Glass	80	80	160	225	255	265	220	200	255	**290**
Investment: small	145	125	155	75	110	180	210	90	40	**50**
large	110	180	240	270	130	60	105	90	(100)	**0**
Jewellery	1,510	1,615	1,740	1,810	1,990	2,160	2,430	2,880	2,830	**2,520**
Petroleum	120	105	90	120	185	170	125	115	105	**130**
Other	150	165	190	225	255	295	305	335	375	**435**
	3,815	**4,045**	**4,530**	**4,710**	**4,960**	**5,130**	**5,370**	**5,590**	**5,660**	**5,940**
Western Sales to China	0	20	50	130	-	-	-	-	-	-
Total Demand	**3,815**	**4,065**	**4,580**	**4,840**	**4,960**	**5,130**	**5,370**	**5,590**	**5,660**	**5,940**
Movements in Stocks	5	325	(50)	150	20	(170)	30	(720)	(370)	**(360)**
	3,820	**4,390**	**4,530**	**4,990**	**4,980**	**4,960**	**5,400**	**4,870**	**5,290**	**5,580**
Demand By Region										
Europe	860	895	935	880	840	875	910	995	1,140	**1,405**
Japan	1,870	1,975	2,145	2,215	2,005	1,885	1,795	1,820	1,410	**1,210**
North America	705	760	940	1,015	1,180	1,250	1,325	1,080	1,215	**1,190**
Rest of the World	380	415	510	600	935	1,120	1,340	1,695	1,895	**2,135**
	3,815	**4,045**	**4,530**	**4,710**	**4,960**	**5,130**	**5,370**	**5,590**	**5,660**	**5,940**
Western Sales to China	0	20	50	130	-	-	-	-	-	-
Total Demand	**3,815**	**4,065**	**4,580**	**4,840**	**4,960**	**5,130**	**5,370**	**5,590**	**5,660**	**5,940**

Platinum Demand by Application: Regions

'000 oz	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Europe										
Autocatalyst: gross	575	610	605	560	515	510	545	560	680	**980**
recovery	(5)	(5)	(10)	(15)	(20)	(25)	(30)	(30)	(40)	**(55)**
Chemical	50	40	50	55	60	70	60	80	100	**95**
Electrical	30	20	25	25	25	45	45	70	75	**65**
Glass	15	15	30	35	40	20	25	20	20	**15**
Investment: small	35	25	45	10	5	5	5	5	0	**0**
Jewellery	85	105	100	120	125	150	160	185	190	**160**
Petroleum	20	25	25	15	15	15	15	15	10	**20**
Other	55	60	65	75	75	85	85	90	105	**125**
Totals	**860**	**895**	**935**	**880**	**840**	**875**	**910**	**995**	**1,140**	**1,405**
Japan										
Autocatalyst: gross	350	320	290	270	245	255	240	250	290	**345**
recovery	(45)	(50)	(45)	(40)	(50)	(50)	(55)	(60)	(60)	**(65)**
Chemical	20	15	15	20	20	20	20	20	20	**20**
Electrical	50	45	45	45	45	65	55	75	90	**75**
Glass	20	30	80	105	80	85	80	65	65	**85**
Investment: small	40	55	40	35	25	25	25	20	5	**5**
large	110	180	240	270	130	60	105	90	(100)	**0**
Jewellery	1,290	1,350	1,450	1,480	1,480	1,390	1,290	1,320	1,060	**700**
Petroleum	10	10	5	5	5	5	5	5	5	**5**
Other	25	20	25	25	25	30	30	35	35	**40**
Totals	**1,870**	**1,975**	**2,145**	**2,215**	**2,005**	**1,885**	**1,795**	**1,820**	**1,410**	**1,210**
North America										
Autocatalyst: gross	525	600	790	820	850	800	775	535	620	**700**
recovery	(180)	(200)	(230)	(260)	(275)	(290)	(310)	(315)	(350)	**(365)**
Chemical	90	75	65	70	80	80	80	95	90	**100**
Electrical	55	65	75	115	130	100	105	120	145	**120**
Glass	15	15	20	25	30	45	20	25	50	**35**
Investment: small	65	40	65	25	75	145	175	60	35	**45**
Jewellery	35	45	55	65	90	160	270	330	380	**270**
Petroleum	35	40	5	40	60	50	40	40	35	**40**
Other	65	80	95	115	140	160	170	190	210	**245**
Totals	**705**	**760**	**940**	**1,015**	**1,180**	**1,250**	**1,325**	**1,080**	**1,215**	**1,190**
Rest of the World										
Autocatalyst: gross	100	155	185	200	270	265	240	265	300	**335**
recovery	0	0	(5)	(5)	(5)	(5)	(10)	(15)	(20)	**(25)**
Chemical	55	50	60	70	70	65	120	125	75	**70**
Electrical	30	35	40	55	75	95	95	105	140	**120**
Glass	30	20	30	60	105	115	95	90	120	**155**
Investment: small	5	5	5	5	5	5	5	5	0	**0**
Jewellery	100	115	135	145	295	460	710	1,045	1,200	**1,390**
Petroleum	55	30	55	60	105	100	65	55	55	**65**
Other	5	5	5	10	15	20	20	20	25	**25**
Totals	**380**	**415**	**510**	**600**	**935**	**1,120**	**1,340**	**1,695**	**1,895**	**2,135**

Palladium Supply and Demand

'000 oz	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Supply										
South Africa	1,260	1,395	1,500	1,600	1,690	1,810	1,820	1,870	1,860	**2,000**
Russia	2,100	2,400	3,300	4,200	5,600	4,800	5,800	5,400	5,200	**4,600**
North America	450	415	410	470	455	545	660	630	635	**815**
Others	70	70	70	70	95	95	120	160	105	**115**
Total Supply	**3,880**	**4,280**	**5,280**	**6,340**	**7,840**	**7,250**	**8,400**	**8,060**	**7,800**	**7,530**
Demand By Application										
Autocatalyst: gross	490	705	975	1,800	2,360	3,200	4,890	5,880	5,640	**4,840**
recovery	(95)	(100)	(105)	(110)	(145)	(160)	(175)	(195)	(230)	**(290)**
Chemical	205	190	185	210	240	240	230	240	255	**245**
Dental	1,195	1,210	1,265	1,290	1,320	1,350	1,230	1,110	820	**690**
Electronics	1,830	2,015	2,230	2,620	2,020	2,550	2,075	1,990	2,160	**1,050**
Jewellery	205	210	205	200	215	260	235	235	255	**240**
Other	60	35	115	110	140	140	115	110	60	**65**
Total Demand	**3,890**	**4,265**	**4,870**	**6,120**	**6,150**	**7,580**	**8,600**	**9,370**	**8,960**	**6,840**
Movements in Stocks	(10)	15	410	220	1,690	(330)	(200)	(1,310)	(1,160)	**690**
	3,880	**4,280**	**5,280**	**6,340**	**7,840**	**7,250**	**8,400**	**8,060**	**7,800**	**7,530**
Demand By Region										
Europe	675	680	885	1,340	1,525	1,840	1,985	2,095	2,410	**2,085**
Japan	1,780	1,990	2,200	2,445	1,885	2,350	2,215	2,205	2,105	**1,415**
North America	1,155	1,295	1,430	1,960	2,185	2,675	3,690	4,255	3,445	**2,350**
Rest of the World	280	300	355	375	555	715	710	815	1,000	**990**
Total Demand	**3,890**	**4,265**	**4,870**	**6,120**	**6,150**	**7,580**	**8,600**	**9,370**	**8,960**	**6,840**

Palladium Demand by Application: Regions

'000 oz	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Europe										
Autocatalyst: gross	40	115	260	650	860	1,100	1,370	1,530	1,900	**1,740**
recovery	0	0	0	0	(5)	(5)	(5)	(10)	(15)	**(25)**
Chemical	75	65	60	65	65	70	65	65	95	**75**
Dental	300	265	255	250	255	260	210	180	100	**60**
Electronics	210	210	255	325	300	340	270	255	265	**180**
Jewellery	35	35	30	30	30	50	50	50	45	**35**
Other	15	(10)	25	20	20	25	25	25	20	**20**
Totals	**675**	**680**	**885**	**1,340**	**1,525**	**1,840**	**1,985**	**2,095**	**2,410**	**2,085**
Japan										
Autocatalyst: gross	85	90	125	145	180	245	480	600	510	**540**
recovery	(35)	(30)	(30)	(25)	(30)	(45)	(50)	(55)	(50)	**(55)**
Chemical	20	20	20	20	20	20	20	20	20	**20**
Dental	450	500	550	580	600	620	590	545	470	**430**
Electronics	1,130	1,280	1,400	1,600	990	1,390	1,060	980	990	**330**
Jewellery	120	120	120	115	115	110	105	105	150	**140**
Other	10	10	15	10	10	10	10	10	15	**10**
Totals	**1,780**	**1,990**	**2,200**	**2,445**	**1,885**	**2,350**	**2,215**	**2,205**	**2,105**	**1,415**
North America										
Autocatalyst: gross	320	450	525	950	1,230	1,680	2,820	3,490	2,805	**2,020**
recovery	(60)	(70)	(75)	(85)	(110)	(105)	(115)	(125)	(155)	**(200)**
Chemical	65	65	60	70	70	70	70	75	65	**75**
Dental	400	400	410	410	410	415	390	350	230	**190**
Electronics	405	420	450	545	490	550	460	405	485	**240**
Jewellery	0	5	5	5	5	10	10	10	10	**10**
Other	25	25	55	65	90	55	55	50	5	**15**
Totals	**1,155**	**1,295**	**1,430**	**1,960**	**2,185**	**2,675**	**3,690**	**4,255**	**3,445**	**2,350**
Rest of the World										
Autocatalyst: gross	45	50	65	55	90	175	220	260	425	**540**
recovery	0	0	0	0	0	(5)	(5)	(5)	(10)	**(10)**
Chemical	45	40	45	55	85	80	75	80	75	**75**
Dental	45	45	50	50	55	55	40	35	20	**10**
Electronics	85	105	125	150	240	270	285	350	420	**300**
Jewellery	50	50	50	50	65	90	70	70	50	**55**
Other	10	10	20	15	20	50	25	25	20	**20**
Totals	**280**	**300**	**355**	**375**	**555**	**715**	**710**	**815**	**1,000**	**990**

Rhodium Supply and Demand

'000 oz	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Supply										
South Africa	278	278	330	342	359	377	400	410	457	**441**
Russia	80	80	80	80	110	240	110	65	290	**100**
North America	19	17	15	13	5	16	16	18	16	**22**
Others	1	1	1	1	2	3	4	8	3	**4**
Total Supply	**378**	**376**	**426**	**436**	**476**	**636**	**530**	**501**	**766**	**567**
Demand By Application										
Autocatalyst: gross	305	356	379	464	424	418	483	509	793	**548**
recovery	(22)	(25)	(34)	(37)	(45)	(49)	(57)	(65)	(79)	**(92)**
Chemical	18	11	10	13	21	36	31	34	35	**43**
Electrical	7	9	8	8	9	9	6	6	7	**6**
Glass	7	3	14	17	53	43	34	35	42	**41**
Other	13	12	11	9	9	10	10	9	11	**11**
Total Demand	**328**	**366**	**388**	**474**	**471**	**467**	**507**	**528**	**809**	**557**
Movements in Stocks	50	10	38	(38)	5	169	23	(27)	(43)	**10**
	378	**376**	**426**	**436**	**476**	**636**	**530**	**501**	**766**	**567**
Demand By Region										
Europe	119	127	129	139	154	165	175	178	199	**202**
Japan	63	68	68	59	64	70	75	84	154	**110**
North America	110	127	139	224	170	137	177	167	332	**108**
Rest of the World	36	44	52	52	83	95	80	99	124	**137**
Total Demand	**328**	**366**	**388**	**474**	**471**	**467**	**507**	**528**	**809**	**557**

Glossary

g	grams
kg	kilograms
tonne	1,000 kg
oz	ounces troy
pgm	platinum group metals
prices	all prices quoted are per oz unless otherwise stated
$	US dollars
R	South African rands
¥	Japanese yen
Almaz	Almazjuvelirexport, the pgm marketing agency of the Russian Federation
CO	carbon monoxide
HC	hydrocarbons
HIC	hybrid integrated circuit
NOx	oxides of nitrogen
LCD	liquid crystal display
LEV	Low Emissions Vehicle
MLCC	multi-layer ceramic capacitor
Merensky, UG2, Platreef	platiniferous orebodies in South Africa
NYMEX	New York Mercantile Exchange
TOCOM	Tokyo Commodity Exchange
ZEV	Zero Emissions Vehicle

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