PLATINUM GROUP METALS

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It was a year of contrasting fortunes for the platinum group metals. Platinum underpinned by strong fundamentals soared through both the psychological US$500 and US$600 barriers, reaching a high of US$607 before closing the year at US$598/oz. With ample metal availability, sister metals palladium and rhodium remained under constant pressure throughout the year. At year end, both metals' prices had declined by around 50%, to US$233/oz and US$485/oz respectively.

The platinum market remained in deficit for the fourth consecutive year in 2002. Strong demand from both the automotive and jewellery sectors outstripped supply, which saw the first significant contribution from the South African expansions. It was a watershed year in the case of palladium in that it was the first time in almost a decade that Russian sales from inventory were not required by the market. Indeed it took an approximately 60% decrease in Russian supplies to balance a market that witnessed declines in both the automotive and electronic sectors. The rhodium market remained balanced as the increase in South African supply was compensated by lower Russian sales. The average annual prices per ounce for platinum, palladium and rhodium were US$539, US$338 and US$817 respectively.

Automotive
The automotive industry has been, and will continue to be, the major consumer of platinum group metals. In 2002, auto catalysts accounted for 37% of platinum demand, 62% of palladium demand and 87% of rhodium demand.

Despite the weak global economic environment vehicle sales proved remarkably resilient in 2002. In the US, a surge in December sales resulted in light vehicle sales of 16.8 million units, a mere 1.9% down on the previous year's total. Sales were once again sustained by incentives from the mainly cash-strapped US manufacturers. The year was also notable in that it was the first time that more than half the number of light vehicles sold were trucks. Western Europe's passenger-car market mirrored its US counterpart with a final month incentive-driven surge in sales bringing the total for the year to 14.4 million units, 2.9% down on the same period a year ago. Diesel cars, which use platinum-only auto catalysts, continued to increase their market share in Europe. In 2002, diesels maintained their growth profile and now account for 40% of sales. In Japan, despite the ongoing economic woes, car sales rose 3.5% to 4.4 million units as consumers switched to small and midget cars at the expense of standard vehicles.

The combination of firm vehicle sales, the imposition of, and early adherence to, stricter emission standards, and the surge in the growth of European diesel sales combined to increase platinum demand by 22% to 2.65 Moz. Palladium demand declined by 16% to 4.48 Moz, the first reversal in over a decade. This

was due to a combination of thrifting and a shift back to platinum brought about by the price surge of recent years. The use of rhodium increased by 5% to 631,000 oz in response to the tighter emission legislation and the use of additional metal in order to reduce dependence on palladium.

As mentioned above emission legislation is the driver of platinum group metal usage by the automotive industry. First introduced in the mid-1970s, the legislation has spread worldwide and has been progressively tightened, with the ultimate goal being zero emissions. In the US, there are two sets of emission standards: those promulgated in California and subsequently adopted by New York, Massachussets, Maine and Vermont; and those applicable to the rest of the country, namely the US Federal Standards.

The next set of standards, US Federal Tier 2 and California LEV II take effect from 2004 with full compliance by 2009. The Tier 2 standards bring significant emissions reductions relative to the current legislation. The Tier 2 requirements have eight levels of stringency, termed certification bins, and an average fleet standard for NO_x. Automakers can certify vehicles to any one of the categories, but must meet the fleet average NO_x requirement. The most stringent level is no emissions. Tier 2 also brings new requirements for fuel quality, as cleaner fuels will be required by auto catalysts in order to meet the regulations. The more stringent California LEV II standards require car manufacturers to produce a percentage of vehicles certified to increasingly more stringent emission categories. The standards allow for three emission categories, low (LEV), ultra low (ULEV) and super ultra low (SULEV) emission vehicles. The phase-in schedules are generally based on vehicle fleet emission averages. A key feature of both standards is that light duty trucks will have to meet the stricter passenger car limits. In addition the emission limits will apply to all engines regardless of the fuel used, ie gasoline, diesel or other.

In Europe, the next set of regulations Euro IV will be introduced in 2005. Different standards apply for diesel and gasoline vehicles. Diesels have lower CO standards but are allowed higher NO_x standards. The new legislation reduces emission of CO, HC, NO_x and particulate matter for diesels by 22%, 46%, 50% and 50% respectively. Limits for CO, HC, NO_x for gasoline cars are reduced by 57%, 50% and 47% respectively. The next set of emission standards in Japan has been brought forward from 2007 to 2005 and will involve new test methods. Most countries in Asia and South America have adopted emission legislation. In the majority of cases the legislation adopted is based on earlier US or European standards thus allowing considerable leeway for tightening of the controls.

While conventional auto catalysts have made enormous strides in reducing automotive emissions, and will continue to do so, they are unable to achieve zero emissions. The only truly pollution-free technology is the platinum-based fuel cell, an electro-chemical device that combines hydrogen and oxygen to produce electricity with water and heat as by-products. The main components of the fuel cell are two platinum-coated electrodes separated by a conducting medium called an electrolyte. Of the various types of fuel cells, the proton

exchange membrane fuel cell is best suited for vehicle propulsion due to its low operating temperature and high power to weight ratio.
During the course of the year a number of positive announcements were made regarding their development. General Motors unveiled the AUTOnomy, a concept vehicle designed around a fuel cell propulsion system. The US Administration gave its backing to the Department of Energy's 'Freedom Car' programme, a plan to develop hydrogen fuel cells to power cars of the future to help alleviate the country's dependence on foreign oil. In Japan, the major automakers Honda, Nissan and Toyota announced they will begin selling limited fuel cell vehicles both locally and in the US from 2003. The partnerships developed in recent years between the major automotive companies and with energy and power technology companies like Ballard Power continue with their fuel-cell programmes.

The road to commercialisation still faces significant challenges such as cost, fuel storage and infrastructure. However, each year sees significant in-roads being made in these areas. Given the current developments, commercialisation can be expected by the end of the decade. Fuel cells will thus ensure that platinum group metals will continue to play a major role in automotive emission control for the foreseeable future.

Jewellery
Another year of record demand in China resulted in platinum jewellery demand growing by 10% to 2.81 Moz.

In China, the consumers' growing affinity for platinum jewellery continued unabated and sales rose by 15% to 1.5 Moz. Platinum is favoured by the younger more affluent households who desire it for its elegance, purity and rarity. Demand has broadened in recent years to cover most of the larger cities and there has also been an increase in demand in the southern part of the country, where platinum's popularity was countered by a stronger tradition for gold. The rising platinum price has thus had little impact at the consumer level. However, with retailers reticent to raise prices, manufacturers have seen their margins strongly eroded. The resultant cut-back in production was not evident due to the fact stores had adequate levels of inventory. Platinum sales have revived in Taiwan after a long gap, with two leading retail chains both promoting platinum jewellery.

With Japan mired in recession, platinum jewellery sales fell for the third successive year. Sales on a piece and value basis declined by 15% and 10% respectively compared with the previous year and are at their lowest level for the past decade. This is not reflected in metal purchases by the industry due to a run down of inventories. As has been the case in the past few years, white gold (gold alloyed with nickel or palladium) continues to take market share from platinum in the lower price brackets, where the price differential makes it uncompetitive for manufacturers to produce in platinum. The important outlets in the department stores have, however, increased their share of platinum on display and reported better sales at the end of the year. Platinum's bridal market share remains high and relatively unaffected.

Consumer desire for platinum jewellery, particularly in the bridal sector remained strong in the US in 2002 with demand increasing by 10%, to 310, 000 oz. However, the high and fluctuating price together with the poor economic outlook deterred retailers from making major commitments to the industry, especially in the fashion jewellery category. In the latter part of the year most retailers restricted themselves to replacing inventory. However, the number of weddings has increased and platinum share of the bridal market rose in 2002.

In Europe, demand was unchanged at 170,000 oz despite contrasting fortunes in the major UK and German markets. Strong demand from the bridal sector continues to drive growth in the UK. Figures from the UK Assay Office showed that the number of platinum pieces increased from 184,000 to 243,800 pieces. The German market endured another disappointing year as the country laboured under the ongoing effects of a weak economy. In addition to white gold, platinum jewellery is now facing competition from other white metals such as titanium, steel and silver. However, the platinum bridal sector was one of the few areas showing growth. In Italy, which is primarily an export market, sales of chain, which is the main product, were marginally down on last year. Switzerland increased both watch and jewellery sales for export. Platinum has maintained its growth trend in the watch business, with manufacturers broadening their range of platinum production into more mid priced products. Jewellery manufacturers continue to play an important role in the export market and in supplying the international brands.

Sales of platinum in India continue to grow, with the number of retailers selling platinum increasing to over 100. Quantities remain relatively low in relation to the other markets, but there are growing signs of consumer interest and the export market remained strong.

Other demand

Other demand for platinum remained firm at around 1.62 Moz in 2002 despite the global economic malaise and concern over the rising tensions in the Middle East. Consumption by many of the applications mirrors changes in manufacturing capacity. This was well reflected by the chemical and glass industries. Demand in the chemical industry increased as new plant came on-stream whereas in the case of the glass industry the reverse was true as the majority of new expansions were completed in the prior year. Demand in electronics and petroleum industries was virtually unchanged. Investment demand declined by 20% as buyers withdrew from the market in the latter part of the year in response to the rising price.

Non-automotive industrial demand for palladium declined by 13% to 2.33 Moz. Once again the electronics industry was the worst affected, with demand below 1.0 Moz for the first time since the early 1980s. Although the shift to nickel-based multi-layer ceramic capacitors continued, the decline was not as severe as the previous year due to the fact that most of the excess inventories had been consumed by the end of the first quarter of the year. The ongoing fall in the palladium price halted the decline in dental demand and consumption remained steady at 750,000 oz. Japan continues to be the main user of palladium alloys

due to the fact that they are covered by the Ministry of Welfare. Industrial demand for rhodium remained stable at around 100,000 oz.

Supply

Platinum supply increased by 5% in 2002 to 6.56 Moz, primarily as a result of the growth in South African output as the first expansion projects came on stream.

In South Africa, platinum production increased by 8.2% to 4.46 Moz which represents close to 70% of world output. Production at Anglo Platinum increased by 6.7% to 2.25 Moz. The Rustenburg UG2 Phase 1 and Modikwa projects, both of which commenced operations during the year, together with increases at Amandelbult and Bafokeng–Rasimone, accounted for the majority of the additional refined output. At Impala, production from the lease area increased by 6% to 1.07 Moz while output at Crocodile River remained steady at 30,000 oz. Implats also benefited from the increase in production at Kroondal whose metal it purchases in concentrate form and markets. Kroondal's output grew by around 40% to 135,000 oz. Lonmin recorded its third successive year of growth, expanding production by 8% to 780,000 oz. Refined output at Northam recovered to prior years' levels of around 190,000 oz following the strike of 2001.

In North America, refined platinum output rose by 9% to 370,000 oz. At Stillwater, mine production declined marginally to 113 000 oz as a result of a fall in the mill head grade. The East Boulder mine, which came into commercial production during the year, produced 28,000 oz of refined platinum. In November, the company announced it had signed an agreement with Norilsk Nickel whereby the latter would acquire a 51% majority ownership in Stillwater. One of the terms of the deal is that Stillwater will purchase at least 1.0 Moz of palladium annually from Norilsk. The transaction, which is expected to be completed during the second quarter of 2003, is subject to shareholder and other customary approvals and US anti-trust review. In Canada, North American Palladium's Lac des Îles mine increased PGM production by close on 80% to 238,000 oz, of which 19,000 oz was platinum.

In Zimbabwe, Mimosa maintained its output at around 15,000 oz of platinum. Zimplats Makwiro project (formerly the Ngezi project) commenced production during the second quarter of 2002 and produced 60,000 oz of platinum. Russian sales are estimated to have been in the region of 950,000 oz. The recovery of platinum from scrapped auto catalysts, boosted by the higher price of recent years, is estimated to have increased by around 5% to 555,000 oz. The US Defense Logistic Agency (DLA) sold 90,000 oz of platinum, thereby depleting its platinum inventory.

While the South African expansion targets remain in place, the planned build-up profile has changed. Anglo Platinum announced that while annual production of 3.5 Moz of refined platinum could still be achieved by the end of 2006, delays experienced with mining authorisations had impacted on the rate of ramp-up. The result is a slower build-up in 2003 and 2004, as a number of projects will only be commissioned in 2005 and 2006. The current status of the projects is as

follows: the Bafokeng-Rasimone mine, commenced production in 1999, together with the new 162,000 oz Modikwa Platinum mine, are scheduled to reach full production in 2004; Rustenburg UG2 Phase 1 and Rustenburg Tailing Retreatment will begin in 2006 at rates of 395,000 oz and 120,000 oz of platinum respectively; Twickenham and Rustenburg UG2 Phase 2 in 2007 at rates of 160,000 oz and 306,000 oz of platinum respectively; and the Pandora and Styldrift joint ventures with Lonmin and the Royal Bafokeng Nation, respectively, will reach full production post 2006.

Implats, growth strategy to deliver 2.0 Moz/y of platinum by 2006 remained on track. This growth is a combination of the maximisation of existing mineral resources and the tolling and concentrate purchase business. At Marula Platinum, first output is scheduled for the last quarter of this year and full production of 100,000 oz of platinum is planned for 2005. Aquarius Platinum's Kroondal and Marikana projects remain on track. Kroondal will reach its maximum annual production level of 150,000 oz of platinum this year while the Marikana project, which commenced production late last year, will reach steady state of 90,000 oz/y of platinum during 2004.

The final feasibility study for the Two Rivers project is expected to be concluded by mid-2003. Full production of 115,000 oz of platinum is forecast for 2006. The Messina mine commenced production late in the year and will build up to full output of 60,000 oz/y of platinum over the course of the next year.

In Zimbabwe, both the Makwiro and Mimosa mines will reach steady-state production in 2003. The Makwiro mine, which commenced production during the second quarter of 2002, will reach full production of 100,000 oz/y of platinum while Mimosa's expansion will see production rise from 15,000 to 70,000 oz/y of platinum. In the case of both these projects, Impala smelts, refines and markets the metal.

Lonmin's annual growth profile of 870,000 oz of platinum by 2003 and 1.0 Moz by 2008 also remained on schedule. The additional output will be achieved by expanding existing operations coupled with the Pandora joint venture with Anglo Platinum.

Palladium supply slumped by almost 20% in 2002 to 7.28 Moz as Russia withdrew from the spot market in response to anemic demand. Russian sales are estimated to have been in the region of 1.8 Moz, thus bringing to an end almost a decade of destocking. South African production rose by almost 10% to 2.18 Moz as the platinum expansions started to ramp up. In North America, expansions at both Stillwater and North American Palladium saw production rise by 15% to 950,000 oz.

Supply from spent auto catalysts grew by 17% to 350,000 oz as increasing numbers of vehicles that used palladium-based catalytic convertors first introduced in the early 1990's, were scrapped. The DLA continued to deplete its palladium stockpile. Sales in 2002 were close on 300,000 oz which leaves 225,000 oz remaining for disposal.

Terminal markets

Platinum trading volumes fell 10.6% on Tocom in 2002 to 14.44 million contracts as lack-lustre trading conditions prevailed. Open interest mirrored the directionless performance of trading volumes. Having once again seen the year's high, traded in January (259,081 lots), open interest traded either side of 220,000 lots for the balance of the year. Warehouse stocks were virtually unchanged at year-end at 18,551 oz.

It was a case of *deja-vu* for palladium on Tocom with volumes continuing their decline of recent years, down 25% to 87 928 contracts, while open interest once again traded around the 3,000 lots per month level. In an attempt to stimulate its futures contract, Tocom introduced a smaller-size contract of 500 g compared with the previous 1.5 kg lot size.

The decline in volumes for platinum and palladium on Nymex was reversed in 2002. Platinum and palladium volumes rose by 8.2% and 60.6% to 217,773 and 41,482 contracts respectively. Open interest mirrored the turn-around in volumes, with platinum and palladium closing the year at 8,255 and 1,941 lots, respectively, compared with 6,363 and 1,273 lots the previous year.

Prices

It was an inauspicious start to the year for platinum as it traded for most of January in a US$470–480/oz range. Having slipped to the low fixing of the year of US$449 on February 1, platinum rallied on the back of a firming gold price to pass through the psychological US$500/oz barrier in early March, a level it would not relinquish for the balance of the year. In the ensuing three months, a combination of strong consumer demand, a strengthening gold price coupled with a host of global economic and political concerns, saw platinum make a series of steady gains culminating in spot fixing at a 12-month high of US$567/oz on June 21. Having fallen sharply on the announcement of the accounting irregularities at WorldCom, platinum traded in a narrow US$530–540/oz band in July. In the lead-up to year-end, platinum witnessed a series of rallies, each inevitably capped by profit-taking. However, each rally saw the price move higher, culminating in the year's high of US$607 on December 17. The year's final fixing of US$598/oz represented a 24% increase over the year's opening fix.

Palladium's first fix of US$440 on January 2 proved to be the high for the year. The news on the 11th that Ford was to take a US$1.0 billion charge against its precious metal inventories, mainly palladium, resulted in a price slide that saw palladium close the month at US$370. In the absence of any selling, February and March proved uneventful with the price for the most part trading in a narrow US$365–380/oz band. Palladium resumed its decline in April on the back of inventory de-stocking amidst an increasingly bearish fundamental outlook. Having closed June at US$318, the summer months provided a temporary respite. Palladium's 21-month long downward spiral resumed in November as selling pressure resurfaced. The decline continued into December and on the 23rd the price fixed at both the year's low and also a five-year low of US$222/oz. The price edged up to US$233/oz at year-end, a decrease of 47% over the year.

Rhodium traded either side of US$1,000/oz during the early months of the year, underpinned by steady consumer demand and an absence of producer selling. The price began to decline steadily from mid-year due to a combination of steady offers and weakening demand. At year end the price was trading at US$485/oz.

Market outlook

The fundamentals for platinum remain sound. The automotive and jewellery sectors remain the pillars of this market. Automotive usage will continue to grow due to the adoption of stricter emission standards worldwide and increasing diesel vehicle sales. China is forecast to remain the cornerstone of the jewellery sector which will also be bolstered by a return of economic growth worldwide and the development of new markets. Palladium is expected to remain under pressure in the short term as thrifting and substitution in both the automotive and electronic industries run their course. A period of secure supply and stable prices should result in a partial move back to palladium by the automotive industry. Rhodium will benefit from the tighter emission legislation, particularly for the control of nitrous oxide, for which it is unique.

Platinum Supply and Demand
('000 oz)

DEMAND	**2000**	**2001**	**2002 e**
Automobile	1,950	2,180	2,655
Jewellery	2,830	2,550	2,810
Other	1,425	1,635	1,620
Total Demand	**6,205**	**6,365**	**7,085**
SUPPLY			
South Africa	3,770	4,120	4,460
Rest of Western World	400	495	505
Russian Sales	1,150	1,100	950
Secondary Metal	500	535	555
Total Supply	**5,820**	**6,250**	**6,560**
Implied change in stock	(385)	(115)	(525)

e = estimate

Palladium Supply and Demand
('000 oz)

DEMAND	2000	2001	2002 e
Automobile	5,275	5,355	4,485
Industrial	3,550	2,695	2,330
Total Demand	**8,825**	**8,050**	**6,815**
SUPPLY			
South Africa	1,830	1,985	2,175
Rest of Western World*	945	2,135	2,955
Russian Sales	5,200	4,500	1,800
Secondary Metal	255	300	350
Total Supply	**8,230**	**8,920**	**7,280**
Implied change in stock	(595)	870	465

e = estimate
* = includes stocking / destocking

Price Movements

2002	Platinum US$/oz	Palladium US$/oz	Rhodium US$/oz
January	472	409	956
February	471	374	934
March	512	375	952
April	540	370	970
May	534	356	933
June	555	335	840
July	526	323	776
August	546	325	726
September	556	328	728
October	580	317	708
November	588	285	701
December	596	243	583
Average	**539**	**338**	**817**

Monthly average price for platinum and palladium is the London pm fix.