PLATINUM-GROUP METALS

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In 2001, the average price of palladium, platinum, and rhodium decreased by 12%, 3%, and 20%, respectively. The price of ruthenium was essentially unchanged. Decreased prices for palladium can be attributed to decreased demand from the automobile sector. Russia accounted for 51% of U.S. palladium supply and 3% of U.S. platinum supply in 2001.

In 2000, higher platinum-group metal (PGM) prices were followed by an increase in the pace of exploration for PGM, and a growing number of joint ventures were signed in recognition of the strong market fundamentals for these metals. Decreasing prices in 2001 did little to dampen enthusiasm for further exploration because of expected increases in demand from the automobile industry, jewelry manufacturing, and other industrial applications.

In 2001, the automobile industry continued to be the major consumer of PGM. Autocatalysts accounted for approximately 98% of rhodium demand, 66% of palladium demand, and 41% of platinum demand. Despite strong vehicle sales in 2001, demand for palladium declined, because automakers and electronic component makers made concerted efforts to reduce the palladium content of their products. U.S. demand for platinum in jewelry manufacture continued to grow and has become one of platinum's largest applications. Demand for platinum in the automobile industry increased in Europe due to higher loadings on catalysts in diesel automobiles. Diesels have been gaining substantial market share in Europe over the past several years. In the United States, a return to the use of more platinum in autocatalysts for gasoline-powered motor vehicles that first began in 2000 gained momentum in 2001. This trend was expected to continue, even as the price of palladium appeared to be falling to pre-1999 levels. Demand for platinum metal in the industrial sector continued to increase; demand was up by more than 3,000 kilograms (kg) in 2001. Platinum use in computer hard disks was down owing to slumping computer sales.

According to Johnson Matthey plc, global automobile demand for rhodium decreased by 7,400 kg to 17,900 kg in 2001. The world's two leading producers of rhodium, South Africa and Russia, contributed equally to a rise in production in 2000. Russian exports rose to more than 9,000 kg in 2000 from 2,000 kg in 1999. Supplies of rhodium, however, fell sharply in 2001 as Russian and South African exports were scaled back. Demand for rhodium fell even more steeply as automakers—who had accumulated substantial stocks—drew upon inventories to meet their needs. As a result, the market moved into a surplus in 2001 after more than 2 years of deficits, causing a retreat in price from more than $2,000 per ounce in January to less than $680 per ounce in December (Johnson Matthey plc, 2002, p. 39).

Legislation and Government Programs

On March 29, the Defense National Stockpile Center (DNSC) announced that it had awarded contracts for the upgrading of about 18,700 kg of palladium to "commercially good deliverable" metal and the establishment of metal accounts at commercial vaults. This action allowed the DNSC to sell the palladium commercially. The sales will be via the Internet, and the transfer of the metal will follow either the commercial practice of a "paper transfer" or a physical transfer of the metal (Defense National Stockpile Center, 2001).

On June 6, American Eagle Platinum Proof Coins, featuring the fourth of the 5-year Vistas of Liberty™, were offered for sale by the U.S. Mint. Effective June 12, these coins were available for online orders at URL http://www.USMINT.gov.

Production

Stillwater Mining Co. operates the Stillwater Mine in Nye, MT. The company is the only primary palladium-platinum producer in the United States. In 2001, the Stillwater Mine reported production of 15,710 kg of palladium and platinum, more than 18% higher than the 13,400 kg produced in 2000. Of the 15,710 kg produced, palladium accounted for 12,100 kg, and platinum accounted for 3,610 kg. Mine production was defined by Stillwater as the quantity of PGM contained in a concentrate at the time it was shipped to the smelter. The company milled 827,000 metric tons (t) of ore in 2001, 34% more than in 2000. The mill head grade was 19.3 grams per metric ton (g/t) of combined palladium and platinum compared with 19.9 g/t in 2000.

Stillwater revised its operating plans for the fourth quarter of 2001 by pausing its expansion plan at the Stillwater Mine and completing construction at its East Boulder Mine for operations at 50% of the mine's ultimate 1,820-metric-ton-per-day (t/d) of ore design rate. The change in plans followed the palladium price collapse that occurred shortly after the terrorist attacks on September 11. The fall in price sharply reduced cash flow from operations that were an important source of financing for the company's expansion programs. Under the revised operating plan, combined PGM production for the Stillwater and East Boulder Mines is projected to be 23,000 kg in 2002 and 22,700 kg in 2003 and 2004. Production under the original expansion plan had been expected to reach 31,100 kg in 2003 (Stillwater Mining Co., 2002, p. 10).

Stillwater also operates a smelter and base metal refinery at its metallurgical complex in Columbus, MT. Expansion of the smelter has continued since it was commissioned in 1999. A concentrate sampling and drying facility for production from

both mines was commissioned in May. A second top-blown rotary converter was commissioned in November, and other ancillary equipment to support the simultaneous operation of two converters was in place by yearend.

Stillwater's automobile catalyst recycling effort also continued to grow in 2001. The smelter processed spent autocatalyst at the rate of 3.5 t/d, recovering 2,140 kg of palladium and platinum, more than double the 923 kg recovered in 2000. Spent autocatalysts typically contain two parts platinum to one part palladium, reflecting the metals use in older clean-air technology. This ratio will shift in time as the palladium-dominated catalysts used in 1999-2000 begin to be recycled.

In 2000, Stillwater had completed construction of copper-dissolve-pressure-leach and selenium-tellurium removal circuits at its base-metal refinery. The function of the copper-dissolve-pressure-leach is to increase PGM production and provide ideal copper solution feed to the selenium/tellurium removal circuit. The selenium-tellurium circuit, as the name implies, removes selenium and tellurium from the copper solution that feeds a copper electrowinning circuit. The refining process removes small amounts of copper, gold, nickel, and rhodium to produce a final palladium-platinum product. A nickel sulfate crystallizer was completed in 2001. The crystallizer allows the company to ship its nickel sulfate byproduct as a solid rather than a liquid. The first nickel sulfate was shipped to Canada in the second quarter of 2001 for further refining. The palladium-platinum product was shipped to California and New Jersey for conversion to palladium and platinum sponge. The sponge is sold, primarily for use in catalytic converters (Stillwater Mining Co., 2002, p. 16-17).

Stillwater's proven and probable reserves are contained in the J-M Reef in southern Montana. The average ratio of palladium to platinum contained in the reef is 3.3:1. The company's proven and probable palladium and platinum reserves as of December 31, was 42 million metric tons (Mt) with an average grade of 18 g/t. The reserve estimates assume a combined palladium and platinum price of $305 per ounce. For purposes of reserve estimation, values for minor products (copper, gold, nickel, rhodium, and silver) are not taken into account. The probable reserves at East Boulder consists of about 19 Mt of ore at a grade of about 17 g/t, a 60% increase from 2000. The increase was reportedly due to underground development and diamond drilling activities during 2001 that expanded the probable reserves area (Stillwater Mining Company, 2002, p. 12-14).

Secondary production of PGM from spent autocatalysts and other PGM-bearing waste materials yielded increased amounts of metal in 2001 when compared with that of 2000. Large amounts of platinum contained in catalytic converters from end-of-life vehicles helped push the amount of platinum recovered from this source to 16,200 kg versus 14,600 kg in 2000. U.S. secondary production of platinum was estimated to be about 12,000 kg. Increasingly stringent regulations designed to reduce hydrocarbon and nitrogen oxides emissions prompted higher loadings of palladium in autocatalysts. Increased demand and short supplies prompted sharply higher prices and an attendant increase in the secondary recovery of palladium. About 9,000 kg were recovered globally in 2001, up from slightly more than 7,200 kg in 2000. Johnson Matthey reported that global recovery of rhodium from spent autocatalysts reached 3,000 in 2001, up 23% from 2,430 kg in 2000. The United States accounted for most of the increase, although significant increases were reported for Europe and Japan (Johnson Matthey plc, 2002, p. 47-52).

Consumption

In 2001, global demand for platinum increased by 8% to about 191,300 kg (Johnson Matthey plc, 2002, p. 3). U.S. apparent consumption of platinum was about 51,000 kg. U.S. industry consumed an additional 11,000 kg of platinum that had been recovered from spent autocatalysts. World demand for palladium was down 23% from 276,800 kg in 2000 to 212,700 in 2002. U.S. apparent consumption of palladium was estimated to be 104,000 kg.

Platinum.—U.S. demand for platinum increased by about 19% in 2001, boosted by increased consumption in autocatalysts and motor vehicle sales of 17.1 million units (National Automobile Dealers Association, 2002§[1]).

In the United States, there was a return to the use of platinum catalysts for gasoline engines. Automobile manufactures were under increasing pressure to reduce the amount of emissions from vehicles. In order to meet the new standards and keep prices down, automakers needed to reduce their dependence on the more expensive palladium.

Diesel powered vehicles have become increasingly popular in Europe and are expected to account for 30% of the market in 2001. At the same time, platinum loadings for diesel engines have been increased in order to comply with European stage III emissions requirements, which apply to all new vehicles manufactured in 2001 (platinum loaded autocatalysts are more efficient than palladium loaded catalysts on diesel engines). The use of platinum in diesel catalysts is expected to account for almost three-quarters of demand from the European automotive sector. The increased use of platinum in gasoline vehicles was somewhat offset by decreased demand in the electronics, glass, and jewelry industries.

Global demand for platinum in jewelry declined for the second consecutive year, down by 10% to 79,300 kg, its lowest level since 1998. There was a 26% decline in consumption by the jewelry trade in the United States as sales fell back in response to the weaker U.S. economy. Higher platinum prices in 2000 and 2001 were the main cause of the decline, which caused a loss of market share to white gold in the lower price segments of the market and encouraged the recycling of old stocks of platinum jewelry (Mining Journal, 2001a).

Palladium.—High prices in 2001 had a negative impact on U.S. demand for palladium, which declined by 30% to about 73,000 kg. High prices had the greatest impact on the automobile sector where demand fell by 28% to 63,000 kg. The electronics industry was also hit by high palladium prices; however, producers of multilayer ceramic capacitors were successful in replacing palladium with lower priced nickel and silver in all but the highest performance capacitors (Johnson

[1]References that include a section twist (§) are found in the Internet References Cited section.

Matthey plc, 2002, p. 15-16).

Prices

Russian shipments of PGM were delayed again in 2001, exerting upward pressure on PGM prices. Concern about supplies continued to run high as late as May when Russia resumed sales on a spot basis. Volatility in the PGM market increased markedly in 2001, as prices increased to record levels in the first few months and then fell sharply during the later part of the year. Russia supplies more than 60% of the world's palladium and about 25% of the world's platinum. During the past 4 years, customers have had to wait several months before Russian supplies of palladium became available and even longer for delivery of the metal. Over the short term, consumers could not find suitable substitutes and Western producers could not ramp up their production to fill the supply gap left by the Russians, leading to erratic and exaggerated price moves.

Palladium.—The palladium price set an alltime record in 2000, ending the year at an average of $691.84 per ounce. Fueled by anxiety over delays in Russian exports and heightened speculative interest, prices continued to rise into January and February 2001. The spot palladium price rose to $1,075 per ounce at the London PM fix on February 5, 2001, and nearby futures contracts on NYMEX reached a record settlement of $1,082.80 per ounce (Platts Metals Week, 2001a). Prices began to fall on February 9, falling by $25 to $1,015 per ounce on the London PM Fix, and the March contract on NYMEX fell by $31.90 to reach a settlement price of $1,010. The sharp price decreases were driven by uncertainty over the global economy and a gloomy outlook for industrial use of the metal. By July 13, the price of palladium had almost halved, falling to $560 per ounce. Prices continued to fall, reaching $326 per ounce on November 6. Prices began the traditional seasonal surge higher in the first week of December, reaching $423 per ounce before retreating to below $400 per ounce for the remainder of 2001 (Mining Journal, 2001c).

Platinum.—Platinum prices peaked at $645 per ounce in January and remained above $540 per ounce through the first 6 months of 2001. Subsequently, slack seasonal demand, the strong U.S. dollar, and weaknesses in the end-use markets, caused prices to ease, falling to $462 per ounce in July and $429 per ounce in September. Platinum prices rallied early in December, although the gains were more subdued than palladium price increases. The price rise was attributed to potential disruptions of Russian exports in 2002. At about the same time, RAO Norilsk Nickle, the world's leading palladium producer, announced that it planned to reduce nickel output in 2002 as part of a modernization program. Prices peaked at $467 per ounce on December 14 before falling back to $446 per ounce on December 31 (Metal Bulletin, 2001a, b).

Rhodium.—Strong consumer demand and short physical supplies pushed the price of rhodium to an 8-year high of $2,600 per ounce in August 2000. Increased sales from Russia caused prices to weaken to $1,625 per ounce in October, before recovering to $2,025 at yearend. In 2000, lower prices were driven by a combination of weak demand and oversupply. Shipments from Russia were affected by restrictions on rhodium and platinum sales introduced under a clause of the previous year's budget. The removal of this clause in January 2000 paved the way for a sharp increase in exports from Russia. Much of this metal was shipped to the United States, with U.S. trade statistics revealing imports of more than 9,000 kg during 2000. Supplies from South Africa also rose sharply, despite a decline in platinum output. This was largely due to the sale of rhodium from stocks. Also, increased mining from the rhodium-rich UG2 reef had an impact on South African output; the rhodium content of the UG2 ore is about twice that of the Merensky Reef (Johnson Matthey plc, 2001). With demand slowing and supplies increasing, the metal's price declined steadily in 2001 after reaching a high of over $2,200 per ounce in February. By the end of June, prices had fallen below $1,600 per ounce. Prices continued to fall throughout the remainder of the year, closing at $950 per ounce on December 28, 2001 (Platts Metals Week, 2001b).

Trade

In 2001, U.S. net import reliance as a percentage of apparent consumption was estimated to be 87% for palladium and 66% for platinum. South Africa accounted for 59% of refined platinum and 17% of refined palladium imports; Russia accounted for 35% of refined palladium imports and 4% of refined platinum imports. Palladium imports decreased by 13% to 160,000 kg from 181,000 kg in 2000; platinum imports were down by 11% in 2001 to 84,200 kg from 93,700 kg in 2000. Rhodium imports were 12,400 kg, down from 18,200 kg in 2000. The U.S. exported 37,000 kg of palladium (57,900 kg in 2000), 29,300 kg of platinum (25,000 kg in 2000), and small amounts of other PGM.

World Review

In 2001, world mine production of PGM increased by about 9%, to 410,000 kg compared with 378,000 kg in 2000 (table 5). In South Africa, the world's leading producer, PGM output increased 12% to 230,000 kg. Production in Russia, the world's second largest producer, was estimated to have increased by 6% to about 141,100 kg.

Russia.—Russia, the world's leading palladium producer, set off a dramatic increase in PGM prices when its normal deliveries of metal to markets were disrupted from January through late February. As the year proceeded, the onset of global economic slowdown and the terrorist attack on the United States in September, caused a sharp price drop as holders of the metal sold into the market. It appeared that Russia took advantage of the price spike early in the year by delivering nearly 78,000 kg of palladium to Zurich, Switzerland, in the first quarter. Then, in an attempt to minimize the effect of that action, Ghokran, the Central Bank, Almaz (Almazjuvelirexport), and RAO Norilsk Nickle—entities that control Russian palladium supplies and sales—made announcements supportive of the market. The announcements suggested that a centralized sales policy was being put in place, that Russian supplies of palladium were sufficient but would not be "dumped" onto the market, and that the excessive downward price movement was not acceptable. No new Russian supplies were delivered during the last months of 2001 when prices were

near lows for the year. In addition, Norilsk's proposal to increase production and recovery of PGM, announced early in 2001 when prices were high, was no longer mentioned. Meanwhile, for the first time ever, alluvial producers in the Far East of Russia—at Kondyor and Koryak—obtained export quotas for PGM. However production at these operations are believed to be at lower levels than in the late 1990s (Johnson Matthey plc, 2002, p. 9-10; Platts Metals Week, 2001c).

Russia has the potential to increase its production of PGM by more than 40% in the next few years, according to a study led by the U.S. Geological Survey. The study was based on previously unavailable published Russian information on the PGM content of reserves at RAO Norilsk in East Siberia and Norilsk's development plans. Norilsk produces almost all of Russia's PGM, approximately 50% of the world's palladium, and 15% of the world's platinum (Bond and Levine, 2001).

South Africa.—In 2001, South Africa produced about 230,000 kg of PGM, 11% more than the 207,000 kg produced in 2000. Producers initiated aggressive plans to increase production of PGM over the next 5 to 7 years—plans that are in line with the projected growth in demand. Anglovaal Mining and Impala Platinum Holdings Limited formed a joint venture to develop a new mine at the Dwars River property. The property, south of the town of Steelpoort in South Africa's Mpumalanga Province, lies on the UG2 and Merensky reefs, which provide the country with much of its PGM reserves. The property is expected to produce 3,000 kilograms per year (kg/yr) of PGM over a period of 20 years (Impala Platinum Holdings Limited, 2002).

On March 29, Anglo American Platinum Corporation (Angloplats) and Lonmin Platinum announced the formation of a joint venture to develop the Pandora platinum deposit in the Bushveld Complex. Angloplats and Lonmin estimate that Pandora will produce 7,200 kg/yr of platinum, 3,400 kg/yr of palladium, and 3,110 kg/yr of other precious metals at full production. Angloplats and Lonmin estimate total probable reserves and indicated resources at 136 Mt grading 4.51 g/t PGM for a total of 613,000 kg of contained PGM. At a planned operating rate of 3.8 million metric tons per year (Mt/yr), mine life is expected to exceed 30 years. Angloplats and Lonmin expect that some development material will be produced in 2002 with a steady buildup to full production in 2007 (Franco-Nevada, [undated]§).

Zimbabwe.—Mining investments in Zimbabwe have often been discouraged by political and economic instability. In 2001, a new framework for investing in platinum mining was proposed and, if implemented, would relax foreign exchange restrictions, grant permission to create offshore bank accounts, and reduce the tax rate on platinum operations. An improved climate for investment will likely lead to funding for the development of the Ngezi opencast mine. Zimbabwe Platinum Mines Ltd. (Zimplats), which owns the mine, reported that it had carried out a 3-month trial mining program at Ngezi and full-scale mining would begin as soon as favorable mining legislation is implemented. The Ngezi platinum mine is expected to produce at least 2.2 Mt/yr of unrefined ore. A 2-Mt/yr mining rate is considered a minimum, and if the project proceeds, the tonnage is expected to increase. The mine processing plant would include a conventional crusher, mill, concentrator, and dryer. Ore will be processed at the Selous Metallurgical Complex at the Hartley mine site, producing 6,500 kg of PGM contained in matte. This material will be transported to Impala Refining Services in South Africa for refining and marketing. Zimplats owned a 33.3% share in Australia-based Broken Hill Proprietary Company Limited before the company closed Hartley. Impala Platinum acquired a 30% stake in Zimplats' Ngezi project and the Hartley Platinum joint venture for R240 million (Metal Bulletin, 2001a).

Current Research and Technology

New Ruthenium-Based Coating Could Quadruple Hard-Disk Storage Capacity.—IBM announced that it has begun mass producing a magnetic coating technology that will eventually allow a quadrupling of the amount of data that can be stored on a single hard disk. The technology, called antiferromagnetically coupled (AFC) media, sandwiches a 3-atom-thick layer of ruthenium between two magnetic layers on a disk. The new technology will eventually permit hard drives to store 100 gigabits of data per square inch of disk area, according to IBM. With the new technology, desktop computers by 2003 will be able to have 400 gigabyte hard drives, and handheld devices will be able to store as much as 6 gigabytes of video data or the equivalent of eight movies. Not only does the new technology promise to reduce the footprint of data storage systems, but by increasing data density, disks will be lighter and consume less energy (Computer World, 2001).

Ruthenium-based Catalyst for Ammonia Synthesis Developed.—A Netherlands-based company has developed a ruthenium-based catalyst for ammonia synthesis that is 10 to 20 times more active than conventional iron-based catalysts and has an equivalent lifetime of 10 to 15 years. The new catalyst's activity is reportedly comparable to ruthenium (Ru)-on-graphitized-carbon (C) catalyst used in the KAAP ammonia process. Ru-C catalysts, however, are prone to methanation (the carbon may react with hydrogen in the process to form methane), and this can limit catalyst life. The new catalyst is barium promoted Ru on a boron nitride (BN) support. BN has a layered structure similar to that of graphite so it provides similar high activity but without the methanation problem (Chemical Engineering, 2001).

Graphite Fuel Cell Electrodes.—Graphite may serve as effective support material for fuel-cell electrodes, according to researchers at Northeastern University, Boston, MA, and Villanova University, Villanova, PA. The high cost of precious-metal (platinum) catalysts needed to oxidize fuels remains a key obstacle to widespread commercialization of fuel cells. Researchers are trying to find ways to reduce the dependence on platinum without sacrificing fuel-cell performance. The researchers determined that in methanol oxidation studies, fuel-cell anodes made from graphite nanofibers with platelet and ribbon-type structures require a platinum loading of just 5 weight-percent to function as effectively as carbon electrodes loaded with 5 times more platinum. In addition, the graphite-nanofiber supported catalysts were found to be much more resistant than traditional catalysts to carbon monoxide poisoning (Journal of Physical Chemistry B, 2001).

Outlook

In the first quarter of 2002, producers of PGM had to cope with prices that were down sharply from historically high prices in 2000 and 2001. High palladium prices caused automobile manufacturers to seek ways to reduce their dependence on palladium. Ford Motor Co. plans to use rare-earth oxides in tandem with PGM in its North American autocatalyst beginning with its 2003 production models. The new converters reportedly will reduce the company's PGM requirements by 50% (American Metal Market, 2002). The other major automobile manufacturers are expected to introduce similar reductions in their palladium requirements.

After 2 years of deficits, the platinum market was near balance in 2001 as demand increased but at a slower rate than supplies. In the short term, demand for platinum will be driven by the auto industry, as sales of diesel-powered vehicles in Europe increase and manufacturers in the United States and Japan add more platinum to catalysts in an effort to reduce their dependence on palladium.

The prospects for the PGM industry in the near term are, to a large extent, contingent on the strength of the economy. A rebound in global gross domestic product growth would lead to higher demand for automobiles and a wide range of PGM containing products. In particular, the health of the electronics industry will be an important factor for palladium, as it was in this area that demand increased sharply in 1999 and 2000 and then declined even more sharply in 2001. If, as expected, supply and demand for platinum increase moderately in 2002 and move close to balance, the price of platinum probably will remain firm.

The scope for a price recovery of PGM in 2002 may be restricted by supply-side factors. At the same time that consumers are reducing their dependence on PGM, there are a number of projects in various stages of development that will eventually increase global palladium output by about 10% and platinum production by about 15%. Although mine production of PGM is expected to increase in 2002, any increase is expected to be slight, leaving supply close to 2001 levels. Less predictable is the quantity of sales from Russia, where statistics for PGM production are state secrets.

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TABLE 1
SALIENT PLATINUM-GROUP METALS STATISTICS 1/

(Kilograms of metal content unless otherwise specified)

		1997	1998	1999	2000	2001
United States:						
Mine production:						
Palladium 2/						
Quantity		8,430	10,600	9,800	10,300	12,100
Value	thousands	$49,900	$98,500	$114,000	$228,000	$237,000
Platinum 2/						
Quantity		2,610	3,240	2,920	3,110	3,610
Value	thousands	$33,300	$39,000	$35,600	$54,900 r/	$61,900
Refinery production:						
Palladium						
Quantity		NA	NA	10,400 r/	7,980 r/	9,790
Value	thousands	NA	NA	$122,000 r/	$178,000 r/	$192,000
Platinum						
Quantity		NA	NA	12,900 r/	15,800 r/	15,000
Value	thousands	NA	NA	$157,000 r/	$278,000 r/	$258,000
Imports for consumption, refined:						
Iridium		1,860	1,950	2,250	2,700	3,110
Osmium		54	71	23	133	77
Palladium		148,000	176,000	189,000	181,000	160,000
Platinum, includes waste, scrap, and coins		77,300	96,700	125,000	93,700 r/	84,200
Rhodium		14,400	13,500	10,300	18,200	12,400
Ruthenium		11,500	8,880	11,400	20,900	8,170
Exports, refined:						
Iridium, osmium, and ruthenium (gross weight)		574	905	851	1,480	1,370
Palladium		43,800	36,700	43,800	57,900 r/	37,000
Platinum		23,000	14,300	19,400	25,000	29,300
Rhodium		282	811	114	797	982
Stocks, National Defense Stockpile, December 31:						
Iridium		920	920	784	784	784
Palladium		39,300	38,800	28,200	19,000	16,300
Platinum		14,100	13,700	7,060	5,190	3,680
Price, average:						
Iridium 3/	dollars per troy ounce	205.42	441.85	411.40	415.00	415.25
Palladium 4/	do.	184.14	289.76	363.20	691.84	610.71
Platinum 4/	do.	396.59	374.61	378.94	549.30 r/	533.29
Rhodium 4/	do.	298.00	619.83	904.35	1,990.00 r/	1,600.00
Ruthenium 3/	do.	40.51	47.95	40.70	129.76	130.67
Employment		550	620	954	1,290	1,120
World, mine production		339,000 r/	354,000 r/	374,000 r/	378,000 r/	410,000 e/

e/ Estimated. r/ Revised. NA Not available.

1/ Data are rounded to no more than three significant digits except for prices.

2/ Source: Stillwater Mining Co., 2001 10-K report, p. 80.

3/ Price data are annual averages of daily Engelhard unfabricated quotations published in Platts Metals Week.

4/ Price data are annual Engelhard unfabricated quotations published in Platts Metals Week.

TABLE 2
U.S. IMPORTS FOR CONSUMPTION OF PLATINUM, BY COUNTRY 1/

(Kilograms of metal content unless otherwise specified)

Country	Platinum grain and nuggets		Platinum sponge		Other unwrought platinum		Platinum, other		Platinum waste and scrap		Platinum coins	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
2000	2,550	$42,900	68,000	$1,050,000	3,870	$70,200	7,480	$111,000	11,800 r/	$83,700 r/	27	$561 r/
2001:												
Australia	--	--	--	--	--	--	(2/)	7	182	4,660	12	179
Belgium	155	2,720	4,580	65,700	78	1,480	71	3,320	--	--	--	--
Brazil	--	--	--	--	--	--	--	--	1,390	6,210	--	--
Canada	36	571	--	--	17	347	618	11,000	372	12,000	5	112
Chile	--	--	--	--	--	--	--	--	156	2,310	--	--
Colombia	4	36	--	--	217	3,630	--	--	(2/)	22	--	--
Costa Rica	--	--	--	--	--	--	--	--	12	632	--	--
Czech Republic	--	--	--	--	5	105	--	--	--	--	--	--
Dominican Republic	--	--	--	--	--	--	--	--	1	25	--	--
Finland	--	--	--	--	--	--	--	--	10	289	--	--
France	--	--	29	574	2	28	2	22	27	906	--	--
Germany	272	4,870	4,810	83,200	307	5,380	2,660	37,300	711	22,400	(2/)	4
Hong Kong	--	--	--	--	--	--	--	--	2	81	--	--
Ireland	--	--	65	1,310	--	--	(2/)	6	--	--	--	--
Israel	--	--	--	--	722	7,770	1	5	--	--	--	--
Italy	9	182	1,040	15,500	(2/)	8	--	--	--	--	--	--
Jamaica	--	--	--	--	--	--	--	--	2	13	--	--
Japan	--	--	237	3,520	16	247	634	9,530	5	189	--	--
Korea, Republic of	--	--	--	--	15	192	19	231	256	13,000	--	--
Malaysia	--	--	--	--	--	--	--	--	2	31	--	--
Mexico	--	--	--	--	2	42	--	--	178	6,560	--	--
Mongolia	--	--	--	--	--	--	--	--	--	--	1	24
Netherlands	--	--	--	--	--	--	1	25	--	--	--	--
Norway	--	--	494	7,980	--	--	--	--	--	--	--	--
Peru	--	--	1	9	--	--	(2/)	9	(2/)	5	--	--
Philippines	--	--	--	--	--	--	--	--	8	105	--	--
Russia	--	--	1,950	34,000	735	12,900	5	95	11	259	--	--
Saudi Arabia	--	--	--	--	--	--	--	--	4	60	--	--
Singapore	--	--	--	--	2	55	--	--	40	237	3	70
South Africa	1,590	24,400	44,200	755,000	1,220	22,500	35	570	236	9,210	--	--
Spain	--	--	--	--	--	--	26	407	--	--	--	--
Sweden	--	--	--	--	--	--	1	9	--	--	--	--
Switzerland	(2/)	3	--	--	49	730	841	10,500	--	--	18	283
Taiwan	--	--	--	--	--	--	--	--	35	2,700	--	--
United Kingdom	413	7,380	11,300	195,000	276	6,790	419	6,870	310	7,880	14	196
Other	--	--	0	0	4	76	--	--	7	52	--	--
Total	2,480	40,200	68,700	1,160,000	3,660	62,200	5,330	79,800	3,960	89,900	53	869

r/ Revised. -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 3
U.S. IMPORTS FOR CONSUMPTION OF PLATINUM-GROUP METALS, BY COUNTRY 1/

(Kilograms of metal content unless otherwise specified)

Country	Unwrought palladium		Palladium, other		Iridium 2/		Unwrought osmium		Unwrought ruthenium		Rhodium 3/	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
2000	154,000	$3,120,000 r/	27,900	$364,000	2,700	$27,400	133	$1,130	20,900	$49,600	18,200	$851,000
2001:												
Austria	--	--	--	--	--	--	--	--	--	--	70	3,970
Belgium	18,000	201,000	1,640	13,100	--	--	--	--	5	22	1,560	86,200
Canada	3,740	61,300	52	771	--	--	--	--	--	--	10	353
Chile	--	--	20	295	--	--	--	--	--	--	--	--
China	796	9,350	--	--	--	--	--	--	--	--	(4/)	13
Colombia	3	37	--	--	--	--	--	--	--	--	--	--
Czech Republic	6	18	--	--	(4/)	3	--	--	--	--	--	--
Ecuador	20	544	--	--	--	--	--	--	--	--	3	169
Estonia	--	--	2	5	--	--	--	--	--	--	83	5,520
France	2,180	41,900	1,500	36,400	136	1,540	9	113	665	2,610	266	13,700
Germany	3	20	--	--	--	--	--	--	--	--	--	--
Honduras	406	13,700	1	17	--	--	--	--	--	--	--	--
Hong Kong	31	620	--	--	--	--	--	--	--	--	--	--
India	--	--	--	--	--	--	--	--	--	--	25	1,460
Ireland	719	12,700	565	12,400	5	102	--	--	--	--	6	346
Italy	5,840	102,000	825	10,100	--	--	--	--	--	--	31	910
Japan	62	1,240	16	393	--	--	--	--	--	--	1	16
Korea, Republic of	2	78	--	--	--	--	--	--	--	--	--	--
Mexico	--	--	7	25	--	--	--	--	--	--	--	--
Netherlands	3,400	49,300	12	421	--	--	--	--	--	--	7	429
Norway	0	--	2	18	--	--	--	--	--	--	--	--
Panama	7	74	--	--	--	--	--	--	--	--	--	--
Peru	540	4,460	3	50	--	--	--	--	--	--	--	--
Philippines	51,800	1,240,000	4,030	91,100	15	203	--	--	937	1,300	3,230	116,000
Russia	--	--	12	336	1	15	--	--	1	4	--	--
Singapore	23,800	404,000	2,790	54,900	1,490	8,830	68	533	6,210	25,400	4,520	238,000
South Africa	5	54	--	--	--	--	--	--	--	--	--	--
Spain	572	5,260	--	--	--	--	--	--	--	--	--	--
Sweden	10,100	281,000	339	3,830	--	--	--	--	--	--	2	40
Switzerland	1	13	27	348	--	--	--	--	--	--	--	--
Taiwan	--	--	6	161	--	--	--	--	--	--	--	--
United Kingdom	24,100	539,000	1,790	32,200	1,460	19,600	--	--	345	1,450	2,630	127,000
Total	146,000	2,970,000	13,600	257,000	3,110	30,300	77	646	8,170	30,700	12,400	594,000

r/ Revised. -- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Unwrought and other forms of iridium.

3/ Unwrought and other forms of rhodium.

4/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 4
U.S. EXPORTS OF PLATINUM-GROUP METALS, BY COUNTRY 1/

(Kilograms of metal content unless otherwise specified)

Country	Palladium		Platinum		Platinum, waste and scrap		Iridium, osmium and ruthenium		Rhodium	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
2000	57,900 r/	$518,000	25,000	$294,000	7,360	$208,000 r/	1,480	$17,200	797	$50,800
2001:										
Argentina	--	--	2	21	--	--	--	--	1	51
Australia	248	1,940	143	799	--	--	--	--	1	15
Austria	2	19	112	578	--	--	--	--	--	--
Bahrain	--	--	(2/)	3	--	--	--	--	--	--
Barbados	2	9	1	9	--	--	--	--	--	--
Belarus	151	658	--	--	--	--	--	--	--	--
Belgium	534	3,660	34	521	102	3,250	--	--	--	--
Bermuda	--	--	(2/)	3	--	--	1	17	--	--
Brazil	216	4,350	1,450	19,300	--	--	(2/)	3	--	--
Canada	4,350	57,400	2,910	40,900	506	18,100	295	2,550	(2/)	34
Cayman Islands	--	--	2	21	--	--	--	--	--	--
Chile	12	14	(2/)	3	--	--	--	--	--	--
China	337	2,960	3	37	20	796	28	210	--	--
Costa Rica	3	3	--	--	--	--	--	--	--	--
Cyprus	5	20	2	6	--	--	--	--	--	--
Denmark	54	255	18	60	--	--	2	14	--	--
Dominican Republic	--	--	(2/)	4	--	--	--	--	1	28
Finland	19	123	16	106	--	--	--	--	--	--
France	798	7,850	487	6,460	40	851	3	77	73	4,180
Germany	4,200	37,900	4,510	76,600	4,740	48,400	15	188	231	15,200
Greece	8	20	(2/)	4	--	--	--	--	--	--
Haiti	6	21	--	--	--	--	--	--	--	--
Hong Kong	969	7,610	171	2,370	--	--	4	71	31	2,060
Hungary	--	--	4	15	--	--	--	--	--	--
Iceland	8	21	1	7	--	--	(2/)	3	--	--
India	--	--	141	2,460	(2/)	6	1	5	1	102
Ireland	290	739	130	907	--	--	23	477	--	--
Israel	38	202	4	27	--	--	1	25	(2/)	7
Italy	1,450	16,000	248	3,110	6	262	--	--	111	5,370
Japan	4,230	72,100	6,290	80,500	694	44,200	195	1,230	234	15,600
Korea, Republic of	3,900	84,200	2,740	49,600	106	1,600	19	736	89	2,520
Kuwait	1	5	6	54	--	--	--	--	--	--
Lebanon	(2/)	8	--	--	--	--	--	--	(2/)	19
Malaysia	8	42	50	457	--	--	--	--	1	240
Mexico	57	259	139	1,140	2	27	5	57	1	146
Netherlands	69	281	110	632	--	--	2	57	20	1,450
Netherlands Antilles	--	--	519	997	--	--	--	--	--	--
New Zealand	61	419	(2/)	3	--	--	--	--	--	--
Nicaragua	1	7	--	--	--	--	--	--	--	--
Norway	64	923	52	970	--	--	--	--	2	120

See footnotes at end of table.

TABLE 4--Continued
U.S. EXPORTS OF PLATINUM-GROUP METALS, BY COUNTRY 1/

(Kilograms of metal content unless otherwise specified)

Country	Palladium		Platinum		Platinum, waste and scrap		Iridium, osmium and ruthenium		Rhodium	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
2001--Continued:										
Oman	--	--	(2/)	$4	--	--	--	--	--	--
Philippines	54	$144	27	147	--	--	--	--	--	--
Poland	--	--	2	5	--	--	--	--	--	--
Romania	--	--	7	36	--	--	(2/)	$10	--	--
Russia	1	5	7	88	--	--	--	--	--	--
Saudi Arabia	2	11	17	134	--	--	(2/)	3	--	--
Singapore	678	1,510	18	161	--	--	6	90	(2/)	$11
Slovenia	202	874	--	--	--	--	--	--	--	--
South Africa	9	17	2	19	6	$241	--	--	(2/)	15
Spain	157	770	21	107	--	--	(2/)	6	--	--
Sweden	89	562	53	415	5	318	1	3	--	--
Switzerland	6,020	126,000	2,230	36,900	73	3,010	--	--	--	--
Taiwan	3,700	28,500	211	1,370	--	--	--	--	--	--
Thailand	50	332	31	357	--	--	3	21	(2/)	53
Turkey	6	32	(2/)	3	--	--	1	45	(2/)	23
United Arab Emirates	17	53	1	3	--	--	--	--	(2/)	35
United Kingdom	3,920	29,700	6,430	63,000	6,610	201,000	764	10,700	183	12,600
Uruguay	8	71	--	--	0	--	--	--	--	--
Total	37,000	489,000	29,300	391,000	12,900	322,000	1,370	16,600	982	59,900

r/ Revised. -- Zero.
1/ Data are rounded to no more than three significant digits; may not add to totals shown.
2/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 5
WORLD PRODUCTION OF PLATINUM-GROUP METALS, BY COUNTRY 1/ 2/

(Kilograms)

Country 3/	1997	1998	1999	2000	2001 e/
Platinum:					
Australia e/ 4/	300 r/	150 r/	90 r/ 5/	100	100
Canada	4,813	5,640	5,663 r/	6,302 r/	6,300
Colombia	406 r/	411 r/	448 r/	339 r/	350
Finland e/	60	50	50	50	50
Japan 6/	693	533	737	782	550
Russia e/	30,000 r/	30,000 r/	32,000 r/	35,000 r/	40,000
Serbia and Montenegro e/	10	10	5	5	5
South Africa	115,861	116,483	121,304 r/	114,459 r/	130,307 5/
United States 7/	2,610	3,240	2,920	3,110	3,610 5/
Zimbabwe	345	2,730	479	505 r/	400
Total	155,000 r/	159,000 r/	164,000 r/	161,000 r/	182,000
Palladium:					
Australia e/ 4/	400	800 r/	816 r/	400	400
Canada	7,545	8,905	8,939 r/	9,949 r/	9,900
Finland e/	180	150	150	150	150
Japan 6/	1,899	4,151	5,354	4,712	4,830
Russia e/	70,000 r/	70,000 r/	75,000 r/	84,000 r/	86,000
Serbia and Montenegro e/	50	50	25	25	25
South Africa	55,675	56,608	58,164 r/	55,818 r/	62,601 5/
United States 7/	8,430	10,600	9,800	10,300	12,100 5/
Zimbabwe	245 e/	1,855	342	366 r/	300
Total	144,000 r/	153,000 r/	159,000 r/	166,000 r/	176,000
Other platinum-group metals:					
Canada e/	651	742	716	720	720
Russia e/	13,500 r/	13,500 r/	13,700 r/	14,100 r/	14,500
South Africa	25,068 r/	26,862 r/	37,011 r/	36,493 r/	37,000
Zimbabwe	27	177 r/	37 r/	40 r/	30
Total	39,200 r/	41,300 r/	51,500 r/	51,400 r/	52,300
Grand total	339,000 r/	354,000 r/	374,000 r/	378,000 r/	410,000

e/ Estimated. r/ Revised.

1/ World totals, U.S. data, and estimated data have been rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through April 29, 2002. Platinum-group metals (PGM) production by Germany, Norway, and the United Kingdom is not included in this table because the production is derived wholly from imported metallurgical products and to include it would result in double counting.

3/ In addition to the countries listed, China, Indonesia, and the Philippines are believed to produce PGM, and several other countries may also do so, but output is not reported quantitatively, and there is no reliable basis for the formulation of estimates of output levels. A part of this output not specifically reported by country is, however, presumably included in this table credited to Japan.

4/ PGM recovered from nickel ore that is processed domestically. PGM in exported nickel ore are extracted in the importing countries, such as Japan, and are believed to be included in the production figures for those countries.

5/ Reported figure.

6/ Production derived entirely from imported ores.

7/ A very small quantity of byproduct platinum and palladium produced from gold-copper ores was excluded.