

PLATINUM-GROUP METALS

(Platinum, palladium, rhodium, ruthenium, iridium, osmium)
(Data in kilograms, unless otherwise noted)

Domestic Production and Use: The Stillwater Mine is the only primary platinum-group metals (PGM) producer in the United States. The mine, near Nye, MT, processed more than 400,000 metric tons of ore and recovered more than 15,000 kilograms of palladium and platinum in 2001. Small quantities of PGM were also recovered as byproducts of copper refining by two companies in Texas and Utah. Automobile catalysts for air pollution abatement continued to be the largest demand sector for PGM. In the United States, more than 100,000 kilograms of PGM were used by the automotive industry in the manufacture of catalysts. Catalysts are also used in other air-pollution-abatement processes to remove organic vapors, odors, or carbon monoxide. Chemical uses include catalysts for organic synthesis, production of nitric acid, and fabrication of laboratory equipment. Platinum alloys, in cast or wrought form, are commonly used for jewelry. Platinum, palladium, and a variety of complex gold-silver-copper alloys are used as dental restorative materials. The primary medical use of PGM is in cancer chemotherapy. Other medical uses include platinum-iridium alloys in prosthetic and biomedical devices.

| Salient Statistics—United States: | 1997 | 1998 | 1999 | 2000 | 2001^e |
|--|-------------|-------------|-------------|-------------|-------------------------|
| Mine production: ¹ | | | | | |
| Platinum | 2,610 | 3,240 | 2,920 | 3,110 | 3,600 |
| Palladium | 8,400 | 10,600 | 9,800 | 10,300 | 12,000 |
| Imports for consumption: | | | | | |
| Platinum | 77,300 | 96,700 | 125,000 | 94,000 | 73,000 |
| Palladium | 148,000 | 176,000 | 189,000 | 181,000 | 220,000 |
| Rhodium | 14,400 | 13,500 | 10,300 | 18,200 | 11,000 |
| Ruthenium | 11,500 | 8,880 | 11,400 | 20,900 | 5,500 |
| Iridium | 1,860 | 1,950 | 2,270 | 2,700 | 3,500 |
| Osmium | 54 | 71 | 23 | 133 | 70 |
| Exports: | | | | | |
| Platinum | 23,000 | 14,300 | 19,400 | 25,000 | 29,000 |
| Palladium | 43,800 | 36,700 | 43,800 | 58,600 | 42,000 |
| Rhodium | 282 | 811 | 114 | 797 | 1,400 |
| Price, ² dollars per troy ounce: | | | | | |
| Platinum | 396.59 | 374.61 | 378.94 | 549.31 | 540.00 |
| Palladium | 184.14 | 289.76 | 363.20 | 691.84 | 770.00 |
| Rhodium | 298.00 | 619.83 | 904.35 | 1,990.00 | 1,800.00 |
| Ruthenium | 40.51 | 47.95 | 40.70 | 129.76 | 130.00 |
| Employment, mine, number | 550 | 620 | 954 | 1,290 | 1,300 |
| Net import reliance as a percentage of apparent consumption: ^e | | | | | |
| Platinum | NA | 94 | 96 | 78 | 66 |
| Palladium | NA | 90 | 92 | 84 | 87 |

Recycling: An estimated 70 metric tons of PGM were recovered from new and old scrap in 2000.

Import Sources (1997-2000): Platinum: South Africa, 50%; United Kingdom, 15%; Germany, 6%; Russia, 6%; and other, 23%. Palladium: Russia, 52%; South Africa, 14%; Belgium, 8%; United Kingdom, 7%; and other, 19%.

Tariff: All unwrought and semimanufactured forms of PGM can be imported duty free.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile:

Stockpile Status—9-30-01³

| Material | Uncommitted inventory | Committed inventory | Authorized for disposal | Disposal plan FY 2001 | Disposals FY 2001 |
|-----------|--------------------------|------------------------|----------------------------|--------------------------|----------------------|
| Platinum | 4,704 | — | 4,704 | 3,888 | 1,960 |
| Palladium | 16,715 | — | 16,714 | 18,662 | 9,331 |
| Iridium | 784 | — | 2 | — | — |

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Events, Trends, and Issues: In the first quarter of 2001, the average price of palladium and platinum increased by 90% and 45%, respectively, from 2000 averages. The price of rhodium and ruthenium also experienced large increases. The price increases for platinum and rhodium can be attributed to increased demand, mainly from the automobile sector. Palladium prices, for the third consecutive year, were influenced by unreliable exports from Russia. Russia accounted for more than 50% of U.S. palladium supply and about 3% of U.S. platinum supply in 2001. Prices for ruthenium increased sharply to an average of more than \$129 per troy ounce in 2001 from \$41 per ounce in 1999. Ruthenium prices were driven by increased demand from the electronics sector and reports of the development of new ruthenium-based superalloys for use in aerospace applications. Higher 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 fundamentals for these metals.

Palladium's rise to more than \$1,000 per ounce prompted the substitution of silver and base metals along with a reduction in the palladium content of its major end-use applications. Lower consumption by automobile manufacturers, a slowdown in the electronics sector, and increased production by Russia and South Africa caused palladium prices to fall to around \$450 per ounce by September 2001. Lower demand by the automobile industry and a slumping global economy in the second half of 2001 caused platinum prices to fall but not nearly as precipitously as prices for palladium. Unlike palladium, platinum, and rhodium, ruthenium has been able to sustain its \$130 per ounce price through September 2001.

World Mine Production, Reserves, and Reserve Base:

| | Mine production | | | | PGM | |
|-----------------------|-----------------|-------------------|-----------|-------------------|-----------------------|---------------------------|
| | Platinum | | Palladium | | Reserves ⁴ | Reserve base ⁴ |
| | 2000 | 2001 ^e | 2000 | 2001 ^e | | |
| United States | 3,110 | 3,600 | 10,300 | 12,000 | 1,700,000 | 2,200,000 |
| Canada | 5,450 | 6,000 | 8,600 | 9,000 | 310,000 | 390,000 |
| Russia | 30,000 | 29,000 | 94,000 | 90,000 | 6,200,000 | 6,600,000 |
| South Africa | 114,000 | 122,000 | 55,900 | 59,000 | 63,000,000 | 63,000,000 |
| Other countries | 1,530 | 2,000 | 5,360 | 7,400 | 700,000 | 850,000 |
| World total (rounded) | 155,000 | 163,000 | 174,000 | 177,000 | 72,000,000 | 73,000,000 |

World Resources: World resources of PGM in mineral concentrations currently or potentially economic to mine are estimated to total more than 100 million kilograms. The largest reserves are in the Bushveld Complex in South Africa. In 2001, there were 10 producing mines in the Bushveld Complex; of these, 9 are producing from the Merensky Reef and UG2 Chromite Layer, and one is producing from the Platreef, on the northern limb of the Complex.

Substitutes: Some motor vehicle manufacturers have substituted platinum for the more expensive palladium in catalytic converters. In addition, electronic parts manufacturers are reducing the average palladium content of the conductive pastes used to form the electrodes of multilayer ceramic capacitors by substituting base metals or silver-palladium pastes that contain significantly less palladium.

^eEstimated. NA Not available. — Zero.

¹Estimates from published sources.

²Handy & Harman quotations.

³See Appendix B for definitions.

⁴See Appendix C for definitions.