

Platinum-group metals

U.S. Geological Survey Platinum-Group Metals Commodity Specialist Henry Hilliard has prepared the following information on the rare and valuable platinum-group metals.

The precious metals commonly referred to as platinum-group metals (PGM) include iridium, osmium, palladium, platinum, rhodium and ruthenium. PGM are among the rarest of elements, and their market values — particularly for palladium, platinum and rhodium — are the highest of all precious metals.

PGM occur in nature at very low levels of abundance. With the exception of the relatively rich ores found in the Merensky Reef in South Africa and the J-M Reef in Montana, the metal content in ore bodies is much too low for economical recovery, except as a byproduct of the production of base metals, notably copper and nickel. Essentially all PGM production in Canada and Russia is a byproduct of nickel production.

The Stillwater and East Boulder Mines, owned and operated by the Stillwater Mining Company in Columbus, Mont., are the only primary PGM mines in the United States. The mines, in south-central Montana, processed more than 820,000 metric tons of ore and recovered about 19,200 kilograms of palladium and platinum in 2002. Two companies in Texas and Utah also recovered small quantities of PGM as byproducts of copper refining.

Their merits long-appreciated, PGM are excellent and versatile catalysts; their uses are constantly increasing in number. Each year, the U.S. automotive industry uses more than 100,000 kilograms of PGM in the manufacture of catalytic converters that reduce automobile tailpipe emissions. Other industrial air-pollution-abatement processes use PGM-based catalysts to remove volatile organic compounds, odors, and carbon monoxide from process streams. 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 in dental restorative materials.

Estimated world resources of PGM are about 71 million kilograms, with a reserve base of about 81 million kilograms. Stillwater's proven and probable reserves are contained in the J-M Reef, a 45-kilometer-long orebody in the Beartooth Mountain Range in Montana. Estimates of the company's proven and probable ore reserves are about 18 million metric tons with an average grade of 18.7 grams per ton, containing approximately 787,000 kilograms of palladium and platinum.

In 2002, world mine production of PGM increased by about 4 percent to 423,000 kilograms compared with 408,000 kilograms in 2001. South Africa, the world's leading producer of PGM, accounted for 57 percent of total mine production in 2002; Russia accounted for 31 percent and the United States 5 percent. A number of other countries, mainly Canada and Zimbabwe, produced the remainder. South Africa, which accounted for 73 percent of total mine production of platinum, increased its output by 3 percent in 2002. Russia dominates the world's mine production of palladium with 48 percent of total mine output; its production of palladium was

estimated to have decreased by 1 percent in 2002.

In 2002, world demand for platinum increased by 5 percent to about 204,000 kilograms. U.S. apparent consumption of platinum was estimated at about 80,000 kilograms. U.S. industry used an additional 12,000 kilograms of PGM recovered from spent autocatalysts.

The value of PGM among the world's most precious metals is expected to grow even greater in the future because platinum is a leading candidate as a catalyst for emerging clean fuel cell technologies to power automobiles and many other consumer products.

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Sample of platinum ore with penny for scale. Image from *Minerals in Your World*.