



# 2012 Minerals Yearbook

---

## PLATINUM-GROUP METALS

---

# PLATINUM-GROUP METALS

By Patricia J. Loferski

Domestic survey data and tables were prepared by Paula R. Neely, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

In 2012, Stillwater Mining Co. (SMC) (Billings, MT), the only domestic mine producer of platinum-group metals (PGMs), recovered PGMs from its Stillwater Mine southwest of Nye, MT, and its East Boulder Mine south of Big Timber, MT. In 2012, world mine production of PGMs totaled 451,000 kilograms (kg), an 8% decrease from that of 2011. Part of the decline was owing to extended workers' strikes in the PGM mining sector in South Africa, which turned violent and resulted in the loss of many lives. Unrest continued beyond yearend, a result of rivalries between two different workers' unions (Yager and others, 2012).

In 2012, the automobile industry continued to be a major consumer of PGMs. Autocatalysts accounted for approximately 81% of global rhodium consumption, 67% of palladium consumption, and 40% of platinum consumption. Jewelry was the second leading use of platinum in 2012, accounting for 35% of global consumption (Johnson Matthey plc, 2013, p. 23–30).

The Defense Logistics Agency, Strategic Materials reported no PGM sales from U.S. Government stockpiles in 2012; 18 kg of iridium and 261 kg of platinum remained in the stockpile. Palladium stocks were exhausted in 2004.

## Production

**Primary.**—During 2012, SMC's palladium and platinum mine production decreased slightly to 12,300 kg and 3,670 kg, respectively, and mine production of rhodium decreased by 20% to 124 kg. The Stillwater Mine produced 9,020 kg of palladium and 2,740 kg of platinum, slight decreases compared with production in 2011. The East Boulder Mine produced 3,297 kg of palladium and 933 kg of platinum, increases of 4% and 3%, respectively. SMC milled 1.08 million metric tons (Mt) of ore from the mines, slightly less than that of 2011. In 2012, the Stillwater and East Boulder Mines processed an average of 1,840 and 1,230 metric tons per day of ore, respectively, 9% less for the Stillwater Mine and 8% more for the East Boulder Mine relative to the rates in 2011. Average PGM mill head grades were 19 grams per metric ton (g/t) at the Stillwater Mine and 12 g/t at the East Boulder Mine. Mill recovery of PGMs was about 92% at the Stillwater Mine, unchanged from 2011, and about 90% at the East Boulder Mine, slightly higher than that in 2011 (Stillwater Mining Co., 2013, p. 31, 58–59).

Progress continued on SMC's three development projects, the Blitz, Far West, and Graham Creek projects. A new tunnel-boring machine was in place at the Blitz project on the east side of the Stillwater Mine, and 7,000 meters (m) of advancement was expected to be completed during the next 5 or 6 years. About 780 kg of PGMs were expected to be produced annually from the Blitz project. At the Graham Creek project, west of the East Boulder Mine, tunnel boring had advanced 1,980 m by yearend 2012; completion of the full 2,500 m of

advancement was expected during the first half of 2013 and initial production was expected in early 2015, with about 930 kg of PGMs produced annually. A second expansion project at the Stillwater Mine, known as the Far West project, was identified. The Far West project contained higher grade ore than the rest of the Stillwater Mine, and was expected to accelerate the increase in annual mine production and to contribute an additional 1,400 kilograms per year (kg/yr) of PGMs from the Stillwater Mine by 2016 (Stillwater Mining Co., 2013, 17, 68–69).

At yearend 2012, SMC reported proven and probable reserves in its Montana operations of 46.1 Mt of ore with an average grade of 14 g/t of PGMs and containing about 667,000 kg of palladium and platinum, with an in-situ palladium-to-platinum ratio of about 3.58 to 1. SMC's proven and probable reserves of PGMs in its Montana operations are contained in the J-M Reef, an ore body within the layered mafic and ultramafic igneous rocks of the Stillwater Complex (Stillwater Mining Co., 2013, p. 16–17).

SMC had a 3-year agreement, effective in January 2011, to supply General Motors Corp. (Detroit, MI) monthly deliveries of fixed quantities of palladium. In 2012, SMC signed a 1-year agreement with Tiffany & Co. (New York, NY) to supply platinum during 2013. SMC also had 1-year agreement to supply palladium and platinum to Johnson Matthey plc (London, United Kingdom) and BASF (Florham Park, NJ) and a month-to-month supply agreement with Ford Motor Co. (Detroit). Based on SMC's expected production for 2013 of 15,600 kg of PGMs, nearly all of mined palladium and about 74% of mined platinum production was committed under supply agreements for 2013 (Stillwater Mining Co., 2013, p. 31).

In 2012, PGM exploration continued at several locations in the United States; the most advanced projects were in the Duluth Complex of Minnesota. Duluth Metals Ltd. (Toronto, Ontario, Canada) released an updated mineral resource estimate for the Twin Metals LLC [a 60:40 joint venture between Duluth Metals and Antofagasta plc (London)] copper-nickel-PGM project. The Twin Metals project, planned as an underground mine, was in the prefeasibility stage and included three deposits in close proximity: the Birch Lake, Maturi, and Spruce Road deposits. Updated estimates indicated that Twin Metals was one of the world's largest PGM deposits outside of South Africa with total indicated resources of 395,000 kg and 174,000 kg of palladium and platinum, respectively, at the three deposits and inferred resources of 236,000 kg and 109,000 kg of palladium and platinum, respectively, at the Birch Lake and Maturi deposits. The inferred resource estimate does not include the Spruce Road deposit. Through December 2012, Twin Metals had invested more than \$160 million in exploration and project development activities (Twin Metals Minnesota LLC, 2012).

PolyMet Mining Corp. (Hoyt Lakes, MN) expected a draft environmental impact statement on the NorthMet deposit to be published for public comment by the first quarter of 2013. The NorthMet deposit was expected to produce 3,300 kg/yr of gold, palladium, and platinum (PolyMet Mining Corp., 2012).

**Secondary.**—In 2012, PGMs were recycled from three main sources—autocatalysts, electronics, and jewelry. In North America, an estimated 56,300 kg of PGMs were recovered from catalytic converters, which was about 59% of the world total but slightly less than that in 2011. The amount of PGMs recovered from catalytic converters decreased by 21% in Europe to about 22,300 kg, and increased by 5% in Japan. The increase for Japan was the result of recovery following the devastating earthquake and tsunami in 2011 and a re-introduction of a Government subsidy for fuel efficient vehicles. In the rest of the world, recycling of autocatalysts increased substantially but total quantities remained far below those of Europe, Japan, and North America.

The global recovery of platinum from recycled autocatalysts was 35,100 kg, a 9% decrease in 2012 from that of 2011, a result of lower platinum prices and weakness in the European car market. About 311 kg of platinum was recovered from electronics recycling in 2012, which was the same amount recovered in 2011. About 27,700 kg of platinum was recovered from the jewelry industry globally, an increase of 10% compared with that of 2011 (Johnson Matthey plc, 2013, p. 21–22).

Globally, about 51,600 kg of palladium was recovered from autocatalysts in 2012, a slight decrease compared with that of 2011. Recovery of palladium from electronics totaled 13,400 kg, a 10% decrease compared with that of 2011 and recovery from the jewelry industry was about 5,910 kg, a 9% decrease. In 2012, recovery of rhodium from autocatalysts decreased by 6% to 8,060 kg (Johnson Matthey plc, 2013, p. 21–22).

SMC's recycling program recovered 13,800 kg of PGMs in 2012, a 9% decrease compared with that of 2011, owing to lower availability of scrap material in the market. SMC produced 8,040 kg, 4,820 kg, and 989 kg, respectively, of recycled palladium, platinum, and rhodium, which were decreases of 5%, 14%, and 9%, respectively, compared with amounts recovered in 2011 (Stillwater Mining Co., 2013, p. 9, 23).

## Consumption

Apparent domestic palladium consumption was estimated to be about 60,200 kg, a 24% decrease from 79,300 kg in 2011.

For the following discussion, PMG sales are considered to be the same as use or consumption.

**Palladium.**—Global palladium sales were 308,000 kg in 2012, about 16% more than those in 2011. About 67% of palladium was used by the autocatalyst industry, about 12% by the electronics industry, and about 5% each by the chemical and dental industries and as investment. The remainder was used in jewelry and others industries. Global palladium use in autocatalysts reached an alltime high in 2012 for the second consecutive year owing to greater global vehicle production, an increase in the palladium-to-platinum ratio in autocatalysts for diesel vehicles, and an increase in Japanese vehicle production

following the earthquake and tsunami in March 2011 (Johnson Matthey plc, 2013, p. 35–40).

Palladium use in autocatalysts worldwide increased by 7% to 206,000 kg in 2012 compared with 2011 consumption. Consumption in the North American autocatalyst sector increased to 56,500 kg, 17% more than that of 2011 owing to increased auto production. Palladium consumption in the European market was 45,300 kg, a slight decrease relative to that of 2011. Consumption in the Chinese and Japanese autocatalyst industries was 39,000 kg and 24,400 kg, respectively, which were increases of 9% and 15%, respectively, compared with those of 2011. Palladium consumption for autocatalysts in the rest of the world increased slightly to 40,600 kg (Johnson Matthey plc, 2013, p. 35–40).

Global palladium consumption by the jewelry industry was 13,800 kg, a 12% decrease compared with that of 2011. China remained the leading user of palladium for jewelry, with 54% of world consumption in that sector. However, demand in the Chinese jewelry sector decreased by 21% relative to that of 2011 owing to a lack of marketing of palladium jewelry, a lack of perceived value by consumers, and price volatility in recent years. Consumption in Europe was 2,020 kg of palladium, an 8% increase relative to that of 2011, and consumption in North America and Japan was 1,400 kg and 2,180 kg, respectively, about the same as that in 2011. Consumption in the rest of the world remained the same at about 780 kg (Johnson Matthey plc, 2013, p. 37–38).

World palladium consumption in dental alloys was 16,500 kg in 2012, down slightly from consumption in 2011. Japan and North America each accounted for about 42% of the global consumption in this sector. The chemical industry consumed 16,500 kg of palladium in 2012, a 20% increase from that in 2011, owing to increased consumer demand for end products that use chemicals that required palladium in their manufacturing. In the chemical industry, palladium was used as a catalyst in manufacturing bulk chemicals, including hydrogen peroxide, nitric acid, terephthalic acid, and vinyl acetate monomer, which in turn were used in the production of many resins, plastics, and polyester and polyethylene terephthalate for use in textiles and packaging. Consumption of palladium by the electronics industry was 37,300 kg in 2012, which was a 13% decrease compared with that of 2011. The majority of demand for palladium in the electronics sector was for multilayer ceramic capacitors (MLCCs), which have widespread use in electronic circuitry. However, palladium use in this sector was decreasing owing to substitution by nickel and copper and to thrifting. Use of palladium for electronic plating, in contrast, was strong, owing partly to the lower price of palladium relative to gold, for which palladium can substitute for some applications (Johnson Matthey, 2013, p. 38–39).

Investment demand for palladium returned in 2012 following a major liquidation late in 2011 following price decreases. Total investment demand was 14,600 kg in 2012. Holdings in exchange-traded funds (ETFs), including a new one launched in 2012 in Canada, were about 62,200 kg at yearend 2012, about 14% more than holdings at yearend 2011. At yearend 2012, the U.S. Mint was planning to reissue a solicitation for a study to explore the feasibility of producing an American Eagle 1-ounce

palladium bullion coin. An independent study to determine potential demand for palladium bullion coins prior to their production was mandated under the American Eagle Palladium Bullion Coin Act of 2010, Public Law 111–303, and the original contract had been canceled in December 2011 owing to problems in the procurement process (Gilkes, 2012; Johnson Matthey plc, 2013, p. 40).

**Platinum.**—In 2012, U.S. apparent consumption of refined platinum was estimated to be about 167,000 kg, a 37% increase from the apparent consumption of 121,000 kg in 2011.

In 2012, global platinum sales totaled 250,000 kg, a slight decrease compared with sales in 2011. About 40% of the total was sold to the autocatalyst industry, about 35% to the jewelry industry, and about 6% each to the chemical industry and to investors. The remainder was used in other industries including electrical, glass, and medical and biomedical. Worldwide use of platinum in the autocatalyst sector increased slightly to 100,800 kg in 2012 compared with that in 2011 as a result of an increase in light-duty vehicle production. Light-duty vehicle production and the market share of diesel vehicles decreased in Europe, whereas light-duty vehicle demand increased in India, Japan, and the United States. The market share of diesel vehicles increased in India. Autocatalyst consumption in Europe was about 41,400 kg of platinum in 2012, which was 12% less than that of 2011, and accounted for about 41% of total global consumption. The market share of platinum-heavy, light-duty diesel vehicles in Europe decreased to less than 50% in 2012 from 52% in 2011. Consumption in the autocatalyst sector of North America was 12,600 kg, a 9% increase from 2011 owing to increased sales of diesel pick-up trucks and heavy duty trucks, stimulated by increased construction, new housing starts, and retail sales. In Japan, platinum consumption in the autocatalyst sector was 18,700 kg, about 20% more than that of 2011 owing to the recovery of the Japanese auto industry following the earthquake and tsunami in 2011. In China, consumption of platinum in the autocatalyst sector was 3,270 kg, about the same as that in 2011. Elsewhere, consumption of platinum for autocatalysts increased by 13% in 2012 because of growth in light duty vehicle output in India and Thailand (Johnson Matthey plc, 2013, p. 23–25).

In 2012, global consumption of platinum in the jewelry industry was 86,500 kg, 12% more than that of 2011, owing to the lower average price of platinum relative to that of gold. Consumption in North America was 5,750 kg, about the same as that of 2011. Consumption in China, the leading consumer, accounting for 70% of global consumption of platinum for jewelry, increased by 16%. Consumption in Europe was 3% more than that in 2011, consumption in Japan was about the same, and consumption in the rest of the world increased by 16% to 4,510 kg (Johnson Matthey plc, 2013, p. 25–27).

Global use of platinum in the chemical sector was 14,000 kg in 2012, 4% less than that of 2011. The leading use for platinum in this sector is for the production of silicones and other chemicals such as terephthalic acid used in the production of polyester fabric and plastic containers. Platinum use in the petroleum refining industry decreased by 5% to 6,220 kg in 2012. Worldwide consumption of platinum in electrical applications was about 5,130 kg in 2012, 28% less than that of

2011 owing to lower demand for hard disk drives. About 95% of electrical consumption of platinum comes from manufacture of hard disks, but new technologies that do not need PGMs are replacing hard disks (Johnson Matthey plc, 2013, p. 28–29, 50).

Platinum equipment was used in the glassmaking industry because of its high melting point and resistance to corrosion. Platinum use in the glass industry decreased by 65% to 5,600 kg in 2012, owing to use of platinum from decommissioned plants and existing inventories, and to over-expansion in 2011. Consumption in the medical and biomedical sector was 7,310 kg, which was slightly more than that in 2011. Consumption in other end uses increased by 6% to 10,600 kg relative to that of 2011, including automotive sensors, coating of aircraft turbine blades, and spark plugs (Johnson Matthey plc, 2013, p. 29, 50).

Global investment demand for platinum decreased slightly to 14,200 kg relative to that in 2011. A new ETF was launched in Hong Kong in November 2012 and global ETF holdings at the end of 2012 totaled 51,300 kg of platinum, 13% more than that at yearend 2011. On August 9, the U.S. Mint released its 2012 platinum American Eagle coin. The 1-ounce coins were 99.95% pure platinum, had a face value of \$100, and were the fourth in the 6-year Preamble series commemorating core concepts of American democracy. The coins were emblematic of the principle “provide for the common defence” and depicted a minuteman from the Revolutionary War. The Mint planned to produce a maximum 15,000 coins (Johnson Matthey plc, 2012; 2013, p. 34–35; U.S. Mint, 2013).

**Other PGMs.**—Global rhodium consumption in 2012 was 30,000 kg, 6% more than that of 2011. A majority of rhodium use, 81% in 2012, was in the production of autocatalysts. In 2012, rhodium use in autocatalysts was 24,300 kg, 9% more than that of 2011 and the highest level since 2007, mainly owing to increased automobile production in Japan and North America. Use of rhodium in the glass manufacturing sector decreased by 60% to 964 kg owing to excess flat-panel glass production capacity and a delay in new capacity additions. Consumption of rhodium in the chemical sector increased by 13% to 2,520 kg in 2012 owing to increases in acetic acid and oxo-alcohol manufacturing capacity in Asia. Use by the electrical sector was 187 kg, about the same as that in 2011, and use in other applications increased by 74% from that of 2011, to 2,050 kg because of increases in investment demand in ETFs and rhodium bars in Europe (Johnson Matthey plc, 2013, p. 41).

Global consumption of ruthenium decreased by 32% to 21,100 kg in 2012 from that in 2011. The consumption of ruthenium in electrical applications decreased by 30% to 11,700 kg, as a result of decreased consumption in the hard disk industry owing to a change in consumer technology preference to tablets and smartphones from desktop and laptop computers. Electrochemical use was 4,040 kg, the same as that in 2011; use in the chemical sector was 3,140 kg, a 64% decrease, which was back to the historical level of consumption after an anomalously large amount in 2011; and consumption in other applications increased by 28% to 2,300 kg (Johnson Matthey plc, 2013, p. 42).

Global consumption of iridium decreased to 5,540 kg in 2012, 46% less than that of 2011. Use in the electrical sector decreased by 78% to 1,310 kg as a result of decreased demand



for iridium crucibles which are used in the electronics industry to grow high-purity single crystal sapphires for use in various applications, including in the production of light-emitting diode lights (Johnson Matthey plc, 2013, p. 42).

## Prices

In 2012, the Engelhard annual averages prices for palladium, platinum, rhodium, and ruthenium were lower by 12%, 10%, 37%, and 32%, respectively, from those of 2011. The 2012 average annual price for iridium was 3% higher than that of 2011 (table 1).

**Iridium.**—The annual average iridium price in 2012 was \$1,066.23 per troy ounce, which was 3% higher than that of 2011. The iridium price began the year at \$1,085 per troy ounce, where it remained until mid-February. The price then decreased to \$1,075 per troy ounce and remained at about that level until early August. The price then decreased to \$1,050 per troy ounce where it remained for the rest of the year. The price decreases were believed to be the result of weak industrial purchasing of iridium.

**Palladium.**—The annual average palladium price in 2012 was \$649.27 per troy ounce, which was 12% less than that of 2011. Palladium prices began 2012 at \$671 per troy ounce, decreased to \$620 per troy ounce in early January and then increased to \$718 per troy ounce in early February, likely as a result of electricity supply concerns in South Africa and strong demand. The price then decreased steadily to \$581 per troy ounce in mid-August. The price increased sharply to \$706 per troy ounce in early September owing to supply concerns related to labor unrest in South Africa. The price decreased until the end of October when it reached \$597 per troy ounce, before increasing steadily to \$705 per troy ounce at yearend.

**Platinum.**—In 2012, the annual average platinum price was \$1,555.39 per troy ounce, which was 10% less than that of 2011. Throughout the year, daily platinum prices followed a trend similar to those of palladium. Platinum began the year at \$1,411 per troy ounce, increased steadily reaching the year's high of \$1,731 per troy ounce in late February. Prices then decreased steadily to \$1,405 per troy ounce in late May and remained around this level until mid-August, when prices rose steadily, reaching \$1,718 per troy ounce in early October. Though fluctuating, prices trended downward through yearend, ending the year at \$1,524 per troy ounce. Platinum prices were above those for rhodium for the first time since early 2004 and below those for gold throughout most of the year.

**Rhodium.**—The annual average rhodium price in 2012 was \$1,274.98 per troy ounce, which was 37% less than that of 2011. The rhodium price began the year at \$1,400 per troy ounce, increased to \$1,540 per troy ounce in mid-February in response to supply concerns caused by the workers' strike in South Africa, and then decreased steadily to \$1,080 per troy ounce in early September. The price spiked to \$1,385 per troy ounce in mid-September in response to concerns about supply from South Africa, and then decreased steadily to \$1,080 per troy ounce at yearend. The latter price was believed to be the result of a selling by investors.

**Ruthenium.**—The annual average ruthenium price in 2012 was \$112.26 per troy ounce, which was 32% less than that of 2011. The ruthenium price began the year at \$110 per troy

ounce, and then increased to \$130 per troy ounce in early February where it remained until mid-March owing to increased industrial purchasing. The price then decreased continuously to \$90 per troy ounce in November, where it remained until yearend, its lowest level in 3 years.

## Foreign Trade

In 2012, the U.S. net import reliance as a percentage of apparent consumption was estimated to be 80% for refined palladium and 98% for refined platinum. Imports of refined palladium in 2012 totaled 80,100 kg, a 19% decrease from those of 2011, with three countries accounting for about 70% of refined palladium imports in 2012—South Africa (29%), Russia (28%), and the United Kingdom (13%). Imports of platinum, including waste, scrap, and coins, increased by 33% in 2012 to 172,000 kg, from 129,000 kg in 2011. Excluding waste and scrap, three countries accounted for 73% of imports of platinum in 2012—South Africa (42%), the United Kingdom (17%), and Germany (14%). Refined imports of other PGMs decreased by 17% in 2012 compared with those of 2011. Imports of rhodium decreased slightly, and those of iridium and ruthenium decreased by 56% and 24%, respectively. In contrast, imports of osmium in 2012 totaled 130 kg, an increase of 171% compared with those in 2011. Three countries accounted for 91% of the imports of other PGMs in 2011—South Africa (64%), the United Kingdom (19%), and Germany (8%) (tables 2, 3).

About 32,000 kg of palladium was exported in 2012, about the same amount as that of 2011. Exports of platinum, including waste and scrap, decreased by 28% to 93,400 kg, and exports of rhodium decreased by 24% compared with exports in 2011. Exports of iridium, osmium, and ruthenium increased by 42% during the same time period (table 4).

## World Review

In 2012, world mine production of PGMs decreased by 8% to 451,000 kg from 488,000 kg in 2011 (table 5). South Africa accounted for 58% of total mine production in 2012; Russia accounted for 26%, Zimbabwe accounted for 5%, and Canada and the United States each accounted for 4%. In 2012, world platinum mine production decreased by about 9%; South Africa produced 133,000 kg of platinum, a 10% decrease from that in 2011, and accounted for 73% of world production. Global mine production of palladium decreased by 6% to 200,000 kg, with Russia and South Africa accounting for 41% and 37%, respectively, of production, and Canada and the United States accounting for 6% each. World mine production of other PGMs (iridium, osmium, rhodium, and ruthenium) decreased by 7% in 2012 compared with that of 2011. South Africa was the dominant producer, accounting for 78% of global production of other PGMs.

**Botswana.**—In 2012, OJSC MMC Norilsk Nickel (Moscow, Russia) produced 2,610 kg of palladium and 435 kg of platinum as byproducts from its nickel operations at the Tati Mine. These quantities were about 24% and 17%, respectively, more than production in 2011 (OJSC MMC Norilsk Nickel, 2013).

**Canada.**—SMC continued to make progress on its Marathon PGM-copper project in Ontario. SMC, through its subsidiary,

Stillwater Canada Inc., submitted an environmental impact statement. SMC owns 75% of the Marathon project and the remaining 25% is owned by Mitsubishi Corp. (Tokyo, Japan). The Marathon project was expected to produce 6,200 kg/yr of platinum and palladium. No timeframe estimate was given for startup of operations (Stillwater Mining Co., 2012).

North American Palladium Ltd. (Toronto) produced 5,100 kg of palladium and 348 kg of platinum from its Lac des Isles Mine in Ontario, increases of 12% and 22%, respectively, compared with production in 2011. A new mine shaft was expected to be commissioned in 2013 allowing increased access to higher-grade underground ore (North American Palladium Ltd., 2013, p. 10–18).

Vale Inco Ltd. (Toronto) produced 7,810 kg of palladium and 4,170 kg of platinum as byproducts of its nickel operations at Sudbury, Ontario, a slight increase for palladium and a 23% decrease for platinum relative to production in 2011 (Vale Inco Ltd., 2013, p. 47). In addition to Vale, Xstrata plc (Zug, Switzerland) produced PGMs as byproducts from nickel mining operations at Sudbury, although production figures were not released.

**Russia.**—In 2012, Russia accounted for 41% of global mine production of palladium, 13% of platinum production, and 18% of other PGMs. Norilsk Nickel produced 81,700 kg of palladium and 20,500 kg of platinum in 2012, a 3% and slight decrease, respectively, compared with 2011 production (OJSC MMC Norilsk Nickel, 2013). Russia's alluvial production was estimated to be about 4,070 kg of platinum, which was a slight decrease compared with 2011 production.

**South Africa.**—In 2012, workers' strikes and violent unrest resulted in a production loss of about 23,300 kg of platinum (Johnson Matthey plc, 2013, p. 14; Maylie, 2012b). Production of palladium, platinum, and other PGMs decreased by about 11%, 10%, and 9%, respectively, compared with production in 2011. The world's leading PGM producer, Anglo American Platinum Ltd. (Amplats) (Johannesburg), reported primary equivalent refined production of 65,000 kg of platinum in 2012, an 8% decrease compared with that in 2011. Production of equivalent refined platinum at the Mogalakwena open pit mine decreased slightly to 9,300 kg. Output from the Khuseleka Mine was 3,900 kg of platinum equivalent, a slight decrease from 2011 production. The Siphumelele Mine produced 2,440 kg of platinum equivalent, 18% less than that of 2011. Equivalent refined platinum production of 3,700 kg from the Mototolo Mine, a joint venture with Xstrata, was about 9% more than 2011 production. The Kroondal and Marikana Mines, operated as pool-and-share agreements with Aquarius Platinum Ltd. (Perth, Western Australia, Australia), produced 6,631 kg and 821 kg of platinum, respectively, which was a slight increase and a 44% decrease, respectively, relative to that of 2011. At Modikwa, which was a joint venture with African Rainbow Minerals Ltd. (ARM) (Sandton), platinum production decreased by 4% to 3,720 kg. At the Bafokeng-Rasimone Platinum Mine (BRPM), which was a joint venture with Royal Bafokeng Platinum Ltd. (Johannesburg), refined platinum production declined by 5% to 5,340 kg. Amplats planned annual production of 65,300 kg to 71,500 kg of platinum in 2013 (Anglo American Platinum Ltd., 2013, p. 4, 39–77).

Production at Impala Platinum Holdings Ltd.'s (Johannesburg) Rustenburg operations declined during their reporting year of July 31, 2011, through June 30, 2012, to 19,500 kg owing to a 6-week workers' strike which halted mining from mid-January until early March. Production included 23,300 kg of platinum, 12,700 kg of palladium, and 3,080 kg of rhodium, which were decreases of 20% for platinum and palladium and 22% for rhodium. Rampup was slow after the resumption of mining. Production at the Marula Mine decreased by 3% to 2,150 kg of platinum. Development was resumed at the Leeuwkop Mine which had been halted since the global financial crisis in 2008. Production at Leeuwkop was expected to begin in 2021, with annual production of about 4,500 kg of platinum expected (Impala Platinum Holdings Ltd., 2012, p. 13, 19, 54–93).

In 2012, Northam Platinum Ltd. (Johannesburg) reported production from its Zondereinde Mine of 8,980 kg of precious metals in concentrate, an 8% increase relative to production in 2011. Northam's Booyendal Mine was at an advanced stage of construction and was expected to be commissioned in 2013, with expected production of about 5,000 kg/yr of platinum by 2015 (Northam Platinum Ltd., 2012, p. 3, 8).

Violent unrest took place at Lonmin plc's (London) Marikana Mine in August during a 6-week workers' strike (Maylie, 2012a,b). In 2012, Lonmin produced 38,600 kg of platinum, a 7% decrease compared with that in 2011. Lost production as a result of the strike was estimated to be 1.8 Mt of ore, containing about 3,400 kg of platinum (Johnson Matthey plc, 2013, p. 16).

Aquarius Platinum Ltd. (Bedford) placed the Everest Mine on care-and-maintenance status in June owing to low metal prices and geological challenges. Production was 1,170 kg of PGMs, which was 67% less than that of 2011 (Aquarius Platinum Ltd., 2013a, b, c).

The Nkomati Nickel Mine, a 50-50 joint venture between ARM and Norilsk Nickel, produced 2,740 kg of PGMs, 33% more than that produced in 2011 (OJSC MMC Norilsk Nickel, 2013, p. 3).

Eastern Platinum Ltd.'s (Vancouver) Crocodile River Mine produced 1,350 kg of platinum in concentrate, 7% less than that in 2011, owing to temporary suspension of stoping owing to low PGM prices. The construction of a concentrator and mine on the eastern limb of the Bushveld Complex were put on hold owing to economic considerations (Eastern Platinum Ltd., 2013).

Platmin Ltd.'s (Centurion) Pilanesburg Mine produced 3,280 kg of PGMs plus gold in concentrate during 2012, an increase of 51% relative to that of 2011. Platmin consolidated its PGM assets including the Pilanesburg Platinum Mine and the nearby Sedibelo and Magazynskraal properties. The new company was to be named Sedibelo Platinum Mines Ltd. (Platmin Ltd., 2013).

**Zimbabwe.**—In 2012, platinum production increased slightly and palladium production increased by about 9% compared with that of 2011. Amplats' Unki Mine reached full production capacity and produced 2,000 kg of platinum, 27% more than that in 2011. The Mimosa Mine, a joint venture between Aquarius and Impala, produced 6,640 kg of platinum, a slight increase from production in 2011. Impala's Zimplats Mine produced 4,610 kg, 5,820 kg, and 519 kg of palladium,

platinum, and rhodium, respectively, during their fiscal year 2012, which was a slight increase for palladium and rhodium and a 3% increase for platinum compared with production in 2011. The phase 2 expansion of the Ngezi Mine, including a third underground mine and a second concentrator, continued and was expected to be completed in 2015. At full capacity, the mine was expected to produce 8,400 kg/yrof platinum (Thomson Reuters GFMS Surveys, 2013, p. 32).

## Outlook

The progress of the global economic recovery is expected to increase demand for PGMs owing to their principal use as industrial metals. Because the primary end use for palladium, platinum, and rhodium is for catalytic converters in automobiles, the outlook for that industry will have the greatest impact on the consumption of these PGMs. Global automobile production is likely to increase, particularly in emerging markets such as China and India; therefore, an overall increase in demand for PGMs, in particular palladium, and rhodium in that sector was expected. Tighter emission standards in China were also expected to cause increased palladium demand. Manufacturers continued to switch to palladium-based catalytic converters and to increase palladium use in diesel light-duty vehicles because of the price difference between platinum and palladium. Thus, the increase in automobile demand will likely affect palladium demand in particular. In the electronics sector, palladium demand may continue to decrease owing to substitution of other metals such as nickel and copper in MLCCs. In the glass sector, demand for platinum and rhodium could increase owing to an expected increase in China's glass production to supply its domestic market. The demand for platinum in the jewelry sector was expected to increase, especially in China and India, whereas palladium jewelry demand is likely to decrease. The consumption of rhodium is expected to increase as a result of higher vehicle production in many areas of the world. Ruthenium demand is expected to increase as a result of depleted stocks in the hard disk industry, although demand in the chemical industry could decrease if metal is recycled. Iridium demand is likely to decrease as a result of lower demand from China owing to the near completion of upgrading of its chlorine industry.

Platinum production from South Africa was expected to decrease owing to work stoppages and to increased mining costs including electricity and labor. Supply from Zimbabwe was expected to increase from new mining projects, but was subject to political uncertainty. Palladium supply was expected to decrease in Russia owing to a decline in average palladium ore grade. Recycling of platinum and palladium is expected to increase, particularly in the automotive catalyst recycling sector.

## References Cited

Anglo American Platinum Ltd., 2013, Reviewing the portfolio with the future in mind—Annual report 2012: Johannesburg, South Africa, Anglo American Platinum Ltd., 274 p. (Accessed May 11, 2013, at [http://www.angloreports.co.za/wp-content/uploads/2013/AAP\\_AR\\_2012-180213.pdf](http://www.angloreports.co.za/wp-content/uploads/2013/AAP_AR_2012-180213.pdf).)

Aquarius Platinum Ltd., 2013a, Aquarius Platinum Ltd. financial and production results to 30 June 2012: Bedford, South Africa, Aquarius Platinum Ltd., 18 p. (Accessed June 10, 2013, at [http://aquariusplatinum.com/sites/aquariusplatinum.com/files/20120723\\_AQP\\_Q4\\_2012\\_Report\\_to\\_30June2012.pdf](http://aquariusplatinum.com/sites/aquariusplatinum.com/files/20120723_AQP_Q4_2012_Report_to_30June2012.pdf).)

Aquarius Platinum Ltd., 2013b, Aquarius Platinum Ltd. financial and production results to 31 March 2012: Bedford, South Africa, Aquarius Platinum Ltd., 26 p. (Accessed June 12, 2013, at [http://aquariusplatinum.com/sites/aquariusplatinum.com/files/AQP\\_Q3\\_2012\\_Report\\_to\\_31\\_March\\_2012\\_FINAL.pdf](http://aquariusplatinum.com/sites/aquariusplatinum.com/files/AQP_Q3_2012_Report_to_31_March_2012_FINAL.pdf).)

Aquarius Platinum Ltd., 2013c, Financial results for the six months ended 31 December 2012: Bedford, South Africa, Aquarius Platinum Ltd., 19 p. (Accessed June 13, 2013, at [http://aquariusplatinum.com/sites/aquariusplatinum.com/files/20130208\\_AQP\\_H1\\_2013\\_FINAL\\_0.pdf](http://aquariusplatinum.com/sites/aquariusplatinum.com/files/20130208_AQP_H1_2013_FINAL_0.pdf).)

Eastern Platinum Ltd., 2013, Eastern Platinum reports results for the quarter and year ended December 31, 2013: Vancouver, British Columbia, Canada, Eastern Platinum Ltd. news release, March 14, 8 p. (Accessed June 10, 2013, at [http://www.eastplats.com/\\_resources/news/nr\\_2013-03-14.pdf](http://www.eastplats.com/_resources/news/nr_2013-03-14.pdf).)

Gilkes, Paul, 2012, Mint to seek new contract on palladium coin study: CoinWorld news release, January 28, 1 p. (Accessed January 30, 2012, at <http://www.coinworld.com/articles/mint-to-seek-new-contract-on-palladium-coin-s/>.)

Impala Platinum Holdings Ltd., 2012, Implats distinctly platinum—Integrated annual report 2012: Johannesburg, South Africa, Impala Platinum Holdings Ltd., 150 p. (Accessed May 9, 2013, at [http://financialresults.co.za/2012/implats\\_ir2012/downloads/implats\\_ir2012.pdf](http://financialresults.co.za/2012/implats_ir2012/downloads/implats_ir2012.pdf).)

Johnson Matthey plc, 2012, US Mint releases 2012 American Eagle platinum coin: London, United Kingdom, Johnson Matthey plc news release, August 13. (Accessed September 24, 2012, at <http://www.platinum.matthey.com/news-and-events/news-articles/2012/august/13th/us-mint-releases-2012-american-eagle-platinum-coin>.)

Johnson Matthey plc, 2013, Platinum 2013: London, United Kingdom, Johnson Matthey plc, 56 p. (Accessed May 23, 2013, at [http://www.platinum.matthey.com/media/1614079/platinum\\_2013.pdf](http://www.platinum.matthey.com/media/1614079/platinum_2013.pdf).)

Maylie, Devon, 2012a, African mine clash takes deadly turn: The Wall Street Journal, August 14, p. B6.

Maylie, Devon, 2012b, Lethal clashes shut platinum mine: The Wall Street Journal, August 15, p. B3.

North American Palladium Ltd., 2013, 2012 annual report: Toronto, Ontario, Canada, North American Palladium Ltd., 84 p. (Accessed May 23, 2013, at [http://www.napalladium.com/files/doc\\_financials/2012/Annual\\_Report\\_2012\\_FINAL.pdf](http://www.napalladium.com/files/doc_financials/2012/Annual_Report_2012_FINAL.pdf).)

Northam Platinum Ltd., 2012, Annual integrated report 2012: Johannesburg, South Africa, Northam Platinum Ltd., 182 p. (Accessed May 15, 2013, at <http://northam.integrated-report.com/2012/>.)

OJSC MMC Norilsk Nickel, 2013, MMC Norilsk Nickel announces preliminary consolidated production results for 4th quarter 2011 & 12 months 2012, and production outlook for 2013: Moscow, Russia, OJSC MMC Norilsk Nickel news release, January 31, 4 p. (Accessed February 13, 2013, [http://www.nornik.ru/\\_upload/editor\\_files/file2009.pdf](http://www.nornik.ru/_upload/editor_files/file2009.pdf).)

Platmin Ltd., 2013, Management's discussion and analysis of financial condition and results of operations for the three and twelve months ended December 31, 2012: Centurion, South Africa, Platmin Ltd. news release, May 31, 17 p. (Accessed June 6, 2012, at [http://www.platmin.com/content/financials/Platmin\\_MDA\\_Dec\\_2012.pdf](http://www.platmin.com/content/financials/Platmin_MDA_Dec_2012.pdf).)

PolyMet Mining Corp., 2012, PolyMet reports technical disclosure review: Hoyt Lakes, MN, PolyMet Mining Corp. news release, June 14. (Accessed July 31, 2012, at <http://www.polymetmining.com/news/news-releases/polymet-reports-technical-disclosure-review/>.)

Stillwater Mining Co., 2012, Stillwater Mining Co. announces submission of environmental impact statement for Marathon platinum group metals-copper project: Billings, MT, Stillwater Mining Co. news release, July 2. (Accessed July 16, 2012, at <http://investorrelations.stillwatermining.com/phoenix.zhtml?c=99837&p=irol-newsArticle&ID=1711423&highlight>.)

Stillwater Mining Co., 2013, Extracting value—2012 annual report: Billings, MT, Stillwater Mining Co., 152 p. (Accessed April 19, 2013, at <http://investorrelations.stillwatermining.com/phoenix.zhtml?c=99837&p=irol-reportsannual>.)

Thomson Reuters GFMS Surveys, 2013, Platinum and palladium survey 2013: London, United Kingdom, Thomson Reuters GFMS Surveys, 82 p.



Twin Metals Minnesota LLC, 2012, Duluth Metals announces an updated mineral resource estimate confirming large increases to Twin Metals contained metal, grade, and indicated tonnage: St. Paul, MN, Twin Metals Minnesota LLC news release, December 4. (Accessed January 24, 2013, at <http://www.twin-metals.com/duluth-metals-announces-an-updated-mineral-resource-estimate-confirming-large-increases-to-twin-metals-contained-metal-grade-and-indicated-tonnage/>.)

U.S. Mint, 2013, 2012 American Eagle one ounce platinum proof coin: Washington, DC, U.S. Mint. (Accessed May 15, 2013, at <http://catalog.usmint.gov/webapp/wcs/stores/servlet/ProductDisplay?catalogId=10001&storeId=10001&productId=16500&langId=-1>.)

Vale Inco Ltd., 2013, Delivering value through capital efficiency—Annual report 2012: Toronto, Ontario, Canada, Vale Inco Ltd., 255 p. (Accessed June 4, 2013, at [http://www.vale.com/EN/investors/Quarterly-results-reports/20F/20FDocs/20F\\_2012\\_i.pdf](http://www.vale.com/EN/investors/Quarterly-results-reports/20F/20FDocs/20F_2012_i.pdf).)

Yager, T.R., Soto-Viruet, Yadira, and Barry, J.J., 2012, Recent strikes in South Africa's platinum-group metal mines—Effects upon world platinum-group metal supplies: U.S. Geological Survey Open-File Report 2012–1273, 18 p. [Available only at <http://pubs.usgs.gov/of/2012/1273/>.]

## GENERAL SOURCES OF INFORMATION

### U.S. Geological Survey Publications

Global exploration and production capacity for platinum-group metals from 1995 through 2015, Scientific Investigations Report 2012–5164, 2012.

Historical Statistics for Mineral and Material Commodities in the United States, Data Series 140.

Platinum-Group Metals (Ir, Os, Pd, Pt, Rh, Ru). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Platinum-Group Metals. Ch. in Mineral Commodity Summaries, annual.

Platinum-Group Metals. Ch. in United States Mineral Resources, Professional Paper 820, 1973.

Platinum-Group Metals. International Strategic Minerals Inventory Summary Report, Circular 930–E, 1986.

Platinum-Group Metals. Mineral Industry Surveys, monthly, since January 2004.

Platinum-Group Metals—World Supply and Demand, Open File Report 2004–1224, 2005.

Platinum Recycling in the United States in 1998. Ch. in Flow Studies for Recycling Metal Commodities in the United States, Circular 1196–A–M, 2004.

Precious Metals. Mineral Industry Surveys, monthly, through December 2003.

Review of selected global mineral industries in 2011 and an outlook to 2017, Open-File Report 2013–1091.

### Other

CPM Group.

Defense Logistics Agency Strategic Materials.

International Platinum Association.

Platinum-Group Metals. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

Platinum Guild International.

Roskill Information Services Ltd.

Thomson Reuters GFMS Surveys.



TABLE 1  
SALIENT PLATINUM-GROUP METALS STATISTICS<sup>1</sup>

		2008	2009	2010	2011	2012
United States:						
Mine production:						
Palladium, Pd content: <sup>2</sup>						
Quantity	kilograms	11,900	12,700	11,600	12,400	12,300
Value	thousands	\$136,000	\$108,000	\$199,000	\$295,000	\$257,000
Platinum, Pt content: <sup>2</sup>						
Quantity	kilograms	3,580	3,830	3,450	3,700	3,670
Value	thousands	\$182,000	\$149,000	\$179,000	\$205,000	\$184,000
Refinery production:						
Palladium, Pd content:						
Quantity	kilograms	7,650	7,820	6,820	17,500	21,000
Value	thousands	\$87,300	\$66,800	\$116,000	\$414,000 <sup>†</sup>	\$439,000
Platinum, Pt content:						
Quantity	kilograms	7,400	7,210	5,410	15,500	16,600
Value	thousands	\$376,000	\$280,000	\$281,000	\$859,000 <sup>†</sup>	\$831,000
Imports for consumption, refined:						
Iridium, Ir content	kilograms	2,550	1,520	3,530	2,790 <sup>†</sup>	1,230
Osmium, Os content	do.	11	68	76	48	130
Palladium, Pd content	do.	120,000	69,700	70,700	98,900	80,100
Platinum, includes waste, scrap, and coins, Pt content	do.	150,000	183,000	152,000	129,000	172,000
Rhodium, Rh content	do.	12,600	11,200	12,800	13,100	12,800
Ruthenium, Ru content	do.	49,800	21,200	14,100	13,300 <sup>†</sup>	10,200
Exports, refined:						
Iridium, osmium, and ruthenium, gross weight	do.	6,450	4,020	3,720	1,150	1,640
Palladium, Pd content	do.	26,400	30,300	38,100	32,000	32,200
Platinum, Pt content	do.	15,600	15,600	16,900	11,300	8,630
Rhodium, Rh content	do.	1,980	1,220	2,320	1,370	1,040
Stocks, National Defense Stockpile, December 31:						
Iridium, Ir content	do.	18	18	18	18	18
Platinum, Pt content	do.	261	261	261	261	261
Price, average:						
Iridium <sup>3</sup>	dollars per troy ounce	448.34	420.40	642.15	1,035.87	1,066.23
Palladium <sup>3</sup>	do.	355.12	265.65	530.61	738.51	649.27
Platinum <sup>3</sup>	do.	1,578.26	1,207.55	1,615.56	1,724.51	1,555.39
Rhodium <sup>3</sup>	do.	6,533.57	1,591.32	2,459.07	2,024.35	1,274.98
Ruthenium <sup>3</sup>	do.	324.60	97.28	198.45	165.85	112.26
Employment		1,360	1,270	1,350	1,570	1,660
World, mine production <sup>c</sup> , PGM content	kilograms	468,000	448,000 <sup>†</sup>	467,000 <sup>†</sup>	487,000 <sup>†</sup>	451,000

<sup>c</sup>Estimated. <sup>†</sup>Revised. do. Ditto.

<sup>1</sup>Data are rounded to three significant digits, except prices.

<sup>2</sup>Source: Stillwater Mining Co., 2012 annual report, p. 45.

<sup>3</sup>Price data are annual averages of daily Engelhard unfabricated quotations published in Platts Metals Daily.

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

Country	Grain and nuggets		Sponge		Other unwrought		Other		Waste and scrap		Coins	
	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)
2011	1,230	\$65,700	35,800	\$1,910,000	7,160	\$211,000	4,660 <sup>1</sup>	\$206,000	78,900	\$832,000	1,200	\$66,300
2012:												
Australia	--	--	--	--	--	--	498	23,700	357	13,200	366	18,700
Belgium	--	--	1,440	71,500	60	3,160	157	7,120	89	6,290	--	--
Brazil	--	--	--	--	30	1,340	1	39	2,510	37,000	--	--
Canada	53	1,910	47	2,170	(2)	5	208	10,500	12,600	82,800	438	22,000
Chile	--	--	--	--	--	--	--	--	19,600	1,230	--	--
China	40	2,140	--	--	146	7,900	14	605	1,940	34,100	--	--
Colombia	--	--	--	--	1,360	56,900	73	3,040	220	6,040	--	--
Czech Republic	5	290	--	--	2	64	50	2,320	(2)	25	--	--
France	--	--	48	2,240	24	1,280	4	76	931	43,200	--	--
Germany	10	380	2,390	119,000	1,830	66,100	2,220	76,500	19,600	270,000	4	135
India	--	--	41	1,960	--	--	(2)	6	241	12,000	--	--
Indonesia	--	--	--	--	--	--	--	--	18	945	--	--
Israel	--	--	--	--	--	--	--	--	62	2,190	--	--
Italy	--	--	2,460	125,000	59	3,050	112	5,350	1,150	31,200	--	--
Japan	--	--	22	1,170	40	1,120	85	2,320	2,440	87,900	--	--
Korea, Republic of	--	--	785	41,100	--	--	6	178	359	15,500	--	--
Malaysia	--	--	--	--	--	--	--	--	568	16,700	--	--
Mexico	--	--	48	2,320	4	212	--	--	17,700	37,600	--	--
New Zealand	--	--	--	--	--	--	--	--	112	2,870	--	--
Nicaragua	--	--	--	--	(2)	4	--	--	14	518	--	--
Norway	--	--	1,870	93,900	--	--	--	--	--	--	--	--
Panama	--	--	--	--	(2)	16	(2)	7	13	419	--	--
Philippines	--	--	--	--	--	--	1	42	140	4,030	--	--
Poland	--	--	--	--	76	4,260	--	--	--	--	--	--
Qatar	--	--	--	--	--	--	--	--	55	2,330	--	--
Russia	354	17,500	32	1,640	9	432	--	--	--	--	(2)	6
Saudi Arabia	--	--	--	--	--	--	--	--	1,080	55,900	--	--
Singapore	--	--	45	2,210	396	20,600	(2)	2	1,420	49,900	--	--
South Africa	552	26,500	17,900	882,000	471	20,800	--	--	31,800	1,600	--	--
Switzerland	--	--	68	3,150	289	14,100	70	3,220	--	--	31	1,720
Taiwan	--	--	--	--	--	--	--	--	702	19,100	--	--
Thailand	(2)	16	--	--	--	--	--	--	788	3,730	--	--
United Kingdom	47	2,110	6,980	345,000	5	286	355	18,300	10,200	123,000	25	1,310
Uruguay	--	--	--	--	--	--	--	--	24	1,050	--	--
Venezuela	--	--	--	--	--	--	--	--	70	2,270	--	--
Other	(2)	5	1	28	10	401	18	886	168	3,510	--	--
Total	1,060	50,900	34,100	1,690,000	4,820	202,000	3,880	154,000	127,000	968,000	864	43,900

<sup>1</sup>Revised. -- Zero.

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Less than 1/2 unit.

Source: U.S. Census Bureau.

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

Country	Unwrought palladium		Palladium, other		Iridium <sup>2</sup>		Osmium <sup>2</sup>		Ruthenium <sup>2</sup>		Rhodium <sup>2</sup>	
	Quantity, Pd content (kilograms)	Value (thousands)	Quantity, Pd content (kilograms)	Value (thousands)	Quantity, Ir content (kilograms)	Value (thousands)	Quantity, Os content (kilograms)	Value (thousands)	Quantity, Ru content (kilograms)	Value (thousands)	Quantity, Rh content (kilograms)	Value (thousands)
2011	87,000	\$1,890,000	11,900	\$268,000	2,790	\$59,000	48	\$261	13,300	\$69,700	13,100	\$844,000
2012:												
Austria	--	--	147	2,250	--	--	--	--	--	--	--	--
Belgium	974	19,000	835	17,100	--	--	--	--	156	456	440	18,900
Brazil	772	16,600	--	--	--	--	--	--	--	--	(3)	2
Canada	660	18,000	2,100	56,200	--	--	--	--	--	--	--	--
China	--	--	(3)	2	--	--	--	--	--	--	21	898
Czech Republic	1	25	1	19	1	28	--	--	--	--	--	--
Germany	2,290	47,500	576	12,200	189	5,930	--	--	1,050	4,290	732	32,300
Hong Kong	--	--	--	--	--	--	--	--	--	--	--	--
Italy	1,620	34,500	140	3,150	37	1,180	--	--	--	--	159	7,420
Japan	2,430	40,000	242	2,730	17	599	--	--	182	594	90	3,310
Korea, Republic of	984	22,100	--	--	--	--	--	--	--	--	16	623
Norway	4,450	91,800	343	7,230	--	--	--	--	--	--	95	3,600
Poland	21	436	--	--	--	--	--	--	--	--	--	--
Russia	17,900	355,000	4,440	92,300	4	96	--	--	--	--	959	37,600
Saudi Arabia	--	--	101	2,130	--	--	--	--	--	--	8	296
South Africa	21,900	445,000	1,210	24,600	671	21,900	130	737	6,120	19,600	8,690	361,000
Switzerland	5,610	121,000	194	4,410	--	--	--	--	--	--	--	--
United Kingdom	7,680	165,000	2,390	50,500	311	10,800	--	--	2,650	10,200	1,570	64,100
Other	4	123	19	323	3	30	--	--	1	2	(3)	5
Total	67,300	1,380,000	12,700	275,000	1,230	40,500	130	737	10,200	35,100	12,800	529,000

<sup>1</sup>Revised. -- Zero.

<sup>2</sup>Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>3</sup>Unwrought and other forms.

<sup>4</sup>Less than ½ unit.

Source: U.S. Census Bureau.

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

Country	Palladium		Platinum		Platinum, waste and scrap		Iridium, osmium, ruthenium		Rhodium	
	Quantity, Pd content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, Pt content (kilograms)	Value (thousands)	Quantity, gross weight (kilograms)	Value (thousands)	Quantity, Rh content (kilograms)	Value (thousands)
2011	32,000	\$416,000	11,300	\$552,000	118,000	\$1,440,000	1,150	\$18,000	1,370	\$71,700
2012:										
Argentina	--	--	104	4,200	--	--	--	--	--	--
Australia	580	8,200	57	2,080	(2)	8	8	111	--	--
Austria	32	401	24	816	1	18	--	--	--	--
Belgium	32	278	277	10,900	7,040	13,700	3	18	14	556
Brazil	815	16,700	206	4,410	--	--	1	12	3	131
Canada	6,350	89,800	124	5,770	35	615	4	44	38	1,030
Chile	--	--	(2)	3	--	--	1	5	--	--
China	1,260	23,300	45	1,120	219	11,300	35	687	252	12,300
Colombia	100	1,210	1	34	--	--	--	--	--	--
Costa Rica	19	113	15	447	--	--	18	317	--	--
Czech Republic	254	525	--	--	--	--	(2)	6	(2)	27
Denmark	123	1,570	(2)	6	--	--	--	--	--	--
Dominican Republic	2	10	10	524	(2)	7	--	--	(2)	9
France	489	3,920	65	2,030	--	--	10	198	--	--
Germany	6,520	122,000	2,920	144,000	23,600	88,900	54	1,170	57	2,830
Hong Kong	923	13,300	58	2,500	(2)	8	106	2,570	486	18,500
India	532	2,380	201	9,800	--	--	5	107	3	439
Ireland	138	1,290	235	7,950	--	--	11	80	--	--
Israel	2,000	9,470	24	689	--	--	15	65	4	383
Italy	689	9,370	189	8,510	8,160	16,200	--	--	88	3,320
Japan	1,850	20,300	2,190	89,000	22,100	65,900	114	882	67	3,010
Korea, Republic of	3,020	58,400	429	21,000	--	--	740	5,150	--	--
Laos	--	--	23	1,110	--	--	--	--	--	--
Mexico	485	3,300	417	14,900	1	36	8	77	1	83
Netherlands	26	251	70	1,470	--	--	3	98	--	--
New Zealand	159	1,370	1	147	--	--	--	--	--	--
Norway	135	1,970	44	1,930	--	--	--	--	3	152
Saudi Arabia	34	715	(2)	17	--	--	--	--	--	--
Singapore	92	992	57	3,510	--	--	180	2,150	17	758
South Africa	41	171	--	--	2,110	18,700	--	--	--	--
Spain	256	674	8	85	--	--	1	9	--	--
Sweden	17	204	14	337	--	--	1	6	--	--
Switzerland	194	2,680	38	2,200	6,110	138,000	(2)	12	--	--
Taiwan	1,290	16,800	33	1,370	--	--	217	1,170	--	--
Thailand	234	2,840	22	1,250	--	--	--	--	(2)	28
United Arab Emirates	25	313	22	843	119	3,540	--	--	--	--
United Kingdom	3,400	50,800	676	27,900	15,200	481,000	102	2,150	(2)	18
Other	98	996	21	846	3	115	3	26	3	88
Total	32,200	467,000	8,630	374,000	84,800	837,000	1,640	17,100	1,040	43,600

-- Zero.

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

<sup>2</sup>Less than ½ unit.

Source: U.S. Census Bureau.



TABLE 5  
PLATINUM-GROUP METALS: WORLD PRODUCTION, BY COUNTRY<sup>1,2</sup>

(Kilograms)

Country <sup>3</sup>	2008	2009	2010	2011	2012 <sup>e</sup>
<b>Palladium:</b>					
Australia <sup>e,4</sup>	580	800	650	600	300
Botswana	3,359 <sup>r</sup>	3,452 <sup>r</sup>	3,328 <sup>r</sup>	2,115 <sup>r</sup>	2,613 <sup>5</sup>
Canada <sup>c</sup>	14,700	7,000	6,200	14,300 <sup>r</sup>	12,200
Finland	342	560	1,493	1,058	1,100
Japan <sup>6</sup>	7,526	6,675	6,107	7,534	7,000
Poland <sup>e,7,8</sup>	15	15	15	15	15
Russia <sup>c</sup>	87,700	83,200 <sup>5</sup>	84,700	84,300 <sup>r</sup>	82,000
Serbia	70	38	22	20 <sup>r</sup>	4
South Africa	75,537	75,117	82,222	82,731 <sup>r</sup>	74,000
United States <sup>9</sup>	11,900	12,700	11,600	12,400	12,300 <sup>5</sup>
Zimbabwe <sup>c</sup>	4,386 <sup>5</sup>	5,680	7,000	8,241 <sup>r,5</sup>	9,000
<b>Total</b>	<b>206,000</b>	<b>195,000</b>	<b>203,000</b>	<b>213,000<sup>r</sup></b>	<b>201,000</b>
<b>Platinum:</b>					
Australia <sup>e,4</sup>	120	230	130	130	90
Botswana	715 <sup>r</sup>	622 <sup>r</sup>	560 <sup>r</sup>	373 <sup>r</sup>	435 <sup>5</sup>
Canada <sup>c</sup>	8,500	4,000	3,500 <sup>r</sup>	8,000 <sup>r</sup>	7,000
Colombia	1,370 <sup>r</sup>	929	997 <sup>r</sup>	1,231	1,025 <sup>5</sup>
Ethiopia <sup>10</sup>	10	10 <sup>e</sup>	8	--	-- <sup>5</sup>
Finland <sup>c</sup>	214 <sup>5</sup>	265 <sup>5</sup>	500	400	400
Japan <sup>6</sup>	1,442	1,417	1,331	1,765	1,500
Poland <sup>e,7,8</sup>	25	25	25	25	25
Russia <sup>c</sup>	25,000	24,500	25,000	25,900 <sup>r</sup>	24,600
Serbia	--	12	--	--	6
South Africa	146,140	140,819	147,790	148,008 <sup>r</sup>	133,000
United States <sup>9</sup>	3,580	3,830	3,450	3,700	3,670 <sup>5</sup>
Zimbabwe	5,642	6,849	8,800 <sup>e</sup>	10,826 <sup>r</sup>	11,000
<b>Total</b>	<b>193,000</b>	<b>184,000<sup>r</sup></b>	<b>192,000</b>	<b>200,000<sup>r</sup></b>	<b>183,000</b>
<b>Other platinum-group metals:</b>					
Canada <sup>c</sup>	1,000	400	400	800 <sup>r</sup>	700
Russia <sup>c</sup>	12,500	11,900	12,000	12,500	12,000
South Africa	53,999	55,456	57,292	58,111 <sup>r</sup>	53,000
Zimbabwe <sup>c</sup>	1,641 <sup>r,5</sup>	1,759 <sup>r,5</sup>	1,820 <sup>r</sup>	1,820 <sup>r</sup>	2,200
<b>Total</b>	<b>69,100<sup>r</sup></b>	<b>69,500<sup>r</sup></b>	<b>71,500<sup>r</sup></b>	<b>73,200<sup>r</sup></b>	<b>67,900</b>
<b>Grand total</b>	<b>468,000</b>	<b>448,000<sup>r</sup></b>	<b>467,000<sup>r</sup></b>	<b>487,000<sup>r</sup></b>	<b>451,000</b>

<sup>e</sup>Estimated. <sup>r</sup>Revised. -- Zero.

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

<sup>2</sup>Table includes data available through July 19, 2013. Platinum-group metal (PGM) production by Germany, Norway, Switzerland, 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.

<sup>3</sup>In addition to the countries listed, China, Indonesia, and the Philippines are thought 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.

<sup>4</sup>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 thought to be included in the production figures for those countries.

<sup>5</sup>Reported figure.

<sup>6</sup>Production derived entirely from imported ores.

<sup>7</sup>Based on official Polish estimates.

<sup>8</sup>Estimates based on reported platinum- and palladium-bearing final (residual) slimes and then average platinum and palladium content from electrolytic copper refining.

<sup>9</sup>A very small quantity of byproduct platinum and palladium produced from gold-copper ores was excluded.

<sup>10</sup>Data for the Ethiopian calendar year ending July 7 of that stated. Yubdo Mine only. Platinum was also reportedly contained in gold ingots from the Lega Dembi Mine, but information is inadequate to estimate output.