



# 2012 Minerals Yearbook

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## PAPUA NEW GUINEA

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# THE MINERAL INDUSTRY OF PAPUA NEW GUINEA

By Susan Wacaster

Copper, gold, and silver were the major mineral commodities produced in Papua New Guinea in 2012. The country was highly prospective for mineralization in epithermal and porphyry-related high- and low-sulfidation systems; skarns; volcanic massive sulfides; exhalative manganese deposits; lateritic nickel, chromite, and cobalt deposits; and seafloor massive sulfides. Other metallic mineral resources that may occur in subeconomic deposits, that had not yet been extensively explored, or that were under development included iron ore, manganese, molybdenum, platinum-group elements, and zinc. Occurrences of industrial minerals included economically important limestone and phosphate rock deposits and minor deposits of asbestos, diatomite, graphite, pozzolan, silica, and sulfur. Papua New Guinea also produced crude petroleum. The country's petroleum production had been in decline, but petroleum exploration was at an all-time high in 2012. Papua New Guinea also had large quantities of natural gas resources. The Papua New Guinea Liquefied Natural Gas Project (PNG LNG) was scheduled to begin in 2014 and was expected to supply liquid natural gas (LNG) to companies in Asia, including the Chinese Petroleum Corp. of Taiwan; Osaka Gas Co.; Tokyo Electric Power Company of Japan; and Unipeac Asia Co. (a subsidiary of China Petroleum and Chemical Corp.) (Mineral Resources Authority of Papua New Guinea, 2013a, p. 1).

## Minerals in the National Economy

Comprehensive official economic data for Papua New Guinea were not available. In terms of gross domestic product (GDP), Papua New Guinea was the leading developing economy among the Pacific island nations. The country's real GDP growth rate was an estimated 7.7% in 2012 compared with 8.9% in 2011. The growth was driven by domestic demand created by ongoing construction of the \$19 billion PNG LNG project, which was jointly financed by Exxon Mobil Corp. of the United States [with Esso Highlands Ltd. as subsidiary operator (33.2%)], Oil Search Ltd. of Australia (29%), National Petroleum Co. of Papua New Guinea (16.6%), Santos Ltd. of Australia (13.5%), JX Nippon Oil and Gas Exploration of Japan (4.7%), Mineral Resources Development Co. [Papua New Guinea landowners (2.8%)]; and Petromin PNG Holdings Ltd. (0.2%). The value derived from the construction sector was estimated to have increased by about 25% in 2012 compared with that of 2011 followed closely by the wholesale and retail trade and transport and communications sectors. All sectors had experienced a surge in demand associated with the PNG LNG project. That demand was expected to diminish as the project was completed, although the increased physical capacity installed as part of the project could continue to contribute to some level of sustained increased economic activity (Bulman, 2012, p. 1; Global Finance, 2013).

## Government Policies and Programs

Mineral resources in Papua New Guinea are owned by the state. Laws that regulate the mining industry in the country include the Mining Safety Act of 1977, the Mining Act of 1992, and the Mineral Resources Authority Act of 2005. The Mineral Resources Authority Act of 2005 provides for the establishment of the Mineral Resources Authority (MRA) and defines the agency's powers and functions. Those functions include (a) promoting the development and exploitation of the country's mineral resources; (b) overseeing the administration and enforcement of the Mining Development Act of 1955, the Mining Act (Bougainville Copper Agreement) of 1967, the Mining Safety Act of 1977, the Mining Act of 1992, the Ok Tedi Agreement, and any other laws related to the development of Papua New Guinea's mineral resources; and (c) acting as the agent for the state for international mining agreements. The Geological Survey Division (GSD) is one of four divisions of the MRA. A few of the core functions of the GSD include compiling geoscience data and information aimed at encouraging mineral sector investment; conducting regional geoscience and geologic resource mapping; and archiving statutory reports submitted by mineral tenement holders (Government of Papua New Guinea, 2005, p. 10; Mineral Resources Authority of Papua New Guinea, 2013b).

## Production

Copper production decreased in 2012 by 3.9% compared with that of 2011, which was a typical decrease in production related to the mining of lower grade ores at the aging Ok Tedi Mine. A greater production decrease of about 18% in 2011 compared with that of 2010 was related to two shutdowns of the mining operation in 2011. Silver production in the country decreased by 10.3% and gold production decreased by 16.2% owing to decreased production from the Hidden Valley Mine. Data on mineral production are in table 1.

## Structure of the Mineral Industry

In 2012, several private international mining companies were majority owners or shareholders in producing metals operations in Papua New Guinea, including Newcrest Mining's wholly owned Lihir Island Mine and Harmony Gold and Newcrest Mining's Hidden Valley Mine, from which the Government received a royalty of 2%. Barrick Gold Corp. of Canada operated and held a 95% interest in the Porgera Mine, and the Government held the remaining 5% share through the state-owned Mineral Resources Development Corp. New Guinea Gold Corp. of Canada was the operator of and held a 92% interest in the Sinivit Gold Mine, and Gold Mines of Niugini Holdings Pty Ltd. of Papua New Guinea held the remaining 8% interest. The Ok Tedi Mine was operated by the PNG Sustainable Development Program Ltd., which held a 70%

share in the operation; the Government held the remaining 30% share. The Simberi Mine was wholly owned by St Barbara Ltd. of Australia, and the Tolukuma Hill Mine was wholly owned by Petromin PNG Holdings. Table 2 is a list of major mineral facilities (SNL Metals Economics Group, 2013).

## Mineral Trade

According to the Central Bank of Papua New Guinea, the value of total goods exported in 2012 from the country was \$5.96 billion. Of this amount, the value of mineral exports was \$4.34 billion, or 74.3% of the total, which was a 19.5% decrease from that of 2011. The value of exported gold decreased by 13.9% in 2012 compared with that of 2011 to \$2.4 billion. The gold export volume was 46,300 kilograms (kg), which was a decrease of 10.8% compared with that of 2011. The decreased export volume was owing to lower volumes of ore extracted at the Ok Tedi Mine and downtime because of maintenance work on the mill at the Simberi Mine, which offset increased production at the Porgera, the Toukuma, the Lihir, and the Hidden Valley Mines. The average gold price on the London Metal Exchange increased by 6.4% in 2012 compared with that of 2011; however, Papua New Guinea's decreased export volume was too large to offset increased prices received for the country's gold (Bank of Papua New Guinea, 2013, p. 14; United Nations Statistics Division, 2014).

According to the Central Bank of Papua New Guinea, the copper export volume was about 125,300 metric tons (t), which was a 12.7% decrease compared with that of 2011. The decrease in copper exports was also owing to extraction of lower grade ore at the Ok Tedi Mine. The total value of copper exports decreased by 32% in 2012 compared with that of 2011 to about \$966.6 million. Data from the United Nations Commodity Trade Statistics Database indicated that about 48,600 t of copper exports, including copper scrap and waste, copper wire, and refined copper, was exported in 2012 (Bank of Papua New Guinea, 2013, p. 14).

The crude oil export volume was 8.2 million barrels, which was a decrease of 6.1% compared with that of 2011. The decrease in the export volume of crude oil was owing to decreased extraction rates brought on by the decline in reserves at the Gobe Main, the Kutubu, the Moran, and the South East Gobe oilfields. The average export price of crude oil from Papua New Guinea was \$111 per barrel in 2012, which was a 13.7% decrease compared with that of 2011. The decreased price per barrel was attributed to higher production by member nations of the Organization of the Petroleum Exporting Countries (OPEC) and to lower demand from China and Europe. The value of crude oil exports was about \$9.2 million (Bank of Papua New Guinea, 2013, p. 14).

## Commodity Review

### Metals

**Cobalt and Nickel.**—The Ramu nickel and cobalt laterite project [a joint venture among Ramu NiCo Ltd. (85%), Highlands Pacific Ltd. of Australia (8.56%), Mineral Resources Development Corp. (3.94%), and unnamed landowners (2.5%)],

also known as the Kurumbukari, the Kurbukan, and (or) the Ramu River project, is located on the Kurumbukari plateau near the Ramu River in Madang Province. China's Metallurgical Corporation of China Ltd. (MCC) held a 61% interest in Ramu NiCo, and a number of other Chinese entities held the remaining 39%. Highlands announced that its share in Ramu would increase to 11.3% after an unspecified amount of internal project debt had been repaid from operating revenue, and that it had an option to increase its interest to 20.55% (Highlands Pacific Ltd., 2013, p. 17).

The Ramu open pit mine is connected by a 135-kilometer (km) slurry pipeline to the Basamuk processing plant, which is located 75 km west of the Provincial capital city of Madang in the Rai Coast District. Parts of the slurry pipeline are buried, and the pipeline drops about 680 m in elevation from the mine to the processing plant. The Ramu Mine is a low-strip-ratio, free-digging open pit mine. Face shovels and backhoe configured excavators were to mine the 12-meter (m)-thick (on average) ore body and load the ore into trucks for delivery to the washing plant and then to the beneficiation plant. Treatment would remove the chromite and create a slurry feed for overland pipeline transport to the Basamuk processing plant. The expected output of the mine as of April 2010 included an annual mining capacity of 5.7 million metric tons (Mt) of ore; an annual processing capacity of 4.28 Mt of wet ore, or 3.21 Mt of dry ore; and an annual output of 79,300 t of nickel-cobalt mixed hydroxides, or 33,000 t of nickel metal and 3,300 t of cobalt metal. When fully operational, the Ramu operation was expected to account for about one-third of all China's nickel imports (Metallurgical Corporation of China Ltd., 2010, p. 23; Highlands Pacific Ltd., 2013, p. 18).

Commissioning of the Ramu Mine took place in March 2012, and the rampup to full production was expected to take 12 to 18 months. In 2012, a total of 1.54 Mt of wet ore was delivered to the beneficiation plant, of which 735,000 t of wet ore was mined and delivered in the fourth (December) quarter. The total amount of ore treated and transported through the pipeline in 2012 was 647,000 t (dry weight); of that amount, 298,000 t (dry weight) was transported in the fourth (December) quarter. At full capacity, the operation was expected to process 3.3 Mt (dry weight) of ore with 1.04% nickel and 0.11% cobalt (Highlands Pacific Ltd., 2013, p. 18).

**Copper.**—The Ok Tedi Mine, which was also known as the Mt. Fubilan Mine, is located at Mt. Fubilan in a region of steep cliffs known as the Hindenberg Wall within the rainforest of Papua New Guinea's Western Province approximately 16 km east of the border with Indonesia. The Hindenberg Wall is a limestone terrain that is underlain by easily eroded siltstone. The location and geology surrounding the mine contributed to the collapse of a tailings dam in 1984 that was part of the site's initial construction. Since then, from 20 to 60 Mt/yr of tailings from the operation had been released into the upper Ok Tedi River, resulting in massive environmental degradation of the Fly River and Ok Tedi River systems (Garrett, 2013).

In 2012, negotiations continued within the country regarding a mine life extension plan. Ok Tedi's Mine Life Extension proposal would extend the life of the mine from its original scheduled closing date in 2013 to 2022, during which time the

mine would produce at one-half of its original capacity from two underground mines and one open pit mine. By yearend, seven of nine affected community groups had agreed to continue production for 11 more years. In 2012, the Ok Tedi Mine produced about 125,350 t of copper contained in about 482,900 t of concentrate compared with 130,500 t of copper contained in 494,900 t of concentrate in 2011.

**Gold.**—In 2012, the Hidden Valley Mine produced about 5,524 kg of gold and about 53,345 kg of silver compared with 3,118 kg of gold and 20,934 kg of silver in 2011. The Porgera Mine produced about 14,276 kg of gold in 2012 compared with about 15,600 kg in 2011. The Ok Tedi Mine produced about 12,286 kg of gold in 2012 compared with about 12,977 kg in 2011 (SNL Metals Economics Group, 2013).

### Mineral Fuels

**Natural Gas.**—The PNG LNG project was 80% complete and on track for its first deliveries in 2014. The project was being developed with two processing trains, but additional resources had been discovered that would allow for an expansion to three trains. The consortium was deciding whether to expand the project rather than build a second plant because expansion would be less expensive and less labor intensive as the essential infrastructure (including roads and pipelines) would already be in place. A decision to expand the plant could cause conflict with the Government, however, which reportedly was seeking as much infrastructure investment as possible in order to stimulate continued economic growth (Kelly, 2013).

### Outlook

GDP growth in Papua New Guinea is expected to decrease in 2013 and 2014 as construction of the PNG LNG and related private sector investments are completed; the decrease could be offset in part by commissioning of the Ramu nickel cobalt mine in 2012. In late 2014 and 2015, however, the GDP is predicted

to increase by 20% to 25% as a result of the first production from the PNG LNG project. Construction activity is expected to decrease by between 8% and 9% in 2014, which is nonetheless about 20% more activity than in 2011 and greater than twice that of 2008 (Bulman, 2012, p. 16).

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TABLE 1  
PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES<sup>1</sup>

Commodity <sup>2</sup>		2008	2009	2010	2011	2012
Copper, mine output, Cu content	metric tons	159,650	166,700	159,821	130,473 <sup>r</sup>	125,348
Gas, natural, marketed	million cubic meters	141 <sup>r</sup>	113 <sup>r</sup>	113 <sup>r</sup>	113 <sup>r</sup>	100 <sup>c</sup>
Gold, mine output, Au content	kilograms	67,463	63,600	58,983 <sup>r</sup>	62,200	52,100
Nickel hydroxide:						
Gross weight	metric tons	--	--	--	--	13,777
Co content	do.	--	--	--	--	469
Ni content	do.	--	--	--	--	5,283
Petroleum, crude	thousand 42-gallon barrels	13,993	12,806	11,100 <sup>r</sup>	11,000 <sup>r</sup>	10,000
Silver, mine output, Ag content	kilograms	51,300	50,000	74,000 <sup>r</sup>	90,700 <sup>r</sup>	81,300

<sup>c</sup>Estimated; estimated data are rounded to no more than three significant digits. <sup>r</sup>Revised. do. Ditto. -- Zero.

<sup>1</sup>Table includes data available through November 15, 2013.

<sup>2</sup>In addition to the commodities listed, cement, construction materials (common clays, sand and gravel, and stone), and refined petroleum products are produced, but available information is either inadequate to make a reliable estimate of output or output is insignificant.

TABLE 2  
PAPUA NEW GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2012

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities <sup>1</sup>	Annual capacity <sup>e</sup>
Cement	thousand metric tons	Papua New Guinea-Halla Cement Pty. Ltd. (Halla Cement Corp., 50%, and Government, 50%)	Lae, Morobe Province	200
Cobalt	do.	MCC Ramu NiCo, Ltd., 85%; Highlands Pacific Ltd., 8.56%; Mineral Resources Development Corp., 3.94%	Open pit mine facility, Basamuk beneficiation plant, Madang Province	3
Copper	do.	Ok Tedi Mining Ltd., operator (PNG Sustainable Development Program Ltd., 70%, and Government, 30%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	170
Gold		Newcrest Mining Ltd., operator, 100%	Lihir open cut, Lihir Island, New Ireland Province, 700 km northeast of Port Moresby	26
Do.		St Barbara Ltd., 100%	Simberi Island open cut, New Ireland Province	3
Do.		Newcrest Mining Ltd., 50%, and Harmony Gold Mining Co. Ltd., 50%	Hidden Valley open cut, Morobe Province, 90 km southwest of Lae	8
Do.		Ok Tedi Mining Ltd. (PNG Sustainable Development Program Ltd., 70%, and Government, 30%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	17
Do.		Porgera Joint Venture (Barrick Gold Corp., 95%, and Mineral Resources Development Corp., 5%)	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	22
Do.		New Guinea Gold Corp., 92%	Sinivit open pit, East New Britain Province, about 50 km south southwest of Rabaul	1
Do.		Petromin PNG Holdings, 100%	Tolukuma Hill open pit, 100 km north of Port Moresby	216
Nickel	thousand metric tons	MCC Ramu NiCo, Ltd., 85%	Open pit mine facility, Basamuk beneficiation plant, Madang Province	33
Petroleum, crude	thousand 42-gallon barrels per day	Petroleum development license 2: Chevron Niugini Ltd. (operator and manager), 19.37%; Oil Search (Kutubu) Ltd., 27.14%; Orogen Minerals Ltd., 25.44%; Exxon Mobil Corp., 14.52%; Petroleum Resources (Kutubu) Ltd., 6.75%; Merlin Petroleum Co., 6.78% Petroleum development license 5: Exxon Mobil Corp. (operator and manager), 47.5%, and Oil Search Ltd., 52.5%	Central Moran oilfield, Southern Highlands Province (includes Agogo and Iaqufi-Hedinia fields). Onshore Papuan Basin, petroleum development licenses 2 and 5	20
Do.	do.	Chevron Niugini Ltd. (operator and manager), 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 30.19%; Exxon Mobil Corp., 14.52%; Merlin Petroleum Co., 6.78%; Petroleum Resources Ltd. (Gobe), 2.0%	Gobe Main oilfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license 4	11
Do.	do.	Chevron Niugini Ltd. (operator and manager), 19.37%; Oil Search Ltd., 27.14%; Orogen Minerals Ltd., 25.44%; Exxon Mobil Corp., 14.52%; Petroleum Resources (Kutubu) Ltd., 6.75%; Merlin Petroleum Co., 6.78%	Kutubu oilfield, Southern Highlands Province. Onshore Papuan Basin, petroleum development license 2	16
Do.	do.	Santos Ltd. (operator and manager), 15.5%; Southern Highlands Petroleum Ltd., 39.14%; Orogen Minerals Ltd., 20.5%; Oil Search Ltd., 15.50%; Cue PNG Oil Co. Ltd., 5.42%; Petroleum Resources (Gobe) Ltd., 2.0%; Mountains West Exploration, Inc., 1.94%	South East Gobe oilfield, Gulf and Southern Highlands Provinces. Onshore Papuan Basin, petroleum development licenses 3 and 4	11
Silver		Porgera Joint Venture (Barrick Gold Corp., 95%, and Mineral Resources Development Corp., 5%)	Porgera open cut and underground mines, Enga Province, 620 km northwest of Port Moresby	4
Do.		Newcrest Mining Ltd., 50%, and Harmony Gold Mining Co. Ltd., 50%	Hidden Valley open cut, Morobe Province, 90 km southwest of Lae	124
Do.		Ok Tedi Mining Ltd. (operator) (PNG Sustainable Development Program Ltd., 70%, and Government, 30%)	Ok Tedi open cut, Western Province, 20 km northwest of Tabubil and 390 km southwest of Wewak	30

<sup>e</sup>Estimated. Do., do. Ditto.

<sup>1</sup>Abbreviations used for units of measure in this table include the following: km, kilometer.